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Social Networking and eLearning Tools: The Jos experience and its implications for Planners

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ABSTRACT

Various social networking/communication tools abound and the popular ones amongst these are facebook (www.facebook.com), Skype (www.skype.com), Twitter (www.twitter.com), MySpace (<http://www.myspace.com>) and so on. In the face of these competing social networking tools, institutions are under pressure to integrate new technologies, particularly online learning into teaching (Mason, 2006). A student on the average is likely to have at least one of these tools for communicating with peers. This level of interaction with social networking tools cannot be said to exist between students and elearning tool such as a University Learning Management System (LMS) – the reason being that elearning is still at its infancy at some African universities such as the University of Jos, Nigeria. The LMS available does not yet provide the social networking capabilities available to students on social networking tools. This paper investigates the causes of why students enjoy using social networking tools while on the other hand rarely use elearning tools that support their studies. This then led us to a research question which sought to know if students can engage elearning tools as much as they do with social networking tools. Two research instruments were used in the conduct of this research – questionnaire and interviews. It was found that if it is possible for LMS to inherit some of the functionalities of social networking tools, students will most likely be more focused on their studies while they connect and share with friends and peers.

KEYWORDS: Facebook, ICT, LMS, MLE, MOODLE, Social networking tools

INTRODUCTION

Computers and other related technologies have become part of our daily lives (Norman, 2002). In his paper, Norman further observed that tomorrow's future is in today's students. Technological advances have changed the nature of communication and social interactions among peers. One of such changes is notably in the social networking media enjoyed by the students. Students are digital natives as corroborated by VanSlyke (2003) who stated that "the native/immigrant analogy can help us understand the differences between those who are comfortable with technology and those who are not". Natives are those who use technology for numerous tasks; adapts as the tools change; may have grown up with technology or adopted it as an adult (Toledo, 2007). Online social networking tools allows for individuals to remain in relatively close social contact with others through the use of these tools. These networks have been described as "relationship facilitators" that help individuals build connections with others (Educause, 2007). Facebook has become one of the most popular social networking tools available for peers to get connected with space, distance and time not a barrier. Opinion shows that students are the greatest users of these tools as a means of

connecting to friends and upholding relationships. A large scale analysis of Facebook message headers of (5 241,000,000) among college students revealed that the majority of messages on Facebook are between friends (90.6%), within the same school (54.9%), and share distinct temporal patterns. One of the conclusions the researchers drew from the analysis was that Facebook usage is not relegated to leisure time, but rather part of natural social interaction that is intertwined with other school-related activities within a week (Golder, Wilkinson, Huberman, 2007). The available elearning tools, to a large extent, allow students to participate in class discussions.

The University of Jos recognizes that new technologies are changing teaching and learning practices across the world and are also bringing about new approaches in research and administration. The emerging approaches are in response to diverse student and employer demands which utilize new technologies. Furthermore, the use of educational technology has shown to positively increase the performance of students in their studies (Mann, et al, 198; Leung, 1994) become an important factor in measuring the performance index and rating of universities. Such technology-supported methods of teaching, learning and research have become widespread, whether they are blended, distance, mobile or other methods of learning.

The history and development of ICT at the University of Jos could be traced to early 1980s (Liverpool, 2006). The university took the first shot at digitizing teaching materials when she became a member of the African Virtual Open Initiative and Resource in 2004 (AVOIR, <http://avoir.uwc.ac.za>). The development of KEWL (Knowledge Environment for Web-based Learning) by AVOIR started in the year 2004 (AVOIR internal Evaluation, 2007). The exploration of KEWL did not enjoy a wide spread acceptance within the University community as it was still undergoing development that was still affecting its functionality. This posed enormous challenges to end users. This led to a decision for an alternative elearning platform for the University community. MOODLE - Modular Object Dynamic Learning Environment was adopted as the official platform for the elearning initiative at the University of Jos. Some of these have been documented in Akinmade et al (2009)

The university has made several efforts at getting both faculty members and students to imbibe the use of technology to enhance teaching and learning. Some of these were the direct efforts to capacitate faculty members by way of training and retraining on course design, the use of LMS and pedagogy for the courses they teach. In addition, a template that will facilitate course development was designed and made available to faculty members. On the students' side, some sensitization workshops have been held to make students appreciate technology for teaching.

While some faculty members progressed from these initial trainings by using technology to teach, much has however not been achieved as it is still a challenge getting most faculty members and students to accept technology for teaching. The slow pace of acceptance may not be completely blamed on faculty members and students, it may be partly due to the challenge of insufficient content on the learning management system (LMS) that is being populated at a slow pace by faculty members and secondly, the inadequate ICT Infrastructure (Computer laboratories and electricity that is still a major challenge in the country). Also, the lack of interest in the use of university LMS may be due to the fact that the university LMS largely runs on client systems even when faculty members engage students during class hours. This client-server mode portrays the notion that LMS could only run on or are made for stationary systems. Most students are not aware that these systems could actually be configured to run on mobile devices. If mobile learning is implemented and popularized at

the University of Jos, it may actually be solving the challenge of power that has hindered the continuous use of computer laboratories after class hours. Despite the power challenge, students always find means of keeping their mobile devices running. Given these, it may be premature at this point in the paper to conclude that 1) social networking tools are preferred by students over and above elearning tools being operated at the University 2) elearning may not be thriving at this university as it should be as elearning technologies are not as user friendly as social networking technologies. Hacifazlioglu (2007) observed that instruction technology must be easy to use for learners and there must be benefit for its usage. Considering all these observations, we arrive at the research question below:

Can students engage elearning tools as much as they do with social networking tools?

To address this question, a survey instrument with 17 items was designed with the sole aim of gathering information from students. Interviews were also conducted with faculty members and students. The questionnaires and the interviews were administered/conducted and analyzed with findings used to draw conclusion. The instrument, data analysis and findings are presented in the methodology section.

LITERATURE REVIEW

The increased mobile usage of recent years is a clear example of the system's growth; it therefore merits special attention from researchers (Bigne et al, 2005). Today the Internet is the most widespread technological tool in the world (Strohm, 2002). This has facilitated the development and the use of social networking tools by all and sundry, the students inclusive. Despite the negative side of technology as documented by Strohm (2002), Norman (1999), Corkern (2009), Kumar (1999), technology is still being used by students to create positive impacts on their study. Some of the positive impacts are: (1) it motivates teachers and students, (2) ICTs promote learner autonomy.

Educational strategies will be better understood in a community of practice as described by Allen et al (2008). Despite the lack of required result, a community of practice is building up at the University of Jos for elearning and it comprises of both faculty members and students. This community of practice is being enhanced with the introduction of e-fellowship programme. A programme that seeks to recruit on a yearly basis, a handful of faculty members committed to undertake a one-year programme to create content for the courses they teach. Aside from creating contents, they meet weekly to share ideas, compare notes, and undertake pedagogy training that helps in the understanding of the rudiments of how to create contents and administer courses online. The university on her part supports the fellows by creating an enabling environment for an unhindered access to the LMS while their fellowship is in progress. Hacifazlioglu et al (2007) observe that most researchers believe that technology can be used effectively to improve students' learning process. This claim is supported by Kutay and Lister (2006).

Jain (2002) identified some ways for motivating students for face-to-face and online time classes and these are: provide an overview of the course material in the first lecture, practice collaborative learning, facilitate degree of interaction, encourage interaction with other e-learners and e-instructor, and make learning fun. Students could be motivated to use elearning facilities and this could come in form of games or something that could get students' attention to use technology to facilitate learning. Some of these motivations are already part of learning management systems but they still don't spur students to effectively use it the way they ought to. This is the reason why pedagogy designers need to work on

LMS design with a view of putting social networking features into LMS; so as to making learning fun.

Facebook is a tool that aids students in developing their identities and finding their “fit” within a college community. Helping students connect and stay in contact with old and new friends is touted as one of the significant benefits of Facebook. Making connections on campus which help them feel that they belong, may be an important factor in student retention. These capabilities along with the many facets of communicating with friends make social networking tools very appealing (Educause, 2007). Although such media have been popular, particularly among the youth, they are not without their challenges. A study by Boogart (2007) on the social impact of Facebook on college campuses by surveying students (53149) at 4 different institutions observed significant relationship between heavy Facebook usage and lower grade point averages (GPAs). However, frequent Facebook visitors also reported a much closer connectedness to their school than those who accessed the service less frequently. The researcher concluded that although heavy Facebook usage is correlated with lower GPAs, this same usage helps build and maintain social connections and creates a connectedness with the campus. Can the same be said of LMS in our institutions? If not, what can be done to make its uses memorable to students?

A number of challenges have been identified in literature as inhibiting the adoption of mobile learning. Keri et al (2005) identified lack of teachers’ confidence, lack of training and technical difficulties with the devices as some of the challenges associated with mobile learning. Cobcroft et al (2006) identified learners, technological and institutional changes as challenges that inhibit adoption of mobile learning while Costabile et al (2008) identifies user experience of m-learning as a complex task and there is no consensus among researchers as to which specific techniques should be used.

RESEARCH METHOD

In this research, the investigation method employed is survey method which included the use of questionnaire and interview. The questionnaire consist of questions we considered to have adequately address the research question which is *Can students engage elearning tools as much as they do with social networking tools?* The questionnaire has 17 questions divided into three broad areas thus: 1) general questions such as gender, social networking tools accounts they have, duration of use of the social networking tools, time spent on using the social tool on a daily basis, and what they engage in while using the social networking media. 2) Awareness of social networking and elearning media. In this section, students were asked what they do on the computer when they are connected (elearning and/or social networking) and 3) and how much access they have to computing facilities. Other questions include knowing the source of their hardware they use – whether it is a personal or university owned. Interviews were also conducted with students and faculty members.

A total of 150 students were selected for this pilot study. Even though the sample population size is small compared to the total students’ population, we decided to take the small population size from students group that have had some form of access to technology for teaching. Significant percentage of students in some faculties have not yet have the opportunity to engage with the university LMS. They were selected from the science and the arts based departments to provide some form of spread that provides the desired result for this investigation and also answer our research question stated above. We also had discussions with some of the students in form of interview to get first hand information on their

preferences for social networking or elearning media with some of the things they consider as inhibiting to the use of learning management systems at the University of Jos. Faculty members were also interacted with. Responses were digitally recorded and transcribed. Some of the interview responses indicated that students preferred engaging in the social networking tools such as facebook because it was easier to use mobile devices to get access. This is contrary to our notion that LMS could sometimes be affected by power outages. Even when there were power supplies, the university had its own challenge of low bandwidth that cannot support the current students' population to be online simultaneously. These have been identified as some of the frustrating why students avoid using the LMS. Another reason identified was the issue of low bandwidth.

The questionnaire designed used the Likert scale (Trochim, 2006) and the Delphi method (Skulmoski et al, 2007) - an interactive questioning process was used to gather information from students. A total of 150 questionnaires as earlier mentioned were distributed with a response rate of 94%. It was administered to students in departments that engaged technology for teaching.

RESEARCH ANALYSIS

For the research analysis, the SPSS software was used. There was 94% response rate to the questionnaire. 70% of the respondents were males while 30 were females. 92% of these students are within the age group of 21-40 years. The respondents were 100% students. The questionnaire was made up of 17 questions with proviso for comments by students. The questions were divided into three (3) sections, namely (1) personal information/questions, (2) Awareness of social networking and elearning media, (3) Access to computing facilities

Discussions of the research analysis.

Personal information/questions

On response to personal information/questions, 70% of the students indicated having account with facebook some of which predate their entry into the university. 33% indicated having account with the university LMS. 9% indicated having account with Skype while 13% indicated having account with twitter. 42% of the respondents indicated that they have used the facebook for more than one year. 65% indicated that they spend at least an hour every day on facebook. 53% indicated that they connect to the internet to get information while 20% indicated that they join facebook to socialize.

Awareness of social networking and elearning tools

63% of the respondents agreed using computer to connect to facebook while 75% indicated that they use computer to check their mails. 49% agreed to using computer to enhance their studies while a negligible percentage agreed that they rarely use computer for any of these. Some students interviewed on their awareness of elearning tools at university claimed ignorance of the existence of any form of elearning facilities.

Access to computing facilities

81% of the students indicated that they have some personal mean of connecting to the internet. 39% indicated that they use available computing facilities in the university while 65% indicated that they visit cybercafés to gain access to the internet.

Interviews

During the conduct of this research, two categories of respondents were interviewed randomly from different faculties other than Arts and Sciences. 24 students and 14 faculty members took part in this interview. The purpose is to enhance and widen the scope of the views of members of the community (faculty members and students) for answering our research question. We got the views of respondents on the following areas.

Students

We interviewed students using the following questions.

1. *What attracts you to using facebook?*
2. *Why don't you spend as much time on Learning Management Systems such as moodle as much as you do with facebook?*
3. *Do you have a personal computer? If no, why?*

On question 1 (*What attracts you to using facebook?*), out of the 24 students interviewed, 67% claimed they have account with facebook. Various reasons were advanced by those with facebook account. They included a) It is easy to connect with peers b) It provides rooms for expressing oneself c) permits one to create an event , advertise etc d) Chatting e) it helps keep their social wings flying f) meeting friends g) For communication/keeping in touch h) it is an interesting platform.

On question 2 (*Why don't you spend as much time on Learning Management Systems such as moodle as you do with facebook?*).

Various reasons were advanced why students were not able to spend as much time on elearning management systems as they do with facebook. Some of the reasons provided were a) slow connection/lack of network access b) Learning is boring on learning management system c) LMS is not as easy to use as facebook d) LMS is not a work and play system e) LMS is not fast and as interesting as facebook

On question 3 (*Do you have a personal computer? If no, why?*), only 25% of students interviewed said they had their personal computers while the larger 75% said they don't have a personal computer due to lack of funds.

Faculty members

The following questions were asked faculty members

1. *Have you developed online content for teaching your course(s)? If yes, how often do you teach using technology? If no, why not?*
2. *What difficulties do you encounter while using technology for teaching?*

Various reasons were given by faculty members interviewed on the first question which stated that *Have you developed online content for teaching your course(s)?* A total of 43% of the 14 faculty members interviewed responded that they have developed content for their course(s) and they also use it to teach their course(s). 14% revealed that they are almost completing the content of their course(s), but have not yet started using them for teaching their students while the remaining 43% gave various reasons why they have not developed their course contents. They include a) Lack of time to do so b) Lack of motivation c) Time involved does not count in their promotion

On the second question (*What difficulties do you encounter while using technology for teaching?*), some of the difficulties identified by them included:

- a. Most lecture rooms have no connection and are not ready
- b. Lack of steady power supply in the labs
- c. Slow connectivity
- d. Lack of adequate computer for students' use
- e. Conflict in IP addresses sometimes stalls the effective use of available systems
- f. Antivirus sometimes blocks some software from running while teaching
- g. Time factor and other responsibilities were alluded as of the difficulties encountered by faculty members in developing their contents

RESEARCH FINDINGS

The research findings indicate that a high percentage (70%) of students have accounts with facebook while 33% indicated having LMS account. Students cannot yet engage with LMS the way they do with social networking tools due to a number of reasons such as slow connectivity, inadequate power supply, lack of awareness, lack of robustness of LMS and lack of adequate content. The research findings also show that even if this challenge of engagement is resolved; the university, the faculty members and students have roles to play to sustain the engagement. The university has a number of challenges to grapple with such as irregularity in power supply, slow connectivity, e-readiness of lecture rooms and conflicts in IP addresses sometimes experienced needs to be tackled. Faculty members need to be motivated to upload teaching contents on moodle while students need to be aware of what is available on the LMS. While some students may have mobile devices to connect to the internet, the LMS at the university is still being worked upon to be accessible on mobile devices. The low bandwidth is frustrating as well as the epileptic power supply that goes off and on. High percentages (65%) of students visit cybercafé which corroborate the inadequacies in our connection, access and computing facilities. Awareness on the available resources is still low while some students claimed ignorant of the availability of any operational LMS in the university.

RECOMMENDATIONS

As a fallout of the research (through questionnaire and interview), the following recommendations have emerged from findings.

1. LMS at the university should quickly transform to Mobile Learning (MLE) as that is part of what makes facebook popular amongst students and users
2. LMS should transform into social networking media by upgrading them to accommodate social networking tools
3. A Centre of e-learning needs to be put in place and the establishment of more computer laboratories to move elearning forward at this university
4. Plans for continuous training of both technical and non-technical staffers to support faculty members to achieve elearning strategy at the university should be put in place.
5. There should be improvement on the current student/computer ratio so that more students may have access to computing facilities.
6. Academic staffers should be encouraged to populate the university LMS with useful content that will advance learning
7. The knowledge and use of LMS by faculty members at the University of Jos should count in the vertical growth of academic staff (such as promotion). Poor patronage of LMS can be attributed to lack of incentives.

8. On no account should the university employ an academic staff with no computer and elearning skills.
9. All current and future lecture room and lecture theatres should be internet and elearning ready. The university should make deliberate efforts to mount projectors and projector screens with solar and battery backups for lecturers' use during lectures. The university should set target date to phase out the use of chalks and boards. As a first step, all lecturers should be made to convert their existing lecture notes to PowerPoint presentation.
10. Purchase of notebook computers by students should be encouraged with some seed funds provided to assist those who do not have the means.
11. Record of students accesses to the e-learning media be maintained and adequate motivations be meted to all students who actively use the online resources on the e-learning media
12. Faculty members should ensure that students' assignments and test are conducted on the e-Learning media so as to encourage e-culture.
13. The university must create massive awareness on the available resources on our website, especially on LMS as some students claimed ignorant of all that is available for them on the elearning media.

CONCLUSION

From the research question and the interview conducted, we have gained insights into elearning usage at the University of Jos by both faculty members and students. These insights include 1) For elearning to thrive at the university, the ICT infrastructure that are critical to the survival of education technology should be upgraded. 2) It also shows that for students to be able to engage LMS in advancing their education, the current state of education technology for teaching at the university must transform to what students can engage with to communicate with peers as it is obtainable in social networking media. Faculty members should be motivated to create contents while students must be sensitized on all that is available on the LMS

Findings point to the fact that social networking tools largely represented by facebook will continue to grow amongst students while, if nothing is done to improve its current functionalities of LMS in the university and adequate infrastructure put in place such as uninterrupted power and connectivity, its usage will continue to be on the decline or at best remain stagnant.

For students to be able to engage LMS the way they do with social networking media, requires that LMS should undergo transformation beyond the current state and it should be able to support social interactions as well as for facilitating learning. This shows that pedagogical designers should consider designing elearning systems that will support social interactions amongst students and peers.

Students should be introduced to the tools and facilities available on the Learning Management Systems at the university early enough especially during student orientation. There should be deliberate effort to upgrade the existing facilities that support learning in the university. Some of these facilities include – adequate power supply, connectivity and improvement on student/computer ratio which currently stands at 1:25.

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REFERENCES

- Akinmade C., Amupitan J., Alhassan, J., Durodola, M, Rikko, L. & Dooga J. (Eds) (2009) *Tranche 2 Final Summative Evaluation Report* (Jos-Carnegie Report No. 2). University of Jos, Jos
- Allen A, Kligyte G, Bogle M. Pursey R. (2008) *Community of practice: A community dimension for the UNSW Learning & Teaching Exchange. Proceeding ascilite Melbourne 2008*
- AVOIR Internal Evaluation, October, 2007. Retrieved from <http://idl-bnc.idrc.ca/dspace/bitstream/10625/37578/1/127917.pdf>
- Bigne, E, Ruiz C. and Sanz S. (2005). The Impact Of Internet User Shopping Patterns And Demographics On Consumer Mobile Buying Behaviour. *Journal of Electronic Commerce Research*, 6(3)
- Cobcroft, Rachel S and Towers, Stephen and Smith, Judith and Bruns, Axel (2006) Mobile learning in review: Opportunities and challenges for learners, teachers, and institutions. In *Proceedings Online Learning and Teaching (OLT) Conference 2006*, pages pp. 21-30, Queensland University of Technology, Brisbane. Available at: <http://eprints.qut.edu.au>
- Costabile M. F, De Angeli A, Lanzilotti R (2008) Explore! Possibilities and Challenges of Mobile Learning. Available at: http://www.di.uniba.it/~ivu/papers/2008/CHI2008_Costabileetal.pdf
- Corkern, A. (2009). *The Negative Effects of Advancing Technology on Society*. Available at: <http://www.articleonlinedirectory.com/Art/128143/191/the-negative-effect-of-advancing-technology-on-society.html>
- Educause. (2006). 7 things you should know about Facebook. Educause Learning Initiative; <http://www.educause.edu/ir/library/pdf/>
- Golder S, Wilkinson D, Huberman B (2007). Rhythms of social interaction: Messaging within a massive online network. <http://arxiv.org/abs/cs/0611137>.
- Hacifazlioglu O. Sacli, O. A. and Yengin I (2007) *Lecturer's Attitudes Towards the use of Technology: Alternative Strategies For Faculty Administrators*. Available at _____
- Jain K. K (2002) *Motivating E-Learning – A Case Study of E-Learners Seeking An Advanced Degree from UNITAR*. Student Affairs Online: Fall 2002. Vol. 3, No 4. 2002
- Keri Facer K, Faux F, McFarlane A (2005) Challenges and Opportunities: Making Mobile Learning a Reality in Schools. Available at: <http://www.mlearn.org.za/CD/papers/Facer%20-%20Faux%20-%20McFarlane.pdf>

Kutay C. And Lister R. (2006) *Up Close and Pedagogical: Computing Academics talk About Teaching*. Eight Australian Computing Education Conference (ACE2006), Hobart, Tasmania, Australia, 2006. *Conferences in Reserach in practice in Information Technology*, Vol 52. Denise Tolhurst and Sanmuel mann Eds.

Kumar, M. (1999). *Learning with the Internet*. Available at:
<http://www.marthalakecov.org/~building/strategies/technology/muthukumar.htm>

Leung C. D(1994) *Students Achievement in Educational Technology Course as Enhanced by Cooperative Learning*. A Master of Philosophy in Education Thesis. Available at:
<http://www.fed.cuhk.edu.hk/en/cumphil/95cmleung/conclusion.htm>

Liverpool, L. S. O. (2006). *The History of ICT Developments at the University of Jos*. Fems Publishers, Jos 2006

Mann, D., Shakeshaft, C., Becker, J., & Kottkamp, R. (1998). *West Virginia story: Achievement gains from a statewide comprehensive instructional technology program*. Santa Monica, CA: Milken Exchange on Educational Technology.

Mason R. (2006)*The University – Current Challengess and Opportunities*. In Suzan D’Antoni (eds. *The Virtual University –model and Message*. UNESCO, 2006

Norman, J (1999) *Negartive Effects of Computer in the Classroom* Available at:
<http://courses.wcupa.edu/letcher/english121/projects/10b/jessy.htm>

Skulmoski G. J, Hartman F. T & Krahn Jennifer (2007) *The Delphi Method for Graduate Reserach*. *Journal of Information Technology Education* Volume 6, 2007. Available at:
<http://jite.org/documents/Vol6/JITEv6p001-021Skulmoski212.pdf>

Strohm, C. (2002) *Should we Regulate Childrens Use of the Internet?* Available at:
<http://courses.wcupa.edu/fletcher/english121/projects/10b/courtpaper.htm>

Toledo, C. A (2007) *Digital Culture: Immigrants and Tourists Responding to the Natives’ Drumbeat*. *International Journal of Teaching and Learning in Higher Education*. 2007, Volume 19, Number 1, 84-92. ISSN 1812-9129

Trochim, M R 2006 *Research Methods Knowledge Base*. Available at
<http://www.socialresearchmethods.net/kb/scallik.php>

Vanden Boogart MR(2007). *Uncovering the social impacts of Facebook on a college campus*.
<http://hdl.handle.net/2097/181>.

VanSlyke, T. (2003). *Digital natives, digital immigrants: Some thoughts from the generation gap*. *The technology source*. Available at:
<http://www.wisc.edu/depd/html/TSarticle/Digital%20Natives.htm>

Social Media, Convergence and IT - A Case of Finnish Advertising Sector

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Abstract. The usage of social media is increasing by both consumers and companies. However, utilizing social media poses challenges for marketing practice. Organization of social media marketing is yet unclear inside companies and with outside service providers. In order to explore the current state, exploratory interview study of Finnish social media and advertising experts was conducted. We propose that the wider phenomenon of convergence exists also in advertising sector and has implications to marketing practice. Together with the description of changes in marketing practice, our findings provide background information on how to modify social CRM-systems to adapt to these changes.

Keywords: Social media, marketing practice, convergence, social CRM

1 Introduction

Social media sector now accounts for almost 10% of all time used in the internet. Visiting social networking sites has become the 4th most popular online activity ahead of e-mailing (The Nielsen Company, 2009). In Finland, two thirds of young people and young adults follow some social network service at least daily, but in older age groups it is still more uncommon. Overall, 42 per cent of Finns are registered into social networks and 76 per cent of Finns have searched information about goods or services on the internet. (Official Statistics of Finland, 2010).

Social media has also a significant commercial dimension. Forrester Research (2009) has predicted that the advertising spend in social media is going to increase 34 per cent on average every year from 2009 to 2014. In Finland, 92 per cent of Finnish marketing professionals believe that the importance on social media in marketing will rise in the future. Currently, Facebook with advertisements, company pages and applications is the dominant social media platform from the marketing point of view. Also YouTube, Wikipedia, marketing for bloggers, blogging, and Twitter had a role in Finnish marketing 2010. (Association of Finnish Advertisers 2010).

In the social media field, many actors are providing similar services for companies, and the traditional role balance between companies' own marketing departments, media-, advertising-, digital- and even communication agencies is challenged. In some companies, the messaging in social media is organized inside the company, while in other companies this is currently outsourced. People responsible for social

media can be found from marketing department as well as from communications or customer service departments. Overall, organization of social media marketing is yet unclear.

In spite of the growing usage figures, the definition of the term “social media” is somewhat unclear. We use the definition of Kaplan & Haenlein (2010) which defines social media to be group of Internet-based applications that allow the creation and exchange of user-generated content. Collaborative projects (e.g. Wikipedia), blogs, content communities (e.g. YouTube), social networking sites (e.g. Facebook), virtual game worlds (e.g. World of Warcraft) and virtual social worlds (e.g. Second Life) are all classified to be social media even though with varying degrees of self-presentation/self-disclosure and social presence/media richness. However, people have shared opinions and given recommendations also before digital platforms. Additionally, elements typical for social media are also often integrated to other web content. In spite of these factors that are blurring the boundaries of social media, there seems to be some changes in marketing communications context that are linked to the increasing utilization of these Internet-based applications with user-generated content.

The purpose of this paper is to explore the changes in marketing practice and customer relationship management (CRM) induced by social media. Our research question is:

"How social media is shaping advertising sector and which customer needs for CRM systems can be derived from this change?"

In the next sections 2 and 3 we describe the background from earlier research about the changes in marketing. In the next section 4 we present the findings from the interviews of 11 Finnish experts of advertising sector. They describe the changes that social media has contributed to their daily work and practices. We also demonstrate what kind of challenges this change causes to information systems, especially social CRM. In section 5 we draw some conclusions from our study.

2 Media convergence and active user

The increasing marketing in social media is part of wider change in marketing practice resulting from digitalization. In literature from technology and media contexts, this phenomenon is referred to as media convergence: merging of multiple media platforms, circulation of media content in different media and interaction between new and old media forms (Jenkins 2006).

In the literature, there are different kinds of perspectives to convergence: industry convergence, technical medium convergence and the convergence of social and cultural practices that shape media (Jensen 1998, Holmes 2005, Jenkins 2006). These perspectives are interrelated: for example technological convergence leads to the situation in which one industry's products and services are increasingly linked or blended with another industry's range of offerings (Lei 2000). Jenkins (2006) emphasizes that this is not only technological process: cultural and social shift is even

more important and convergence is both a corporate-driven and a consumer-driven process. Convergence alters also markets, genres and audiences.

In the heart of convergence, is the changing role of users from passive research subjects to active participants (Deuze 2007, Jenkins 2006). Addition to media context, this phenomenon can be seen widely in different research fields, such as open innovation, marketing and human-computer interaction (Kaasinen et al. 2010). The customer co-creation happens around specific objects referred to as social objects. Object-centered sociality as a social form constitutes something like the reverse side of the coin of contemporary experience of individualization (Knorr Cetina, 1997) Social media plays an important role in this: it enables people to shift from content readers into content publishers. It is the shift from a broadcast mechanism to a many-to-many model, rooted in conversations between authors, people and peers. Social media uses the “wisdom of crowds” to connect information in a collaborative manner. (Evans, 1998) In media research, this has brought up many hybrid terms, like “prosumer”, “produser” and “co-creator”, to describe the more active role of users (Bruns 2007).

This new user agency has many implications: it has a cultural role as a facilitator of civic participation and changes in labour market, but also an economic meaning alongside global media conglomerates (van Dijck 2009). This reflects also to the marketing actions and interaction between companies and consumers. Users can be active players also in marketing: they can for example accept, personalize, contextualize, share and create advertising (Ainasoja & Linna 2011). In the marketing research field this has for example increased the interest in word-of-mouth and recommendations again in recent years. Also the paradigm shift in marketing from product and transaction focus to service and relationship focus (Vargo & Lusch 2004, Grönroos 2000) is in line with the changes in marketing practice contributed by social media.

However, earlier research on convergence phenomenon itself has focused more on the convergence of different media from the viewpoints of the audience culture and media companies’ survival. There still is a need to look this phenomenon from marketing and advertising point-of-view. Deuze (2007) has described cases of convergence also in marketing and advertising contexts, but his cases focus on the effects of user-generated content and give less attention to other forms of convergence phenomenon in marketing.

3 Social media marketing and social CRM

Most of the marketing communications in social media are not advertising in a traditional sense referring to one-way mass communications. Instead, social media provides two possibilities to marketers: firstly, better targeting of marketing by analyzing actions and content created by users and secondly, a possibility to utilize user communities in marketing and customer service. Feeding word-of-mouth and viral marketing are central in social media marketing. Social media can also be a way to being present for consumers and ready for interaction and dialogue.

From our research perspective, social media has broader implications through integrating it to other company actions. Addition to marketing, social media can also be utilized for example in communications and PR, in recruiting, in customer relationship management and in co-creation related to product development. It can provide valuable information about customers for the utilization by various company functions. While earlier customer information from web concentrated on tracking customers using their server logs and analyzing website usage patterns, social media data is richer. But this poses challenge for companies as the customer conversations are no longer structured and directed to the company. Social media platforms have millions of people having real time conversation without knowing each other. (Kaplan & Haenlein, 2010).

Current businesses are challenged to make decisions about the level of investment they should make in social computing technologies and how these new capabilities should be, and can be, integrated with their current CRM systems. Traditional CRM solutions will continue to aggregate customer data, analyze that data, and automate workflows to optimize business processes. Customer information system is an older concept describing somewhat the same phenomenon than CRM-system: it plays the role of boundary that manages and distributes customer information (Park & Kim 2003). But business professionals must find innovative solutions to engage with emerging social consumers, enrich the customer experience through community-based interactions, and architect solutions that are flexible and foster strong intra-organization and customer collaboration. (Band & Petouho, 2010)

One solution suggested in the literature is the development of social CRM systems. Mohan et al. (2008) point out that the key component of CRM application development is integrating outside information sources and leveraging concepts of collaboration and community, including social networking applications. In other words, social CRM refers here to integrating external collaboration tools and platforms to the existing CRM platform. The social CRM ecosystem as defined by Forrester includes technologies that support business processes targeting, acquiring, retaining, understanding, and —most importantly— collaborating “socially” with customers (Fig 1). However, there still are many challenges in developing social CRM systems that take customer needs and all these applications and systems into account.

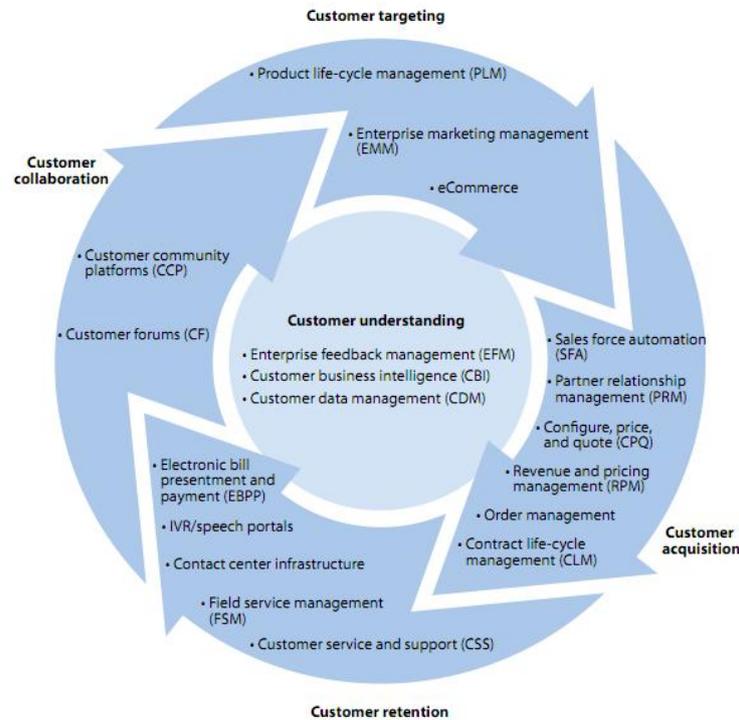


Fig. 1. Social CRM application ecosystem (Source: Band & Petouho, Forrester Research, Inc.)

4 Experiences from the Finnish advertising sector

4.1 Research approach and data analysis

Our research approach is exploratory case study and the data is collected by interviewing Finnish advertising experts. We conducted eleven expert interviews using theme interview technique in the end of 2010. The open-ended questions concentrated on changes and future trends in advertising sector from the viewpoints of advertisers, advertising agencies and consumers. Interviewees were leading Finnish social media experts representing advertising agencies, media agencies, digital agencies and independent consultants. We chose this target group for interviews because they have hands on experience about the possibilities and challenges faced by companies and they also shape the future directions in utilizing social media due to their roles as consultants for companies.

The analysis of interviews is based on reading and rereading the open, freely formulated answers of respondents. In other words, the interview data was analysed without preformulated framework from literature. The changes in practices that started to emerge from the data were written down with descriptions, practical examples and illustrating quotations. The changes and their descriptions were then grouped into wider and wider themes in order to find a meaningful categorization. After exploring the changes in advertising sector based on the interviews, the results were compared to the emerging literature on social CRM. Through these comparisons, customer needs and preliminary implications for CRM were recognized.

4.2 Consumer attitudes and changing role of social media advertising

Interviewees describe that the year 2010 was the year when all companies in Finland, regardless of industry or size, became interested in social media. The first experiments have now been done and marketing in social media is becoming more target-oriented and it is moving to the minds of top management. Like one expert put it: *“social media moved from nerds to executive groups and round tables”*. However, the actual knowledge about social media in companies still varies and there is more talk than investments in social media or social CRM projects.

Most of the respondents do not agree with the idea of drastically rising consumption criticism, but they do believe that consumer attitudes towards traditional mass advertising will become more negative, though it will not disappear completely. Consumers also have more opportunities to skip or block advertisements for example with blocking software online. Especially more digitally oriented respondents are critical towards the success of traditional, one-way, “push” advertising in the future.

“For example TV-spots are dead. They should be banned by law. This type of advertising lives only because advertising agencies and customers live in symbiosis and do cool things only in order to win cool prizes and look good in their organizations”

Even though the consumption criticism as such is not considered to increase and consumers are estimated to accept marketing actions also in social media, all interviewees describe changes in advertising and company actions. Both positive and negative commenting has increased and spreading out quicker through social media. Social media has strengthened the trend that it’s not possible anymore to *“make the product better than it is”* or *“paint things on top of mediocre products”* with advertising. Instead, marketing through services, earning the place in social media and bringing commercial messages to spots where people already are spending their time are emphasized. On a more aggregate level, all this is considered to increase consumer awareness of company responsibility and requirements for honesty.

“The requirements for transparency will definitely grow. Companies will have to express their opinions about social matters and explain their own actions more often.”

4.3 Social media as a driver of integration and change in practices

The one theme summing up many challenges of organizing social media marketing is its integrative nature. In the responses of experts, marketing in social media is in many ways appearing as an integrator. This is in accord with the broader idea of digital convergence. In order to succeed in social media, different actors, company functions and parts of marketing communication have to co-operate more closely than in traditional, campaign based advertising (Fig. 2). Integration and cooperation seem to be both requirements and consequences of successful social media marketing.

There was one thing that all interviewed experts agreed on: social media can not be outsourced fully in the future. Practices are diverse at the moment, but respondents consider unanimously, that in the future, companies are going to take more responsibility of social media and handle more things by themselves in social media, even though they will still need some consulting from outside. This is described to better suit to basic characters of social media like reactivity and authenticity.

Interviewees also clearly agree that **social media combines many functions and company departments**, and requires real changes in organizational structures and practices. It is emphasized that social media should be planted into company culture and integrated into normal, daily business and with other digital communication. Social media can be beneficial to product development, customer service, communications and marketing alike. Like one respondent describes the challenge:

"In order to utilize social media, it should include many functions from advertiser. And bigger the firm, longer away from each other these departments typically are both mentally and physically. And they have different goals and different incentives. It's surprisingly difficult to make this puzzle work as a whole."



Fig. 2. Social media as an integrator

The essence of social media from the marketing point of view, namely interaction, commenting, sharing and recommending, will affect all **marketing communications in all channels** and social media is tightly connected to other forms of marketing. This is how one respondent described the role of social media, when we wanted to know the share of social media compared to other communication channels in the future:

“I see social media as thin strings that bind things together like a ball. It is not a separate sector somewhere. Social media can be the linkage that holds the entity, 360 degrees together.”

Social media as well as other digital marketing, requires continuous presence alongside campaign bursts. Consequently, social media has emphasized a need for long-term planning alongside traditional campaign-based planning in marketing communications.

“The campaign-type doing in a few months cycles is old fashioned. We should think that all we do is service in beta stage for our customers”

This is a challenge also for scheduling, budgeting and marketing related contracts. Respondents envision that companies will have two parallel marketing budgets in the future: one for campaigns and one for continuous visibility.

Social media is becoming integral part of other interaction; it is no longer seen as a separate kind of sociality. For example, two different interviewees describe cases where face-to-face interaction in physical event and interaction in social media have supported each other in marketing purposes. This requires cooperation in marketing planning also inside service providers: planning is less channel specific than before and more centralized.

Social media is considered by respondents as a one force which brings the **roles of advertising, media, digital and communications agencies closer each other**. Media agencies and digital agencies are considered to have reacted to social media faster than traditional advertising and communication agencies. Especially the roles of media agencies and advertising agencies are seen overlapping in social media. Some respondents even envision some concrete integration and fusions of these actors in the near future. The role of communications agencies is seen also an interesting one in the future. On the one hand, communications agencies have traditionally been the place for utilizing free media space (like through publicity and editorial content) and in Sweden they are stronger players in social media than in Finland, but on the other hand, some advertising agencies have started to handle many tasks typical for communications (e.g. communication strategies, reputation, crisis management).

The integrative nature of social media is also seen as a barrier to new players specializing in social media consulting: while social media is linked to many company functions and strategies, companies will primarily prefer larger agencies providing wider range of services.

4.4 Implications for CRM systems

While the utilization of social media in Finnish marketing has moved from experiments to more and more target oriented practice, the next challenge according to interviewees is to integrate marketing in social media into other company routines

and also, to information systems used in companies. One of the future areas mentioned by experts is the integrating of social media data to customer relationship marketing (CRM) systems and integrating it more closely to other contact points with customers.

“It would be damn nice if you would get input from social media to your CRM-system, for example information about who is your fan and what has he or she done there.”

Our findings provide background information on how to develop social CRM systems that can take into account customer needs and challenges faced by companies.

Understanding customers by analyzing integrated picture of online and offline activities, social networks and conversations is a basic need for social CRM. Graph mining, link analysis and social network analysis are useful to capture the topological and communication patterns of social data sets (Wu et al., 2009). This means that mapping social networks based on social network analysis (SNA) is one possible feature of social CRM.

Addition to capturing new customer information, there is a need to publish information to the communities by utilizing social media channels. It can save a lot of time and money if number of potential customers can be connected to at one point (Mohan et al. 2008).

Social media has emphasized the active role of users also in marketing practice and there is a need for two-way, collaborative interaction with customers also in social CRM systems. Park & Kim (2003) describe an example of active customers in CRM as follows:

“Core customers actively participate in the two-way interactions with the firm and expand the firm’s customer base by word-of-mouth marketing... The boundary between the firm and its customers becomes transparent in this phase.” (Park and Kim, 2003)

The described integrative role of social media in marketing practice also leads to system requirements related to access and flexibility. There is a need to utilize CRM-system information in different departments and for different purposes. The continuous communication model alongside campaign requires also continuous updating of information and a possibility to follow-up results in real time.

Table 1 summarizes and combines the special features of social CRM described by Mohan, Choi and Min (2008) with the confirming contributions from our interviews.

Tab. 1. Ways social CRM can help companies (Mohan et al., 2008), modified

Ways social CRM can help companies	Description of advantages	Confirming remarks from our interviews
Single view of Online and Offline Constituent	Social CRM allows organization to capture variety of online interactions and Offline activities.	<ul style="list-style-type: none"> ○ Interaction in social media is seen as a one form of interaction among others - combining online and offline sociality is important ○ Utilizing social media in CRM is one of the future trends
Provides Overall View of the System	Social CRM serves not only its organization but its constituents also with a total view of their relationships with each other. This may also include tools that help organizations better communicate with individuals in the same household, place of work, or alumni group.	<ul style="list-style-type: none"> ○ Integrated view of customer's life and actions is essential ○ This information needs to be accessible to all departments and actors, not only marketing, due to the integrative nature of social media
Comprehensive Knowledge and Oversight	Social CRM provides the comprehensive knowledge and oversight about customer. Real-time reports such as integrated campaign activity statistics or customizable dashboards are always at fingertips.	<ul style="list-style-type: none"> ○ Marketing will change from isolated campaigns to continuous activity which requires also continuous follow-up

5 Conclusions

The results imply that the wider phenomenon of media convergence is present also in the Finnish advertising sector and social media has been a central contributor to it. In Finnish markets, digitalization and social media led first to divergence when digital agencies, social media consultants and other actors specializing in these new forms of marketing appeared. But the advertising experts believe that the future is in convergence due to the integrative nature of social media. The experts see changes in marketing practice, organizational culture and industry structure to be the most prominent although the changes in technology and media channels also take place. The active user role will change marketing content from “push” advertising to other, more interactive and service-based contents. From the marketing implementation point-of-view, these new forms of marketing require more input inside the organization and continuous planning and budgets. The convergence in advertising sector means integration especially in three areas: integrating company functions, integrating media and message parts and integrating service providers in the field. However, further studies with quantitative methods and international comparisons are required. For example in Russia, social media has a role of trustworthy news media

alongside official channels, and marketing practices together with the attitudes are different.

We demonstrated some ways how social CRM can help companies. The customer needs that are based on the described changes in the advertising sector can be summarized as follows:

1. need to get an integrated picture of customer both online and offline
2. need to analyze social networks and conversations as a part of increasing customer understanding
3. need to utilize CRM-systems in social media communications
4. need to utilize CRM information in collaboration instead of one-way campaigning
5. need to take versatile active user participation into account, e.g. possibility of customers to control the advertising or possibility to give feedback and form ideas
6. need to get access and utilize information in different departments and by different actors
7. need for continuous updating and follow-up

Currently many companies in Finland are modifying their CRM systems to enable data gathering from social media communities (like Facebook) and simultaneously trying to automatically run certain campaigns through social media platforms. However, a lot of testing and feedback from users are needed to make these information systems functional and not too intimidating.

On a more aggregate level, the advances in information and communication technology that enable individuals to be active creators and distributors of information, affect different professions and areas of culture including also players in the advertising sector. On the other hand, the development of practices around these information systems is shaped by consumers and professionals other than ICT experts. Business models and marketing practices can have significant effect on future social media and ICT around it, and understanding the changing processes of customer relationship management in companies is a prerequisite for planning CRM-systems.

References

- Ainasoja, M. & Linna, J. 2011. Co-creative Advertising - Exploring the scope of Advertising in Participative Web. Next Media Publications. <http://www.nextmedia.fi>
- Association of Finnish Advertisers 2010. Survey about the use of social media in member organizations in 2010. [referred: 15.4.2011]
- Band, W. & Petouho, N. L. 2010. Topic Overview: Social CRM Goes Mainstream. Forrester Research Inc.
- Bruns, A. 2007. Producersage: Towards broader framework for user-led content creation. Paper presented at Creativity and Cognition 6.

- Deuze, M. 2007. *Convergence Culture in the Creative Industries*. *International Journal of Cultural Studies* 10 (2), pp. 243-263.
- Evans, D. 1998. *Social Media Marketing: An hour a day*. Indianapolis: Wiley Publishing.
- Forrester Research 2009. *US Interactive Marketing Forecast, 2009 to 2014*.
- Grönroos, C. 2000. *Service Management and Marketing. A relationship management approach*. Chichester: Wiley.
- Holmes, D. 2005. *Communication Theory. Media, Technology and Society*. London: Sage.
- Jenkins, H. 2006. *Convergence culture: Where old and new media collide*. New York: New York University Press.
- Jensen, J. F. 1998. *Communication Research after the Mediasaurus? Digital Convergence, Digital Divergence?* *Nordicom Review* 12 (1), pp. 52-39.
- Kaasinen, E., Ainasoja, M., Vulli, E, Paavola, H., Hautala, R., Lehtonen, P. & Reunanen, E. 2010. *User involvement in Service Innovations*. VTT Research Notes 2552.
- Kaplan, A. M., & Haenlein, M. 2010. *Users of the world, unite! The challenges and opportunities of Social Media*. *Business Horizons*, 59–68.
- Knorr Cetina, K. (1997). *Sociality with Objects: Social Relations in Postsocial Knowledge Societies*. *Theory, Culture & Society*, 14, 1-30.
- Lei, D. T. 2000. *Industry evolution and competence development: the Imperatives of technological convergence*. *International Journal of Technology Management* 19 (7-8), pp. 699-738.
- Mohan, S., Choi, E. & Min, D. 2008. *Conceptual Modeling of Enterprise Application System Using Social Networking and Web 2.0 Social CRM System*, 237 - 244
- Official Statistics of Finland (OSF): *Use of information and communications technology 2010* [e-publication]. Helsinki: Statistics Finland [referred: 15.4.2011].
- Park, C.-H., & Kim, Y.-G. 2003. *A framework of dynamic CRM: linking marketing with information strategy*. *Business Process Management Journal*, 9(5), 652-671.
- The Nielsen Company 2009. *Global Faces and Networked Places*. New York: Nielsen.
- van Dijck, J. 2009. *Users like you? Theorizing agency in user-generated content*. *Media, Culture & Society* 31, pp. 41-58.
- Vargo, S. L. & Lusch, R. F. 2004. *Evolving to a new dominant logic for marketing*. *Journal of Marketing* 68 (1), pp. 1-17.
- Wu, B., Ye, Q., Yang, S. & Wang, B. 2008. *Group CRM: a New Telecom CRM Framework from Social Network Perspective*. *Proceeding CNIKM '09, 1st ACM international workshop on Complex networks meet information & knowledge management*, pp. 3-10.

A Research Framework to Study how Digital Service Innovation Transforms Value Networks

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Abstract. This paper reports from preparations in an ongoing research study concerning how digital service innovation transforms value networks in manufacturing industries. The research study is in the context of the vehicle industry and concerns digital e-maintenance services based on remote diagnostics systems. This digital service innovation in particular is of great importance since manufacturing industries have great potential to expand their business and found new and extended boundaries and relationships with other stakeholder in a network they are attached to. Core challenges and opportunities for digital service innovation will lead us to the study of its influence on the business and innovation environment i.e. the value network. This paper presents a framework to study how digital service innovation transforms value networks based on literature reviews on value network, digital innovation and transformation of value networks.

Keywords: value network, digital innovation, digital service innovation, remote diagnostics system

1 Introduction

Innovations in the digital age are rapidly transforming the landscape for contemporary business and the ways to represent these through related networks. Advancements in digital computing, web 2.0, digital convergence and other digital technologies are modifying business and organizations, and disrupting their traditional boundaries and models associated with them [1][2][3][4]. For example, in innovation such as global broadband, mobile infrastructures, electronic patient record system, YouTube videos, e-newspaper, and pervasive use of RFID chips, digital technology is the chief source of innovations. Such digital innovation is transforming the traditional business to e-business, for example, it gives rise to e-maintenance from traditional maintenance, e-manufacturing from traditional manufacturing [5]. In other words, trends of digital service innovation based on digitalized products and the associated opportunities and challenges open new areas of research [6].

As a result of this development, traditional production business such as manufacturing, the physical artifacts are now being intertwined with digital components that provide them digital capabilities. Inspired by this digital convergence of applications, devices, networks and artifacts present both challenges and opportunities for industries [6][2]. The digitalization of equipment is transforming industries from manufacturing to service industries. One example is the transformation of the vehicle industry where new opportunities for digital innovation such as e-maintenance based on remote diagnostics systems are emerging [7].

Digital innovation includes not only a shift in technology but also change in existing relationships within industrial business and with markets. This ultimately forces businesses into new competition which depends upon how it adds value and challenges present market know-how [8]. The addition of value (both digital and non-digital) of is perceived through value network which is then realized through a business model [9]. The value in network is shown with the help of network of relationship which has key role in the innovation process for outsourcing of technology, knowledge etc. [10]. For example, network of external stakeholders is important source of innovation [11].

Digital service innovation triggered by advancement in digital technology or potential service innovation such as e-maintenance services cause change in structures of value network overtime. It may cause migration of innovation to new networks, and new technological paradigms may cause the emergence of new value networks [9]. For example, digital service innovations may be adopted with the result of new emergent but still interconnected value networks [12]. A single innovation may trigger wakes of overlapped and interacted innovations, hence may play the part of as the initial conditions of another innovation process [10]. For example, in digital services innovation remote diagnostics system is one of the pre or initial conditions for providing e-maintenance services. However, the individual business interest and technological frame with different meanings and conflicting interests of different actors leads to distributed digital innovation which is characterized by uncertainty and ambiguity [13][14].

This transformation of modern economy to service economy is mostly enabled and dependant on digitalization of products. The topic has not a long history in Information System research but it is gaining much attention. For example, IFIP working Group 8.2 conference was dedicated to 'IT in service economy', ECIS (2011)¹ conference is dedicated to ICT and Sustainable Service Development, DESRIST (2011)² will focus on Service-oriented perspectives in Design Science Research, MIS Quarterly (2011)³ will publish a special issue on 'Service Innovation in the Digital Age' and The Journal of Strategic Information Systems (2011) will also publish a special issue on 'Service Management & Engineering: Aligning Business & IT Services'. Moreover, recent research work has shown that digital innovation transform value network. For example, Åkesson [12] studied the influence of digital innovation on value network in Newspaper industry and showed the multi-layered, dynamic, dialectic and diametrical character of value network in digital innovation; Yoo et al., [2][3] have studied the characteristics, dimensions etc. of digital innovation while working on AEC⁴ and camera evolution case; Selander et al. [15] extend existing innovation theory and propose a process model for transforming ecosystem relationships in digital innovation. Moreover, Kuschel [7] explains a general trend in vehicle industry which addresses extended equipment functionalities instead of consumers' use of vehicle. However, service innovation in the digital age or IT services are broad terms and capturing variety of services in different areas. The vehicle industry constitutes an area where digitization contributes to an increase in services as opposed to traditional product focus. Thus, a research challenge is to understand the process by which existing value networks in manufacturing industries transform in digital service innovation by attending to their individual characteristics which will be the specific interest for this research.

The aim of this paper is to suggest an framework to address this research challenge based on a literature review of value networks, digital service innovation and e-maintenance. This framework will be applied in a research project endeavoring digital service innovation for e-maintenance based on remote diagnostics system within vehicle industry. Remote diagnostics system refers to a system that is used to provide different types of digital services such as preventive as well as predictive or condition-based maintenance. The system associated with this project will offer these types of services by identifying and detecting (diagnosis) faults and errors. The vehicle firm has ambitions to expand their business with services which will require transformation of their value network and the associated relationships, value creating process and exchanges.

This introduction section is followed by a literature review. This literature review includes description about value network, innovation of services in the digital age and transformation trends due to technology in the networks. This is followed by a research framework to study the transformation process which is coupled with the concluding remarks and future work in the end.

¹ <http://project.hkkk.fi/ecis2011/>

² <http://desrist.org/>

³ <http://www.misq.org/>

⁴ AEC = Architecture, Engineering and Construction

2 Literature Review

The section brings about a review of literature on value networks, digital service innovation and transformation of value networks driven by digital innovation. This will provide the basis to study the transformation of such innovation on value networks. The digital innovation literature serves as a background to establish and describe digital service innovation and its impact on value networks through the lens of digital service innovation based on remote diagnostics systems.

The literature review is done by looking for the material about a value network in general and the elements that constitute it. Further study was aimed at the literature related to service innovation enabled by digitization of the physical products. Finally, the material about ‘how transformation occurs in such an environment’ is studied.

2.1 Value Network

A Value network in general is “Any set of roles and interactions in which people engage in both tangible and intangible exchanges to achieve economic or social good” [16]. It is categorized as internal-facing value networks, that is, within organizations and external-facing, that is, value networks among organizations and its suppliers, investors etc. [16]. Value networks have been recognized as having a key role in innovation process which spans from the practice of inventing to the process of realizing value, and adoption by the community [12]. This practice of inventing is visualized by an innovation network and, realization and adoption by community is effectuated by a value network [17].

A *value network* creates value through complex and dynamic exchanges of three entities called value currencies: goods, services, and revenue; knowledge; and intangible benefits [18][19]. Knowledge values, now, are also considered as a part of intangible values instead of a separate currency value [16]. According to Allee [16][18][19] roles/actors are the main focus for dynamicity and innovation rather than processes in a value network and intangible values are of equal importance as revenue exchanges. For instance, a vehicle company itself can be understood as a value network and it may offer knowledge about the health status of a particular vehicle to its customers as an intangible value currency in the value network.

The relationships are the medium or mechanisms to exchange values. The relations in the value network are linked by the business model defining the value creation process from which the different actors capture value [11]. The business model is the architectural configuration of the components of transactions needed to realized business value and related to a focal actor – an actor who organizes and has the strongest incentive [20]. From the focal actor’s point of view links among organizations, customers, suppliers etc. are known. This includes identification of customer segments and structures for value creation and value capture [17] meaning that different organizations have different business models within the same value network. For example, a service providing company will have one business model for providing health status for an individual vehicle while a parts/vehicle manufacturing company will have another although they co-create value within the same value network. Even referring to a particular focal actor, its impact spans organizational

boundaries [20] showing the tight coupling behaviour of digitized products as mentioned in [2]. These business models align network members to realized value targeting a defined customer base [17]. The value networks shapes the roles in the value creating process [9] and thus value is dependant on how the value network is designed and vice versa [17].

The nature of a value network consists of: value network interrelationships [12]; being multilayered and interconnected system of networks [9]; and innovation paths [21]. For example, vehicle related company may be the part of the value network containing vehicle manufacturing, of the vehicle service providers, vehicle parts manufacturing etc. companies. The value networks surrounding these businesses are not the same since they are built on different relations, exchanges and business models yet they are interwoven and interconnected on different levels and hence innovation paths within each have influence on the others.

In Table 1 below the concepts of value networks is summarized with guidance to the literature references.

Table 1. Summary of value network concepts

Concepts	References
Roles/Actors	Allee (2000a; b; 2008); Åkesson (2009); Biem and Caswell (2008)
Relationships/Medium or mechanism of exchange	Allee (2000a; b; 2008); Chesbrough and Rosenbloom (2002); Biem and Caswell (2008); Amit and Zott 2001, Chesbrough et al., 2006
Values (Tangibles and Intangibles)	Allee (2000a; b; 2008); Christensen and Rosenbloom (1995); Chesbrough and Rosenbloom (2002); Chesbrough et al., 2006; Biem and Caswell (2008);
Exchanges/Transactions/Activities	Allee (2000a; b; 2008); Åkesson (2009); Biem and Caswell (2008)
Nature of value network	Åkesson (2009); Henfridsson et al. (2009); Christensen and Rosenbloom (1995)

These concepts in Table 1 are useful in describing and modeling value networks. For example, e3 value modeling, c3 value modeling, Verna Allee's value network modeling and network-based value modeling [22]. Among these, some present value network as activity-oriented (e.g. Parolini's model) while others as actor/role-oriented (e.g. Allee's model). Moreover, some describe these networks as unmanageable (like ARA model) whereas others (like Gulati) assert that networks are manageable [22]. Describing and modeling the existing value network is a departure point for understanding the transformation process brought by digital service innovation in manufacturing industries.

2.2 Digital Service Innovation

Digital innovation is defined as the realization of new combinations of digital and physical components to produce novel products, while the services enabled by such digitalization are called digital services and innovation in services is called digital service innovation [4]. Driven by advanced development of digital technology digital services differ from conventional services and inherit properties from digitalized products as well as from services in addition to some additional unknown properties, hence it possesses the hybrid nature [1][3]. Drawing on this point, it is necessary to pipeline the underlying properties and concepts' discussion regarding digital innovation in order to study digital service innovation.

An important stimulus of digital innovation is the digitalization of previously non-digital artifacts (e.g. embedded system such as remote diagnostics system in vehicles). This digitalization of non-digital artifacts has undergone evolutionary waves. Yoo et al. [2][3] have identified three waves of digitalization and discussed them while studying digital innovation in case of AEC and camera evolution. According to them, the first wave of digitalization includes simply the technical digitization of analog contents and service into digital format without any basic changes in the industry. So the digital technology provides the same function as non-digital counterparts, with some additions and intelligence advantaging the reduction in cost. The distinct feature of second wave is the separation of digital devices, networks, services, and contents that were tightly coupled. This provides the shift in traditional boundaries across product categories and industries. In the final wave of digitalization, there is possibility to use mesh-up services that can be further re-combined creating incessant stream of new innovation possibilities for products, services, technologies etc. as can be seen in Google digital earth service. As digitalization continues, digital products are being equipped with increasingly diverse set of capabilities. Furthermore, small and powerful computing devices such as RFID chips now can be embedded into previously non-digital artifacts such as trucks, buses and other automobiles. Moreover, these digital capabilities allow digital artifacts to capture and transmit different types of information, and interact with other digital artifacts and services. This may lead to new business opportunities and models that may include information provider, information broker and service provider [23] which can then be shared in the value network [2][4].

The digitalization of non-digital products leads to an emergence of a generic model of digital technology architecture with four layers: devices, networks, services and contents [4]. The device layer is the bottom layer and deals with hardware and operating systems. Network layer manages logical transmission and physical transport while service layer provides application functionality that directly serves users during storage, manipulation, creation and consumption of contents. The top layer is called content layer and it contains data [2]. Because of continuous digitalization of earlier non-digital products and services, this four-layered architecture of digital technology has become more expansively applicable for all types of digitalized products [3]. Before digitalization, these four layers were tightly coupled together with a particular product boundary and in case of some purely mechanical products such as an automotive, these layers did not exist [3]. As a consequence of the digitalization, these four layers will be decoupled or loosely coupled to a greater extent [3].

These digitalized artifacts have different materiality properties that differentiate from their non-digital equivalents [24]. Yoo et al. [2] describe such seven properties as follows: First is programmability which means the ability to accept new set of instructions in order to modify its behavior, so digital artifacts become malleable. Second, addressability means the ability of each digitalized artifact to be identified uniquely within their context. The first two features together make digital products Internet of Things. Third, the senseability relates to the ability to sense and respond to its environment and makes them context-aware. Next is communicability which relates to the ability of sending and receiving any type of digitized message. Another property is memorizeability meaning the ability to record and store information. Then, the property of traceability refers the ability to chronologically identify, memorize and inter-relate events and entities in time. The last one is associability which is concerned with the ability of digitalized artifacts to be related to and identified as something along with other entities and inferring some future states and conditions.

Yoo et al., [3] have described three key design features of a digital technology that differentiate it from earlier technologies as: the re-programmability that relates to the ability of devices to be re-programmable enable separation of semiotic functional logic of device from physical embodiment; the homogenization of data which refers to the binary representation of data and together with emergence of new media separate the content from medium; and the self-reliance nature of digital technology means it requires the use of digital technology.

Further, Yoo et al., [4] introduced six new dimensions (convergence, digital materiality, heterogeneity, generativity, locus of innovation, pace) to innovation outcomes and processes due to the invasion of digital innovation. Convergence in this context means the combination and re-combination of devices, network, services and contents. Digital materiality refers to what it is that the digital capability does or what is its semiotic logic. Heterogeneity includes the combination of resources and components in wide and unforeseeable ways. Generativity is related to the direct quality of digital technology to allow indirect actors to create new forms of products, services, contents etc. while Locus of Innovation refers to make participation of distributed and previously non-connected actors into the innovation process affordable. Finally, pace means the rate at which change to 'new' is enabled within the digitized forms.

As described above, digital services are produced as the result of digitization of products. These services, in general, are characterized by remoteness, heterogeneity, on-going exchange of tangibles, seamless computing capabilities and materiality properties as described above [2][3] [4][25]. These characteristics are embedded due to the involvement of information and communication technologies, databases, and digitized products and so on.

The characteristics of digitization influence the quality and characteristics of digital services. For instance, digital services may take on the characteristics of products, such as storability and separation of production and consumption of services [25]. The use of digital technologies enables services to be automated the same way as the production of goods [7]. Yoo et al. [1] have presented a modular layered architecture to discuss the architecture of digital technology. They have discussed the involvement of heterogeneous actors for the design and production of novel components on layers

outside a firm's digital product platform i.e. outsourcing the part or complete layers to take competitors advantage. In the following instances, IT has either reduced or eliminated the direct involvement of service provider: self-services such as internet banking, remote customer order entry and follow-on customer service systems (e.g. operator surveillance system). Mobile products such as contemporary vehicles are embedded with sophisticated computing capabilities [21] which serve to optimize the uptime of the vehicle.

The advantage of using digitalized artifacts include new dimensions to service relationship as embedded sensors can become eye and ear of remote service provider [25][2] who can access real-time data and in turn can provide seamless services to customers.

In the Table 2 below the concepts relating to digital service innovation are summarized with reference to the literature:

Table 2. Summary of digital service innovation concepts

Concepts	References
Materiality properties of digital products (programmability, addressability, senseability, communicability, memorizability, traceability, associability)	Yoo et al., 2010a; c
Key features of digital innovation (re-programmability, homogenization of data, self-referential nature)	Yoo et al. (2010a;b;c)
Dimensions of digital innovation (convergence, digital materiality, generativity, heterogeneity, locus of innovation, pace)	Jonsson (2010); Yoo et al. (2010 c)

The three concepts i.e. characteristics, dimensions, and materiality properties of digital innovation form the departure point for understanding the driving force of value network transformation inherent in digital innovation.

2.3 Transformation of Value Network Driven by Digital Service Innovation

It is recognized in innovation literature that value networks are not static; they dynamically change over time [9]. With the advent in technology, digital service innovation may influence different processes such as supportive processes, relationship with stakeholders (e.g. customers, suppliers, and partners). Selander et al. [15] showed how relationship transformations are driven by tensions between collaborations and competing values in the telecom industry. As a result, value networks need to be reorganized to show changed relationships, value and exchanges that occur due to addition, deletion or modification of stakeholder roles. On a business level, this also offers several benefits like cost reduction, time efficient and high quality maintenance, increased in sales and new and challenging business opportunities which eventually lead to new revenue-generating business [25]. For

instance, digital services (i.e. services independent of time and place) effect business in manufacturing industry based on remote diagnostics systems. Some other advantages of digital innovation such as creating media-rich channel between companies and their customers have been illustrated in [18]. Allee [18] showed how a value network transforms by providing competitive advantage to customers through the introduction of internet technology. Change in number, type and relationship of actors is another example where digitization influences business and is related to change in value creation structure. However these changes are not one-directional. Åkesson [12] demonstrated in the Newspaper industry how value networks in digital innovation are in constant changing and parallel configurations. Digital innovation drives value networks in to divergent structures whereas stabilization in business drives value networks to convergent structures. This dialectical pattern has also been recognized in the telecom industry [15].

This transformation opens new area of research such as redesigning customer-service processes and redesign of existing value proposals [25]. Hence, more research is required on the impact of digital computing on value creation structures, value proposals and customer relations [25]. In particular, there is relatively little research in Information Systems contributing with an understanding of the process by which value networks are transformed in manufacturing industries expanding their businesses with service economy enabled by digital service innovation [26].

3 A Research Framework for Studying the Transformation Process of Value Networks

As mentioned in introduction section, this research framework will be applied in a three year research project in the vehicle industry. The partnering vehicle company is exploring the challenges and opportunities of digital service innovation based on disruptive digital artifacts. Moreover, they are interested in how it will transform the traditional business approach and existing value networks. To probe into the situation a framework is suggested with guiding research questions based on the literature review.

A preliminary perception about the influence is that the characteristics of digital service platform will influence value network, for example, digital service innovation in the manufacturing industry such as the vehicle industry expand the value network rather than squeezing it, introduce new customer bases, new collaboration and more co-operation. However, it is not known exactly today how this transformation process unfolds. The purposed framework will serve the dual-purpose *(i)* how digital service innovation transforms the value network's roles, relationships, value creation, value perception etc. and, *(ii)* the other way around, i.e. how value network helps to contribute in digital service innovation, as it is established fact that current value networks have already expanded the vision e.g. exchanges by considering both tangibles and intangibles. In Fig. 1 this relationship is described drawing on the concepts identified in the literature review.

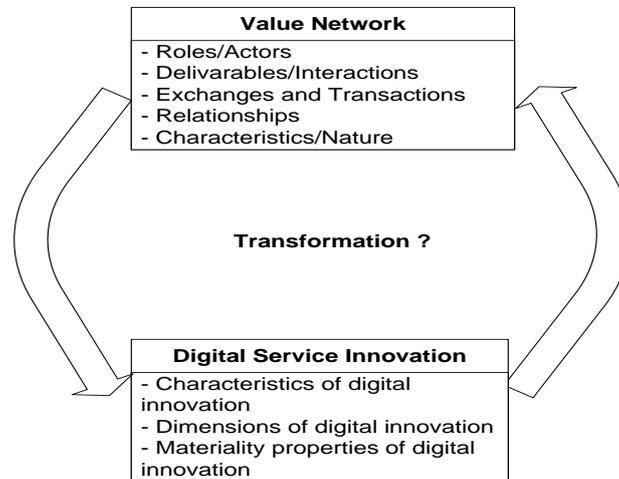


Fig. 1. Relationship between value network, digital innovation and transformation

This model serves an underlying assumption of the relationship in the transformation process addressed within the research. It shows the exploration between related main areas – value networks and digital service innovation based on remote diagnostics system.

The main question addressed in this paper is: what is the process by which existing value networks in manufacturing industries transform in digital service innovation? This research framework will serve as a frame for embarking a three year study. The research will start with describing the starting value network before the digital service innovation is initiated. In collaboration with the partnering vehicle company and its customers, a service innovation process will be initiated in exploring and co-creating services based on remote diagnostics technology under current development in the project. The process will be centered on customer needs and how the technology can be adapted to enable value creating services addressing these needs. Potential value creating services will be implemented, tested and evaluated in real-life settings in large scale. During this process, the transformations of the value network will be observed. After implantation, the transformed value network will be described and analyzed against the starting point and the process observations. In addition, the configuration of the starting value network's influence on the digital innovation will be analyzed. The aim is to provide a process model that explains how digital innovation transforms value networks in manufacturing industries.

4 Concluding Remarks and Future Work

The research framework presented in this paper is a response to recent calls for research on the increased service oriented economy. We concur with [3] that the transformative power of digital technology accelerates and that one of the new centres of interest in IS research will relate to the role of digital innovation in future economy

and human enterprise. Therefore, we hope that the presented research framework can inspire researchers doing similar inquiries in other areas.

The context where the study is being applied provides possible limitations in the research context i.e. it will study the influences in particular to vehicle industry. Even so, our aim is that the results will be of value to understand the process of how digital innovation transforms value networks in manufacturing industries in general.

References

1. Yoo, Y.: Computing in everyday life: A call for research on experiential computing. *MIS Quarterly*, vol. 34, issue 2, pp 213-231(2010)
2. Yoo, Y., Lyytinen K., Boland R., Berente N., Gaskin J., Schutz D., Srinivasan N.: The next wave of digital innovation: Opportunities and challenges. A Report on the research workshop: "Digital challenges in innovation research" (June 8, 2010). Available at SSRN: <http://ssrn.com/abstract=1622170>
3. Yoo, Y., Henfridsson O., Lyytinen K.: The new organizing logic of digital innovation: An agenda for information system research. Forthcoming on *Information system research* 20th anniversary special issue (2010b)
4. Yoo, Y., Lyytinen, K., Thummadi V., Weiss A.: Unbounded innovation with digitalization: A case of digital camera (2010c)
5. Koc M., Ni J., Lee J., Bandyopadhyay P.: Introduction of e-manufacturing. In proceedings of the 31st North American manufacturing research conference, Hamilton, Canada (2003).
6. Lyytinen, K. and Yoo, Y.: Issues and challenges in ubiquitous computing. *Communications of the ACM*, vol. 45, issue 12, pp 63-65 (2002a).
7. Kuschel, J.: Vehicle services. University of Gothenburg, 2009.
8. Abernathy W. J. and Clark K. B. (1985). Innovation: Mapping the winds of creative destruction. *Research policy*, vol. 14, issue1, pp 3-22, (2009).
9. Christensen C. M. and Rosenbloom R.: Explaining the attacker's advantage: technological paradigms, organizational dynamics and the value network. *Research Policy*, vol. 24, pp 233-257, (1995).
10. Van de Ven, A. H., Polley, D., Garud R., and Venkatraman, S.: *The innovation journey*. New York: Oxford University Press, (2008).
11. Chesbrough H. W. and Rosenbloom R.S.: The role of the business model in capturing value from innovation: Evidence from Xerox Corporation's technology spin-off companies. *Industrial and Corporate Change*, vol. 77, issue 3, pp 529-555, (2002).
12. Åkesson, M.: *Digital innovation in the value networks of newspaper*. University of Gothenburg, 2009.
13. Van de ven, A. H. (2005). Running in packs to develop knowledge-intensive technologies. *MIS Quarterly* 29(2), pp. 365-378
14. Yoo Y. and Lyytinen K.: Social impacts of ubiquitous computing: Exploring critical interactions between mobility, context and technology: A special issue for information and organization. *Accounting Management and Information Technologies*, vol. 15, issue 2, pp 91-94, (2005).
15. Selander, L., Henfridsson, O., Havn, F.: Transforming ecosystem relationships in digital innovation. 31st International Conference on Information Systems, St. Louis (2010).
16. Allee, V.: Value network analysis and value conversion of tangible and intangible assets. *Journal of Intellectual Capital*, vol. 9, pp 5-24, (2008).
17. Chesbrough, H., Vanhaverbeke, W., and Joel, W.: *Open innovation: Researching a new paradigm*. Oxford University Press (2006)

18. Allee, V.: Reconfiguring the Value Network. *Journal of Business strategy*, vol. 21, (2000a).
19. Allee, V.: The Value Evolution. *Journal of Intellectual Capital*, vol. 1, pp 17-32, (2000b).
20. Amit R. and Zott C.: Value creation in e-business. *Strategic Management Journal*, vol. 22, pp 493-520, (2001).
21. Henfridsson, O., Yoo, Y., and Svahn F.: Path creation in digital innovation: A multi-layered dialectics perspective. Viktoria Institute, Sweden. *Sprouts: Working paper on Information Systems*, vol. 9, (2009).
22. Biem A., and Caswell N.: A value network model for strategic analysis. *Proceedings of the 41st Hawaii International Conference on System Sciences* (2008).
23. Lofgren J.: Efficient traffic data collection: New business models for its applications connected to E-freight. *17th ITS World Conference Busan*, (2010).
24. Yoffie, D.: *Competing in the age of digital convergence*. Harvard Business School press, (1997).
25. Jonsson K.: *Digitalized industrial equipment: An investigation of remote diagnostics services*, (2010).
26. Barrett, M., and Davidson, E.: Exploring the diversity of service world in the service economy. In M. Barrett, E. Davidson, C. Middleton and J. DeGross (Eds.), *IFIP International Federation for Information Processing*, vol. 267, *Information Technology in the Service Economy*, pp 1-10, Boston: Springer (2008).

Scenario-based design: a possible tool in anticipating complexity in IS design.

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Abstract. The heterogeneity of the information systems (IS) field has led researchers from a diversity of disciplines to work with ICT research and development, subsequently including research and best-practices from a diverse set of disciplines, of which human-computer interaction (HCI) presents several interesting topics, ie. graphical user interfaces (GUI) breaching central usability standards in order to cope with growing system complexity. Building on a case study approach, this paper investigates the differences in how developers and users of an information system in Aftenposten, the largest subscription-based newspaper in Norway, evaluate the user experience and the system complexity in daily operation. The paper presents findings from an ongoing case study, and propose an initial conclusion by suggesting that scenario based development could possibly be a tool for anticipating complexity in information systems design.

Keywords: [human-computer interaction], [information systems], [scenario-based development]

1. Introduction

1.1 Problem domain and motivation

In a real world setting, a company working within the ICT realm or paradigm would need to know and assess the efficiency of their development methods and best practices. In this paper I will discuss the differences in how the users and the development team evaluate the usefulness of an ICT-system, and the possible use of scenarios as a constraining usability tool in coping with complexity in systems development. I will look at scenarios in order to help focus on core workflow elements, and how this can be used to presuppose the usability and user experience of an ICT-system. A concern here is whether scenario based development [1] could help prevent complexity-inducing icon- or element-overflow in graphical user interfaces (GUI) by anticipating user workflow and subsequently constraining user interface (UI) design to this an actual user workflow?

1.2 Problem definition

It is interesting to assess how graphical user interfaces have become more internalized and adherently more dense and information packed as they have matured over time. This implies that they have also become more complex, which is somewhat of a paradox since GUIs initially were meant to pack complexity in a "box" of comprehension. The research question is: can scenario based development help in handling complexity in IS design by constraining user-interface design to adhere to an actual user work situation and workflow described by an anticipating narrative?

1.3 Approach and findings

The empirical data that is used to create scenarios is almost mostly words, and rarely numbers, making them primarily into a qualitative research tool. In the empirical material, whether it is case studies, observations, surveys or statistics, there are several layers and levels of analysis, dependent of the adherent epistemology. According to Miles & Huberman[2] the terms we link to our fieldwork are inevitably coloured by our own preconceptions in a "not minor" fashion, and need to be addressed, as we ought to state our own epistemological standpoint as a context to the analysis. The case study is comprised of interviews and observations, and will be complemented by adding a quantitative element of a user survey, mainly about user

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centered issues like usability, user experience and GUI-based interaction, and how UI issues affect every day use, giving it an element of a mixed methods approach but with a qualitative emphasis.

By evaluating common user experience and the system complexity in daily operation, the paper presents findings and proposes an initial solution by suggesting that scenario based development could possibly be a tool for anticipating complexity in information systems design.

As will be discussed in part 5 an interesting *gap* in the findings shows that the users, in interviews, "beautified" the usability problems found by observation. These problems arose mainly by forced interruption of the work flow. These conflicting findings were particularly interesting as the users defended the system by marginalising the problems while they, on the fly, were forcibly inventing work-arounds needed to get the job done, deviating from the task flow established by a defined best practice leading to an increased level of complexity.

1.4 Paper structure

The remainder of this paper is set out as follows. The next section considers the research method, then section 3 provides presentation of theory and previous research, identifying Carroll[1, 3], Hanseth and Ciborra[4], Hanseth and Lyytinen[5], as key theoretical perspectives. Section 4 presents the case study and outlines the preliminary findings. The paper draws on various sources [4-7] to define the understanding of complexities in IS. Discussion, analysis and concluding remarks follow.

2. Research method

Building on a case study approach [8], and drawing on Miles and Huberman [2] a preliminary analysis of the development process has been conducted. The field research has been carried out by collecting data from interviews with and observations of selected employees in the relevant departments in Norway's largest subscription based newspaper, Aftenposten. Initial contact with management and later middle-management was conducted by email. The project owners, project managers and key users were interviewed for 1-1,5 hours, using a semi-structured set of questions as a starting point, allowing an additional open approach to drift within the topic. The interviews were conducted on site, which is an open office landscape, but in separate office spaces during autumn 2010. The interviews were recorded onto a digital music player and transferred as a digital document to a computer. The interviews have not been fully transcribed, but rather summarized, and are available for relistening. The key users are a group of employees who have been with the company for a long time, and are regarded as especially knowing in their use of the information system. Some of them were also members of the focus group, and took part in the development process as testing personnel. The observations of regular system users have been carried out in an open office landscape by bi-listening to phone conversations between customer support staff and customers while observing user operations of the CRM-system as ordinary events in a natural setting. This took part during spring 2011. Main targets for the observations were user interaction, assessing amount of mouse movement, tab switching, forced recollection of data elements, and mistakes made because of user-interface ambiguity, in addition to general user experience.

Some experiential divergencies in how key-users and regular user perceived the system were discovered, and are discussed in section 5.

This is an ongoing longitudinal case study, and more observation sessions are to be conducted together with a complementary user survey.

3. Theory and previous research

According to Carroll [3] a graphical user interface, although easier to comprehend for a regular user, should still support an underlying workflow, ie. follow a certain order of practice. Good usability should prevent users from making mistakes and making it easy to correct if mistakes are done [3, 9-12].

Human acceptance is a rather crucial aspect regarding any technological development project, and especially regarding ICT systems. User acceptance research has generated several models, of which the Technology Acceptance Model (TAM) [13] and Unified Theory of Acceptance and Use of Technology (UTAUT) [14] are two prominent ones. Although software engineers are human, human perception and subsequent acceptance of technology is dissimilar from that of a software engineer's perception and innate acceptance. Without lending some attention to a regular user approach, we run the risk of conducting self referencing design, which, in short, means that something, in this case software, is created by software engineers for other software engineers. For more information on self-referencing design see i.e. Lazar [15], Nielsen [9], Shneiderman [16] and Shackel [11]. A real world company or organization working in the realm of ICT development would need to know and assess the efficiency of their development methods and best practices, in order to avoid self referencing software, not to forget the actual product and the outcome of its use. They need to know how to plan for and assess user perception and experience [17].

While focusing on user-centered design [18], and by utilizing scenarios as a tool in usability work, in order to avoid self referencing design, we force developing teams to better plan the user experience, which could help ensure that the experience will be a good, or better one. We all have user experiences all the time whether it is with a car or operation of IT artefacts. A planned experience has a better chance of becoming a good one, than an unplanned one. According to Carroll [1], utilizing scenarios as a planning tool would increase the possibility of securing a good user experience.

3.1 HCI

The term Human-Computer Interaction can trace its origin in disciplines like psychology and cognitive sciences, sociology, ergonomics and computer science. There is currently no agreement of a single, unified theory of HCI [19]. What we have is a set of underlying principles and best practices that comprises the underpinnings for a basic understanding on human-computer interaction as a multi-disciplinary field of both work and research [20, 21]. Thus the ACM Special Interest Group on Computer-Human Interaction (SIGCHI) has developed what is considered a so far

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sufficient definition: “Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use in a social context, and with the study of major phenomena surrounding them.” [19]

The human-computer interaction (HCI) discourse is looked upon as the intersection of computer science, design, and social and behavioral science among others, and could contribute in a further development and understanding of human agency in handling complexities in IS.

Ideally, in a software engineering context one HCI perspective should relate to actors as “interacting social beings”, and includes “a concern with the nature of work, and with the notion that human systems and technical systems mutually adapt to each other and must be considered as a whole.” [19]

3.2 Usability

Usability is a principal concept within the HCI discourse, and relates to human-technological interactivity in a greater sense than just computer related interaction. It applies to human-artefact activity in general, including work, workflow, cooperative activity in addition to human organizations as open systems and the reciprocal impact computer based systems and people may have on each other [19]. An extensive debate referring to the epistemology of usability is required in order to construct a framework for usability-related assessment of software development, and is outside the scope of this paper. As a fundamental concept within the HCI discourse, usability has gained recognition to the extent that it is settled as part of ISO standard 9241, and relates to design processes of all technical artefacts of interactive systems with the intent of enhancing human-technological interaction [22].

First from being defined by Shackel [11] ISO, by utilizing different perspectives of usability, has defined it as: “The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.” (ISO 9241-11). This definition is derived from a set of guidelines consisting of aspects of consistency, user control, error handling/recovery, task match, flexibility, guidance [9, 12, 22-24].

3.3 Use-oriented design representations - Scenarios

The concept scenario originates from work done around user centered software, and is normally used to describe a method of storytelling; utilizing a specific story about people and how they accomplish their work tasks, to illustrate and build a design solution. Drawing on Carroll [1], we can describe the concept of scenarios as something that is real, although it is a description of something to come, graspably concrete but flexible. By their anticipating nature they describe task possibilities and future use of a design product, contributing to the design process.

Based on Propp [25] Carroll states that scenarios presuppose a setting or context. This context consists of location, ie. an office, basic work situation, ie. an employee

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sitting at a desk, in front of a computer. The context also identifies the employee's work title, in addition it includes the screen properties, like windows, files and folders, their relevance as working objects, and their relative positions on the screen. Within this context we see that scenarios include one or more actors with goals or objectives, identifying a [possible] change process. A minimum scenario includes at least one actor with one objective. Quite often we see a setting with several actors, and one defining goal followed by several sub-goals on different levels. Lastly, in order to achieve their goals, scenarios identify what the actors would have to do, by including strings of actions. Actions can be what actors positively do, but also things that could happen to them, and possibly change the conditions of an established setting [1].

According to Carroll, scenarios are providing means to supply developers with data that should ideally facilitate a sense of prediction, or at least reduce the resemblance of ambiguity, since these tools give us the means and possibilities to anticipate complex user task flows. They help us understand man-machine interaction, and are as such subject to cognitive and causal aspects of a socio-technological development pattern, which means we can't have absolute knowledge about what specifically is the best user experience, but tools like scenarios are providing a powerful instrument in minimizing the possible results of precarious human interpretation.

3.4 Complexity

Several definitions of complexity have been proposed in the literature. Drawing on Schneberger and McLean [26] Hanseth and Ciborra see complexity as a function of a system's various types of components, amount of different link types, and how quickly the system might change, a definition which, rather well, encompasses the complexity caused by a higher rate of integration [4]. This definition claims that a complex system is only complex while incorporating elements or artifacts of different sorts, in this case both organizational and technical. According to this definition a lack of usability or user-friendliness in user operation is not regarded as complexity, but I would care to discuss that non-optimal/non-best work practices would in fact contribute to an overall complexity as well. This paradox is lightly discussed in part 5.

3.5 Ontological placement

Ontologically HCI might be located within the tradition of Design Research, as this involves evaluation of the deployment and performance of designed artifacts, which includes, among several constructs, software user interfaces and design methods [27], specifically acknowledging the IT *artefact* aspects [28], after a period where IS research has been focusing on organisational issues [29].

According to March and Smith, Design Research involves two separate but internally supportive approaches, *behavioral science* and *design science* [27]. The foundation for behavioral science paradigm is firmly placed within the natural sciences approach and its aim towards theory making and justification regarding most

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aspect of information systems, while the design science paradigm mainly is about inventing and producing and subsequently evaluating IT artifacts aimed at solving organizational problems [30]. This duality might identify Design Research as a suitable ontological companion to the epistemological standpoint of critical realism.

3.6 Epistemological placement

Epistemologically, human-computer interaction is a practice that fits rather well with the intermediate position of critical realism [31, 32] a philosophical approach that accepts the positivist viewpoint that something exists without the impact of perception, but not that it is the only valid scientific knowledge. It therefore rejects the interpretivist viewpoint that all knowledge is a result of human reasoning and interpretation or accrediting all human activities to a societal discourse, but accepts that man produce knowledge as a result of social activity [31]

A computer or software is a quantitative, intrinsically predictable entity, a physical artefact or representation of an artefact that we can sense and acknowledge on an existential level but not independent of our perception of it. After all, it is being utilized by humans, that are not so quantitative and predictable, even though certain behaviourists claim that they are. Humans sense, reason, and interpret to create meaning, therefore, in the junction between man and machine it makes sense to lean on an epistemology that taps into both isms. On this background, it might seem that critical realism is a sensible epistemology for socio-technological research, as it is endowed with the capacity to recognise that technological development is almost never about technology alone but is a process which includes social and societal production of knowledge as well. This would localise it somewhere in between the descriptions made by both Akrich [33] and Law [34] of the somewhat interpretive back-and-forth negotiation that is fundamental in aligning users and technology and a more positivistic technological determinism focusing on pure causality described ie. by Thorstein Veblen [35] and Jaques Ellul [36] among several.

4. Case: Aftenposten information system development

This is an ongoing fieldwork within Norway's largest subscription based newspaper, Aftenposten, which constitutes a significant part of the Schibsted media company. The company base their daily operation on one large web-based Oracle (Siebel) CRM-system for subscriber and customer support, in addition to an invoice module for the economy department. The company's IT-infrastructure has gradually evolved from a non-GUI approach resembling a command-line system, ADAPT, through the first version of a web-based system, Kundefront, until today's second generation web-based system, KuBa. The web based systems are implemented on top of the Oracle Siebel system through an Internet Explorer user interface. The old system was implemented in the early 80s, and was in full use well into the 00's.

The main targets of observation was user interaction, assessing amount of mouse movement, tab switching, forced recollection of data elements, and mistakes made because of user-interface ambiguity, in addition to general user experience and how the system users related to system feedback.

From a managerial level, it was not an explicitly high priority to include users in the development process. Their main target was to develop a system that could scale with a future inclusion of new digital media products in the company's service and product portfolio, and work better with subscription periodizations. The developing team wanted to include users, and put together a test group.

The development of the new system started in 2005 as a pilot study. The background for the company's decision to change the CRM system was the following: (1) they experienced problems with invoice periodizations towards subscribers, (2) it was not independent of the first system, ADAPT, which sometimes would force users to switch system during or immediately after conducting a customer related operation, (3) in-house competence of the Kundefront and ADAPT systems was diminishing at a steady rate, eventually leaving the company without proper resources of maintenance competency (4) the system was regarded as too rigid although robust and stable, but not sufficiently primed for handling subscriptions regarding significantly more dynamic digital media intended for the increasing market of smartphones and tablet PCs. The initial goal was then to build a system that added to the flexibility in this regard, recognizing the need for the system to scale in relation to a new product structure, that to a greater extent recognized digital media distribution, that was not dependent on another system, and solved the invoice problem regarding periodizations. The idea was that this transition should make the system easier to operate for customer support and economy department. Representatives from the user group were involved from an early stage in the development process with the intention of being able to influence the development process head on.

5. Discussion

We know from previous research and literature within the field of HCI and human information processing[3, 10, 12, 16, 21, 37-40] that it is easier for users of a software or information system to *recognize* an interface artifact than *recalling* it from memory. That is presumably the reason we take for granted that a GUI-based system will provide a better user-experience for any given user than a command line interface will do, unless the new graphical interface, in order to encompass and presumably resolve an increased system complexity by adding too many layers and tabs to the interface. Adding tabs and layers, is similar to adding more screens, and adding more screens involves switching between them, which in turn will add to the system complexity by forcing the users to *recollect* rather than *recognize*, which was what we initially wanted to avoid in the first place. Tab-switching is mostly a mouse-clicking action.

The case study is ongoing, and it would be premature to conclude that focus on usability is the only cause for the increased user satisfaction, and I would argue that the empirical material, that consists of interviews with key personnel and observations of regular users also points towards some kind of discrepancies, between what was said by project-owner, management and key-users in interviews, and what was later discovered by observing, and talking to regular users in daily operation. Observations reveal a rather voluminous main user-interface with twenty-six - 26 - sub-pages invoked by clicking on tabs. The lack of keyboard shortcuts for experienced users is remarkable, and leads the users into rather extensive mouse-clicking. Measuring the number of clicks, where every click is preceded by a mouse movement, during an observed work session, the average number of clicks performed during a routine operation was 13, in a range between 8 and 19 clicks. Several operations involve duplicating data or information from one sub-page to another by copying and pasting in between. The users also have to leave the system during certain routine operations, like ie. sending messages to other users or colleagues. Mild frustration is observed during these occasions. Also they are forced to remember information while moving (clicking) from one part of the system to the next, or while switching programs. Some, but not many, routines, like lists of follow-up calls to customers, are still handled by pen and paper, which could seem somewhat subversive regarding logging of customer relations. It seems unlikely that a pen and paper paradigm should be a planned part of a purely computerized task flow

5.1 Scientific implications

While scenario-based design is rather common within the web developer community, it is less so in software engineering of corporate systems. The motivation for the research is to investigate the development and design of user-interfaces of an ICT system, and relate this to the usability theories of scenario based development [1] and how these might apply to the handling of complexity by forcing development to adhere to an narrated workflow *anticipating* complexity.

5.2 Practical implications

From interviewing the project management and members of the user group that were involved in pre-testing, they were claiming that the development process has been a bit more user-centered than was the case with the previous system, Kundefront, and that the process had been a bit more attentive towards usability issues, with repeated usability tests and subsequent reporting during the development process. An in-house survey conducted in 2009 dedicated towards the regular user group confirmed this and reported a significant improvement in user satisfaction on all but one quality marker. On a scale ranging from 1 to 6, where 6 shows the best result, the new system experienced an increased average score up from 2,7 to 4,3.

In the interviews with key-users, they claim that the system shows a less steep learning curve in contrast to the previous system, reducing the need for prolonged learning projects. The in-house survey mentioned above concurs to a certain point, leading towards a certain usability significance, although regular users, while not unhappy with the system, could report on usability issues not mentioned by key staff and stakeholders. These issues were ie. mouse intensive operation and extensive tabbed browsing, caused by the lack of keyboard shortcuts, leading to a degree of screen complexity not fully supporting a completely smooth workflow. In a scenario-induced anticipation of the complexity caused by having to relate to one main user interface and 26 sub-pages, as in extensive mouse-clicking back and forth between the different user-interfaces could possibly have given some clues as to handling this heterogeneity. Nielsen [9] and Shneiderman [12] claims that too many screen properties including the number of interfaces within a system forces users to remember too many screen artifacts, and will subsequently yield mistakes.

Also, while operating the CRM system, the user/employee must copy information from the CRM system and paste in a separate email client window in order to pass it on to other employees in the organisation for further processing. This lack of system integration leads to a paradox emanating from the observation data in this case, in relation to the complexity definition in section 3.4: while *technical complexity* increases with a higher rate of integration, *work practice complexity* seems to increase with a lower rate of integration leading to a rise in complexity level when breaching the natural work flow.

The resulting overall complexity, coming from a lack of focus on work flow best practice, could make it more difficult to correct mistakes when done. This shortcoming in handling both work practice- and systems- complexity could possibly

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have been discovered developing scenario-based prototypes as these are defined by Carroll [1] and Cooper [41] as it would have discovered ie. the need for the possibility to forward messages from within the CRM application. Anticipation by scenarios could possibly have made it easier to focus on work flow best practices in advance.

Workflow based on best practices is an important issue here. Observations show that lack of it leads to mouse wandering, and too many clicks, and that users read the screen "with their fingers", that is directed by moving the mouse over the area they read. When they fail to immediately find what they need, they start to wander, not only by eye movement, but also by mouse movement and excessive mouse-clicking. In addition to slow down a work-flow best practice, it also added to the physical strain already present, leading to muscle pain and fatigue. These findings vary to some degree between experienced and newly employed users, and might be the result of experienced users that have adapted and maybe customised their work place, while new employees still need to adjust.

A particular finding or trend in the empirical material shows that *talking* about work is contrasted by *observations* of actual work, in that by just talking about work tasks, the system was regarded as better suited in supporting the best practices in handling workflow, than what was actually observed in real work settings. A characteristic aspect regarding this particular finding, is that all interviewees were either management, middle management or more than averagely involved key-users talking about the development of the system, while the observations were done among regular users performing daily routines, working under pressure to serve incoming calls from customers and subscribers quickly and efficiently, which means that the management that had ordered and initiated the development of the new system, together with the group responsible for the development and employees that had been more than averagely involved in the development had a slightly more positive view on the system usability than regular workers, and what was observed in daily operation. It is possible that a scenario description or work flow analysis could have revealed this discrepancy, but more data is needed.

5.3 Limitations and further research

The case study is an ongoing project, and the findings and concluding remarks as such, are preliminary, although the trends in the material points in a specific direction. In addition, Scenarios do have an iterative character, and belong somewhere in the tradition of Participatory Design and Agile development methods, and would therefore have a natural place in a discussion of further research on integrating these perspectives. Further investigation will also, therefore, involve research on how usability tests are analyzed and how the results from these tests are integrated into the design.

6. Concluding remarks and limitations

In this paper I have discussed the possible benefit of utilizing scenario-based developments in information systems design. The research question was; «Can scenario based development be beneficial in handling complexity in information systems design, implicitly by constraining user-interface design to adhere to an actual user work situation and workflow?»

The paper offers a possible solution and contributes to the field, in arguing that scenarios, as a developer tool for user involvement and by identifying work flow best practices and usefulness, could prove beneficial in anticipating complexity in information systems development.

References

1. J. M. Carroll: *Making Use: Scenario-Based Design of Human-Computer Interactions*. The MIT Press, (2000).
2. M. B. Miles, M. Huberman: *Qualitative Data Analysis: An Expanded Sourcebook*(2nd Edition). Sage Publications, Inc, (1994).
3. J. M. Carroll: *HCI Models, Theories, and Frameworks: Toward a Multidisciplinary Science (Interactive Technologies)*. Morgan Kaufmann, (2003).
4. O. Hanseth, C. Ciborra: *Risk, Complexity and ICT*. Edward Elgar Publishing, (2007).
5. O. Hanseth, K. Lyytinen: *Design theory for dynamic complexity in information infrastructures: the case of building internet*. *Journal of Information Technology*. 25, 1-19 (2010)
6. M. Gell-Mann: *What is complexity?* *Complexity*. 1, 1, 16-19 (1995)
7. J. Law, in *After ANT: complexity, naming and topology*, J. Law, J. Hassard, Eds. pp. 1-14. Blackwell Publishing, Oxford (1999).
8. D. R. K. Yin: *Case Study Research: Design and Methods (Applied Social Research Methods)*. Sage Publications, Inc, (2008).
9. J. Nielsen: *Usability Engineering (Interactive Technologies)*. Morgan Kaufmann, (1993).
10. J. Raskin: *The Humane Interface: New Directions for Designing Interactive Systems*. Addison-Wesley Professional, (2000).
11. B. Shackel, in *Usability – Content, framework, definition, design and evaluation*, B. Shackel, S. J. Richardson, Eds. pp. 21-38. Cambridge University Press, Cambridge, UK (1991).
12. B. Shneiderman, C. Plaisant: *Designing the User Interface: Strategies for Effective Human-Computer Interaction (4th Edition)*. Addison Wesley, (2004).
13. F. D. Davis: *Perceived Usefulness, Perceived Ease of Use, and User Acceptance*. *MIS Quarterly*. 13, 3, 319-340 (1989)
14. V. Venkatesh, M. G. Morris, G. B. Davis, F. D. Davis: *User Acceptance of Information Technology- Toward a Unified View*. *MIS Quarterly*. 27, 3, 425-478 (2003)
15. J. Lazar: *Web Usability: A User-Centered Design Approach*. Addison Wesley, (2005).
16. B. Shneiderman: *Designing the User Interface: strategies for Effective Human-Computer Interaction*. Addison Wesley, Reading, Mass., ed. 3, (1998).
17. J. J. Garrett: *The Elements of User Experience: User-Centered Design for the Web and Beyond (2nd Edition) (Voices That Matter)*. New Riders Press, (2010).
18. D. Norman: *The Design of Everyday Things*. Doubleday Business, (1990).
19. T. Hewett: *Acm Sigchi Curricula for Human Computer Interaction*. Assn for Computing Machinery, (1992).
20. A. Dix, J. E. Finlay, G. D. Abowd, R. Beale: *Human-Computer Interaction (3rd Edition)*. Prentice Hall, (2003).
21. J. Löwgren, E. Stolterman: *Thoughtful Interaction Design: A Design Perspective on Information Technology*. The MIT Press, (2007).

22. C. Ghaoui: Encyclopedia Of Human Computer Interaction. IGI Global, (2005).
23. Apple Computer: Apple Human Interface Guidelines. Apple Computer, (2009).
24. D. A. Norman: The Psychology Of Everyday Things. Basic Books, (1988).
25. V. Propp: Morphology of the Folktale (Publications of the American Folklore Society). University of Texas Press, (1968).
26. S. L. Schneberger, E. R. McLean: The Complexity Cross—Implications for Practice. Communications of the ACM. 46, 9, 216-225 (2003)
27. S. T. March, G. F. Smith: Design and Natural science Research on Information Technology. Decision Support Systems. 15, 251-266 (1995)
28. W. J. Orlikowski, C. S. Iacono: Desperately Seeking the "IT" in IT Research - A Call to Theorizing the IT Artifact. Information Systems Research. 12, 2, 121-134 (2001)
29. V. Vaishnavi, W. Kuechler,
<http://ais.affiniscape.com/displaycommon.cfm?an=1&subarticlenbr=279>,
(2004)
30. A. R. Hevner, S. T. March, J. Park, S. Ram: Design Science in Information Systems Research. MIS Quarterly. 28, 1, 75-105 (2004)
31. R. Bhaskar: A Realist Theory of Science. Routledge, London, New York, (2008).
32. R. Bhaskar, M. Archer, A. Collier, T. Lawson, A. Norrie: Critical Realism: Essential Readings (Critical Realism: Interventions). Routledge, (1998).
33. M. Akrich, in The De-Description of Technical Objects, W. E. Bijker, J. Law, Eds. The MIT Press, Cambridge, MA (1992).
34. J. Law, in Technology and Heterogeneous Engineering: The Case of Portuguese Expansion, W. E. Bijker, T. P. Hughes, T. J. Pinch, Eds. MIT Press, Cambridge, MA (1987).
35. T. Veblen: The Engineer and the Price System. Viking Press, New York City, (1921).
36. J. Ellul: The Technological Society. Vintage Books, (1964).
37. D. J. Lazar, D. J. H. Feng, D. H. Hochheiser: Research Methods in Human-Computer Interaction. Wiley, (2010).
38. J. Nielsen: Designing Web Usability. Peachpit Press, (1999).
39. B. Shackel, S. J. Richardson, Eds.: Human Factors for Informatics Usability. Cambridge University Press, (2008).
40. D. Te'eni, J. M. Carey, P. Zhang: Human-Computer Interaction: Developing Effective Organizational Information Systems. Wiley, (2006).
41. A. Cooper, R. Reimann, D. Cronin: About Face 3: The Essentials of Interaction Design. Wiley, (2007).

Hybrids acting at the hybrid arena

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Abstract. IT has for a long time been viewed as a success factor for police investigation, but now IT has also become an obstacle. Many modern crimes are of a nature where the evidence needed for police investigations is found in both the analogue world and the digital world. We argue that modern criminals act as hybrids, i.e. they are using IT as natural components in their criminal activities. In this paper we analyze the modern criminal as a hybrid and analyze the effect this perspective has on modern police work. The result is that the crime arena should be seen as a hybrid arena, where the criminals and the police both should take the roles as hybrids. Today, there is a division among the police officers, some are acting in the digital world; others in the analogue world. This gives the criminal a bit of an advantage.

Keywords: Criminals, Hybrid, Hybrid arena, IT use, Police investigation,

1 INTRODUCTION

The adoption of information technology (IT) has for a long time been viewed as a success factor for conducting police investigations. It has for example been argued that the integration of IT has made police work more efficient, but it has also given the police an information advantage over the criminals. There are even arguments that IT has affected the very way police work is carried out [1]. There are, however, also those who question IT's impact on police work [2] [3, 4]. No matter stance towards the impact IT has had on police work, police work has undoubtedly undergone and is undergoing a digital transformation in line with society as a whole.

The first step in this digital transformation of police work was taken already in the 1950s when it became increasingly clear that computers would enable the storage and retrieval of large amounts of data contained in criminal records and files [5]. After that, several other trends focusing on making police work more efficient with IT, hence part of the ongoing digital transformation, can be identified, such as: Extraction and analysis of large data sets, even from various sources, aimed to provide basis for decisions [6, 7]; information and large data sets from different sources used in knowledge management [8, 9], and in information sharing [10]; use of mobile information technology [11–13], as well as intelligence led policing [14, 15].

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The above discussed integration of IT in order to transform police work digitally has so far focused on integrating IT in traditional police work in which the criminals, the crimes, the victims, the evidences, etc., all could be found in the physical world. The digital transformation has, however, more far-reaching implications than just giving the police information advantage over criminals. The very work context of the police is changing when police work is increasingly entering a new arena where the physical and the digital world intersect and the boundaries between them are becoming blurred. IT is in contemporary society present every day and plays an increasingly significant role in society as a whole, hence also in criminal activities. The most palpable example of this is crimes committed in a pure IT based environment, so called cyber crimes [16–19]. However, little research has so far focused on the criminals' use of IT, even if there are some researchers within the field of information systems (IS) that have conducted such research [20]. More research on the ways IT is used in criminal activities and the ways it affects police work is required.

In order to study and understand the implication this digital transformation has on police work, e.g. to study IT in a work context, there is a lot of research conducted in the IS field. Throughout the last 15 years there are several examples on contributions where various approaches have been taken to study IT in organizations and to understand how IT is used in organizations [21–25, Amongst many contributions see 26, 27]. To these contribution the highly relevant debate concerning the core issues in IS research can be found [28]. This is a question that can be seen from many perspectives [29]. In this debate the importance of not forgetting the IT in the research also has been addressed [30].

One of the ways to understand the complex relationship between IT, organization and user is by focusing on how agents act in for example an organization, thus using the concept agency. In a debate section in the Scandinavian Journal of Information Systems in 2005 Rose *et al* [31] debated on the problem of agency, in which several perspectives on how to study IT and organizations using the concept of agency was presented. Two of the most frequently applied theories in IS research were put against each other, the *Structuration theory* and the *Actor network theory* (ANT), which open up different ways to interpret agency. As a complement to using either of the above theories to explain the relationship between IT and organizations and the users, where the user are often seen as separated from technology, you can treat the organization/user and IT as one unit as e.g. a hybrid. Mike Michael [32, 33] has developed the hybrid perspective derived from ANT. Lindroth [34] takes Michael's hybrid perspective and creates the "laptop", which is a laptop and its user seen as a single unit. Lindroth [34] uses this hybrid as unit of analysis in a larger ethnographic study, where he uses the hybrid in form of the laptop to understand agency. The hybrid perspective also conforms to the concept of sociomaterialism, where e.g. Orlikowski argues that "*all practices are always and everywhere sociomaterial*"[35].

Empirical data collected by the authors of this article [36] together with the above presentation of ongoing police research could be used to argue that modern criminals act as hybrids, i.e. they are using IT as natural components in their criminal activities, hence merging the analogue world with a digital ditto. To fully understand the criminals' actions and by that also the requirements on police work, the hybrid

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perspective “IT+user” could be useful. In this paper we will use the hybrid as concept to further contribute to the knowledge on how IT is used in the context of law enforcement i.e. the police officers and the criminals on the criminal arena. The purpose of this paper is to further contribute to the knowledge base of how IT is used in organizations that the above IS research are examples of. Even if this paper is applied to the law enforcement domain, the results are transferable to other organizations in which the actors are acting in both a digital and an analogue world.

2 Applied research method

The data collection and analysis has been a joint effort of three researchers, and the paper rests upon two primary data sources: two separate case studies. One is a longitudinal case study research (2009–2012) focusing on information management within large police operations. The other source is a case study where the case was a large successful police investigation. In both these studies a qualitative research approach was used [37, 38]. The longitudinal study followed an ethnographical approach [39, 40] where the data collection was made through participation observations [37], and interviews [41]. In the case of the large investigation, a case study method was used. A case study is described as studying contemporary events, but the relevant behavior of the participants cannot be manipulated [42]. The primary data collection method was interviews with members of the group investigating crimes. This data collection method was chosen because, as Walsham [43] argues, interviews are the best way to access the interpretations of the participants taking part in the event.

In this paper we have used scenarios as a technique for ‘making work visible’[44]. Scenarios can be used in a variety of situations: “to present and situate solutions, to illustrate alternative solutions, to identify potential problems” [45], and also to describe work practice [46]. Here, scenarios are used in order to present the data collected in the two studies, and to make the data come alive.

2.1 The studies

In the longitudinal study data was collected mainly from two sources. The first source is a large police operation, the informal meeting for the EU energy and environment ministers held in Åre (a village and ski resort in the west of Sweden, located in Jämtland County) on 23–25 July 2009. We followed the operation from start to end. The second source is a large-scale regional catastrophe training exercise (including 1000 actors), where we followed the planning of the exercise and its follow-up.

The case study was a large investigation of an organized prostitution business. This investigation took place in the spring of 2010 and was conducted by the smallest police authority in Sweden. This investigation was selected because the police used IT as an important tool in capturing and aggregating digital footprints into digital evidence valid in court.

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3 Results

First we present an overview of how the police and the criminal act together in the same domain. In many of the crimes committed in contemporary society IT is a natural tool. It could be young men filming an assault and battering of a person, a person advertising on Internet about stolen goods, stolen credit cards used to buy goods, the list is long. What we claim in this article is that the modern criminal is using the current available IT as a natural part of their criminal activities. Of course there are criminals that never use IT, as well as criminals who use IT as the main criminal tool. Pure cyber criminals can be added to the latter category. However, the majority of criminals are using IT in their criminal activities that take place in the analogue world, which results in several digital footprints that the police need to capture and record. Digital footprints correctly captured are important in the chain of evidence of a criminal person's activities. The police needs to collect an unbroken chain of evidence of all the activities of a criminal and be ready to present this at the court proceeding. The chain of evidence is both about activities using IT, on the Internet, i.e. in the digital world and in the physical, analogue world where meeting with people, hiding drugs etc. can be examples. This is also the case for police officers working at the police intelligence units. The police intelligence needs to collect information in both the digital world, and the physical analogue world to be able to present a solid and trustworthy basis for operational and tactical decisions.

It is possible to present this picture of the criminal activities as an oscillating curve of movements between the digital and the analogue world, presented in figure 1.

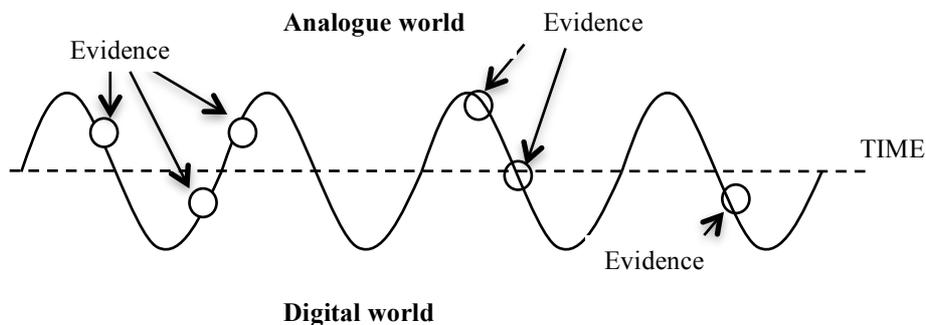


Figure 1. The movement between the digital and analogue world

One can say that the curve presented in figure 1 is an example of how a suspected criminal moves between the digital and the analogue world. The circles represent where the criminal activity results in evidence needed for a successful police investigation.

3.1 Scenarios

In this article we are using scenarios as a way to make the police work more visible, and to make the work practice more visible. The scenarios are neither excerpts from the collected data, nor are they fiction. The scenarios in this article are like short narratives based on the collected data, this in order to increase readability rather than presenting plain excerpts. The scenarios are aimed to illustrate the oscillation between the analogue world and the digital world of criminals using IT and the ways police officers are dealing with this oscillation in their everyday work.

3.1.1 The investigation of the Pimp

A 40-year-old male, in the following text called *the Pimp*, was the organizer of a large prostitution business. He had five women working for him, one of which one was his wife. The Pimp was responsible for the advertisement of the sexual services the five women offered. To advertise the services the Pimp used Internet but also the teletext (Text TV). There are several sites available for this purpose, and the communication and advertisement was done openly. In the advertisements the potential buyers were required to contact the women by mail, SMS or a phone call. The Pimp provided the women with mobile telephones so that they could communicate with potential customers. The women were not stationed in one place but travelled between several cities mostly in the mid of Sweden, for example the counties of Västernorrland and Jämtland. Occasionally they also travelled to other cities in the more southern parts of Sweden. The Pimp arranged the travels as well as booking and paying for hotel rooms, etc. It was no question that he controlled these women and used them in his business even though he never locked them up.

The Swedish police have several regional intelligence units. At a unit for the northern region, one criminal intelligence analyst worked with Internet surveillance. One part of the analysts work was to scan the Internet for web pages and web forums at which sexual services were offered, hence potential violations of the law that prohibits purchase of sexual services. The analyst noticed that there were a couple of women that seemed to actively work as prostitutes mostly in the mid Sweden region (Västernorrland County and Jämtland County). The women seemed to be like prostitute nomads, who moved their business around. The women's activities could be mapped into a cluster of activities with the centre in Västernorrland County. The analyst could through traces left on Internet map patterns of how the girls moved in the mid of Sweden, and how they communicated their presence in advance. The analyst contacted the police authority in Jämtland, informed them that one of the women planned to go to Östersund (the largest city in Jämtland), and that she had offered sexual services in her advertisements on the Internet. The police authority of Jämtland started a surveillance operation, and managed to identify the woman and also get the name of a man (the Pimp) that had booked the hotel room for the woman, where she aimed to meet the potential buyers of the sexual services. This was the start of the criminal investigation of gross procuring.

To reach success in investigations of gross procuring it is important to have documented evidence over the crime, and the public prosecutor needs to have well-

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documented evidence for the court proceedings. As part of this the police got a permit to set up a phone tapping of the Pimp. Through telephone tapping, and Internet surveillance the police identified the other four women that the Pimp controlled. At this stage the police had a goal to collect the unbroken chain of evidence the public prosecutor required. The work at the police was set up like this:

- a) Follow the information put on Internet and teletext, try to see patterns.
- b) Compare this information with telephone tapping, identify patterns.
- c) Carry out real surveillance, document meetings between suspected buyer of sexual service and the women that were suspected to provide the services.

It was important for the police to document as many real life meetings between the women and the buyers of sexual service as possible. In this phase of the police investigation step **a** and **b** was carried out by the intelligence analyst and she used several information systems in order to succeed. After a couple of month of this strategy the police had managed to collect as much evidence as needed; the public prosecutor decided to arrest the Pimp.

Once the Pimp was arrested the police requested mobile telephone lists for all mobile telephones that had been used to contact the five women the last six months. This request was sent to the telephone operators in Sweden. All together the police received lists from the telephone operators comprising more than 16000 records of telephone calls or text messages between the five women and potential buyers of sexual service. Initially the lists were even more comprehensive but the number of records were reduced when for example secret numbers and numbers belonging to phones registered to companies were excluded. The police responsible for the investigation manually checked the 16000 records of telephone calls and text messages, and matched them with all previous collected digital evidence.

The whole police investigation was carried out by only four police officers, and the result of the investigation was presented at a press conference the 24th of June 2010. 427 buyers of sexual service had been identified and reported, which was something that had never happened before in Sweden. The importance of collecting the digital footprints of both the pimp and the buyers of sexual service left in the digital world was highlighted and stated as very important during this press conference.

3.1.2 The parachute

This scenario represents a slightly different activity compared with the above. In this scenario the focus is definable as police intelligence analysis, a proactive police method.

There was always a threat of disturbance during the EU Ministerial meetings that were held in Sweden during the six-month period Sweden was the chair of the EU. There were mainly two groups that historically have been involved in the riots taking place during these meetings: the anarchist wing and the fascist wing. During the planning of large police operations, it is important to be aware of the risk that the police operation will be disturbed by e.g. extreme political groups. Hence it is

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important to identify any indications that such disturbances are planned. This work is carried out by organized police intelligence units. At the intelligence units they work with three kinds of police officers. There is one group who mainly work with the tasks of contacting informants, street surveillance, and technology surveillance (camera, video and telephone tapping). The second group mainly works with Internet surveillance. The third group of police officers consists of those that try to analyze the collected data and information to provide a basis for others to use to make decisions.

In the spring of 2009, the national police intelligence unit had started to gather information from external and internal sources about potential threats towards the ministerial meeting in Åre. The planning process of the Jämtland police authority had as its starting point in the possibility that disturbances could occur during the meeting. However, as time passed the national intelligence units degraded the potential risk of disturbance to a low level. Parallel to the national intelligence units, the local and regional intelligence units also worked towards the same aim, i.e. to identify potential threats towards the police operation. In Jämtland county there were some smaller activist groups that early on declared that they aimed to carry out protest marches both in Åre as well as in Östersund.

Everything worked out well during the meeting until two activists from a known organization confronted a police officer at an outer perimeter and said: "just for your information, we will use a motor driven parachute to land on the roof of the hotel" They also told the police officer their names.

This created a rather chaotic situation. For the security and the police it would have been a media catastrophe if someone had landed on the rooftop of the hotel. The Intelligence unit at the police operation was given the assignment to find out everything about the two persons, to try to activate informants and search the Internet for any hints of a planned action. The surveillance police officers started to look for vehicles that the two persons had registered in their names. The police officer that had spoken to the two activists was shown pictures of the two persons to verify their identity. Even the parachute experts in Åre were asked questions. The overall process of activating all these police officers and plan for a potential parachute landing, took around three hours. One main problem was the distinct border between the intelligence units, especially those that search for information on the Internet contacting informants, and the police officers that only work with operational security work.

In stressful situations, as above, when information needs to rapidly be delivered to decision makers, and the information is not formally recorded, there is a risk of information loss.

4 Discussion

In this article the idea was to apply a hybrid perspective to the law enforcement domain. Upon applying the hybrid perspective i.e. the user+technology something interesting occurs. The hybrid perspective is fruitful to map and understand modern criminal activities. The criminal or the potential criminal is using IT for various

purposes, but does not use IT as an actor or user. The use of IT is a rather normal behavior in his/her everyday action, as stated to be one of the arguments for a sociomaterial [35] approach. This means that the everyday use of technology as mobile telephones for verbal communication, text communication through SMS, and Internet use, together with the use of computer for communication and activities on the Internet, makes the hybrid suitable as a unit of analysis and to contribute to understanding how the criminal acts. By seeing the criminal as a hybrid, activities in which technology is used are not separated from the other activities. Instead they are blended together.

On the other hand when focusing on the police and their work practice the hybrid perspective is not fully applicable on the data collected for this article. All studied police officers are without a doubt using IT in their everyday work. However, scrutinizing how police officers use IT in their attempt to investigate a crime, managing large police operations or identifying potential threats to a large police operation, they need to be divided into two groups of actors. First we have the experts whose main task is to work with advanced technology, such as Internet surveillance, database construction for intelligence analysis, etc. Second we have the traditional police officers that have a more traditional work task i.e. to act as police officers in the physical world. This indicates that the police do not act with their full staff on the same arena as the criminal or potential criminal does. The police have divided their arena into two parts, one digital and one analogue.

If you look at the police as a collector of evidence you will find that the police in the analogue world collects evidence only in that world, just like the police in the digital world collects evidence only in the digital world. A border between the different worlds is created which the different types of police officers do not cross. This forces the police officers to communicate and share the collected evidence and information with each other in order to create an unbroken chain of evidence. The criminal on the other hand moves between the digital and analogue world effortlessly.

Trying to illustrate the above relation between the police and the criminals, a figure like fig. 2 emerges. Here, the black line is the movement of the criminals, and the red is the acting and movement of the police. Each green dot is where the two types of police officers do not cross the border and where they are forced to share and communicate information between them. We do not claim that there is a problem with this approach, but it may be important for the police to make sure that information is not lost during the information exchange at the borders. In stressful situations there is a risk that the police will lose information when the criminal activities are moving between the analogue and digital world.

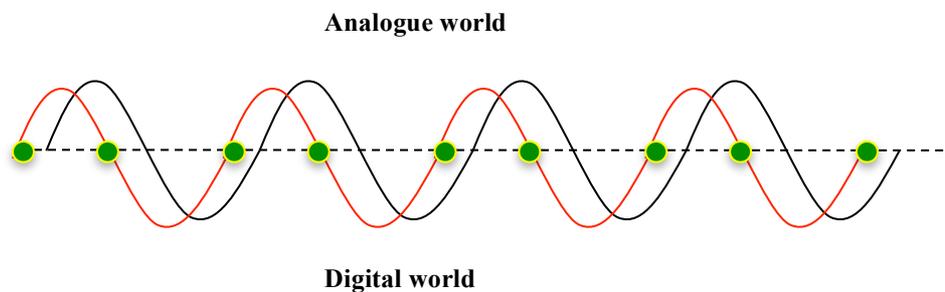


Figure 2. The non border crossing.

4.1 Concluding remarks

Based upon the above presented results, we conclude that the police hybrids are two types of hybrids. They are either the hybrid as an expert in the digital world, or a hybrid in the analogue world. However, the criminals they aim to bring into justice is acting as one hybrid in the two worlds. We therefore propose what we call the hybrid arena. We propose that there is a need to understand the full context in which a crime is taking place as a hybrid arena, i.e. an arena which is both part of the completely digital world and the analogue world. The hybrid crime arena has no borders and within this arena the crimes have been taking place and the police needs to collect that evidence.

We propose the hybrid arena as a complement to the more traditional IS research about IT in organizations, because the crime scene does not just include representatives from Law enforcement, criminals, and others e.g. victims, witnesses. These actors are not acting in an organization, rather on a common arena with rules of its own.

In this article we have shown that there are situations where the police organize themselves into experts collecting evidence either in the digital world or the analogue world. By organizing themselves into two sets of experts instead of one set of generalists, the police and the criminal can be viewed as acting on two different arenas. The police arena is divided into an analogue and a digital part, whilst the arena where the criminal acts is a hybrid, where the border between the digital and the analogue does not exist.

By applying a hybrid arena perspective on the whole arena, where a criminal acts side by side with representatives from law enforcement, you can use the hybrid arena as tool to discuss and strategically decide how law enforcement should best be organized. You can also use the hybrid arena as a way to fully understand how IT is used in law enforcement and implicitly use it to find design implications. By applying the hybrid arena concept you also realize that the criminals are active in the arena, but

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the police are acting as if the arena was separated into two parts, a digital part and an analogue part.

References

1. Chan, J.B.L.: The Technological Game: How Information Technology is Transforming Police Practice *Criminology and Criminal Justice* 1, 139--159 (2001)
2. Colton, K.W.: The impact and use of computer technology by the police. *Communications of the ACM* 22, 10--20 (1979)
3. Garicano, L., Heaton, P.: Information Technology, Organization, and Productivity in the Public Sector: Evidence from Police Departments. *Journal of Labor Economics* 28, 167--201 (2010)
4. Nunn, S., Quinet, K.: Evaluating the Effects of Information Technology on Problem-Oriented-Policing If it Doesn't Fit, Must We Quit? *Evaluation Review* 26, 81--108 (2002)
5. Benson, D.: The Police and Information Technology. In: Button, G. (ed.) *Technology in working order : studies of work, interaction and technology*, pp. 81--97. Routledge, London (1993)
6. Brahan, J.W., Lam, K.P., Chan, H., Leung, W.: AICAMS: artificial intelligence crime analysis and management system. *Knowledge-Based Systems* 11, 355--361 (1998)
7. Oatley, G.C., Ewart, B.W.: Crimes analysis software: 'pins in maps', clustering and Bayes net prediction. *Expert Systems with Applications* 25, 569--588 (2003)
8. Chen, H., Schroeder, J., Hauck, R.V., Ridgeway, L., Atabakhsh, H., Gupta, H., Boorman, C., Rasmussen, K., Clements, A.W.: COPLINK Connect: information and knowledge management for law enforcement. *Decision Support Systems* 34, 271--285 (2002)
9. Chen, H., Zeng, D., Atabakhsh, H., Wyzga, W., Schroeder, J.: COPLINK Managing Law Enforcement Data and Knowledge. *Communications of the ACM* 46, 28--34 (2003)
10. Redmond, M., Baveja, A.: A data-driven software tool for enabling cooperative information sharing among police departments. *European Journal of Operational Research* 141, 660--678 (2002)
11. Sørensen, C., Pica, D.: Tales from the police: Rhythms of interaction with mobile technologies. *Information and Organizations* 15, 125--149 (2005)
12. Sørensen, C., Pica, D., Allen, D.: On Mobility and Context of Work: Exploring Mobile Police Work. *Proceedings of the 37th Hawaii International Conference on System Sciences* Island of Hawaii (2004)
13. Allen, D.K., Wilson, T.D., Norman, A.W.T., Knight, C.: Information on the move: the use of mobile information systems by UK police forces. *Information Research*, vol. 13, pp. paper 378 (2008)
14. Ratcliffe, J.H.: Intelligence-Led Policing And The Problems Of Turning Rhetoric Into Practice. *Policing and Society* 12, 53--66 (2002)
15. Ratcliffe, J.H., Guidetti, R.: State police investigative structure and the adoption of intelligence-led policing. *Policing: An International Journal of Police Strategies & Management* 31, 109--128 (2008)

Hybrids acting at the hybrid arena 11

16. Bednar, P.M., Katos, V., Hennell, C.: Cyber-Crime Investigations: Complex Collaborative Decision Making. Third International Annual Workshop on Digital Forensics and Incident Analysis, pp. 3--11 (2008)
17. Burmester, M., Henry, P., Kermes, L.S.: Tracking cyberstalkers: a cryptographic approach. *SIGCAS Computers and Society* 35, (2005)
18. Mathew, A.R., Hajj, A.A., Ruqeshi, K.A.: Cyber Crimes: Threats and Protection. 2010 International Conference on Networking and Information Technolog, pp. 16--18 (2010)
19. Wang, S.-J.: Measures of retaining digital evidence to prosecute computer-based cyber-crimes. *Computer Standards & Interfaces* 29, 216--223 (2007)
20. Eneman, M.: Developing Child Protection Strategies: A Critical Study of Offenders' Use of Information Technology for the Sexual Exploitation of Children. Göteborgs universitet IT-fakulteten. Institutionen för tillämpad informationsteknologi (GU), vol. Doctoral. University of Gotenburg, Gothenburg (2010)
21. Orlikowski, W.J.: The Duality of Technology: Rethinking the Concept of Technology in Organizations. *Organization Science* 3, 398--427 (1992)
22. Orlikowski, W.J., Baroudi, J.J.: Studying Information Technology in Organizations: Research Approaches and Assumptions. *Information Systems Research* 2, 1--28 (1991)
23. Orlikowski, W.J., Gash, D.C.: Technological Frames: Making Sense of Information Technology in Organizations. *ACM Transactions on Information Systems* 12, 174--207 (1994)
24. Lamb, R.: Social Actor Modelling in ICT Research. In: Conference Social Actor Modelling in ICT Research, pp. 287--296. (Year)
25. Lamb, R., Kling, R.: Reconceptualizing Users As Social Actors In Information Systems Research. *MIS Quarterly* 27, 197--235 (2003)
26. Kling, R.: Learning About Information Technologies and Social Change. *The Information Society* 16, 217--232 (2000)
27. Kling, R., Lamb, R.: IT and Organizational Change in Digital Economies. *Computers and Society* 29, 17--25 (1999)
28. Benbasat, I., Zmud, R.W.: The Identity Crisis Within the IS Discipline: Defining and Communicating the Discipline's Core Properties. *MIS Quarterly* 27, 183--194 (2003)
29. Robey, D.: Identity, legitimacy and the dominant research paradigm: an alternative prescription for the IS discipline. *Journal of the Association for Information Systems* 4, 352--359 (2003)
30. Orlikowski, W.J., Iacono, C.S.: Research commentary: desperately seeking the 'IT' in IT research – a call for theorizing the IT artifact. *Information Systems Research* 10, 121--134 (2001)
31. Rose, J., Jones, M., Truex, D.: Socio-Theoretical Accounts of IS: The Problem of Agency. *Scandinavian Journal of Information Systems* 17, 133--153 (2005)
32. Michael, M.: Reconnecting culture, technology, and nature : from society to heterogeneity. Routledge, London (2000)
33. Michael, M.: Technoscience and everyday life : the complex simplicities of the mundane. Open University Press, Maidenhead (2006)
34. Lindroth, T.: The Lapter: Understanding Agency from a Hybrid Perspective. In review for the *Scandinavian Journal of Information Systems* (forthcoming)

12 Erik A.M. Borglund¹, Lena-Maria Öberg², Thomas Persson Slumpi²

35. Orlikowski, W.J.: Sociomaterial Practices: Exploring Technology at Work. *Organization Studies* 28, 1435--1448 (2007)
36. Borglund, E.A.M., Slumpi, T.P., Öberg, L.-M.: A success story about the investigation of organized prostitution: The Jämtland police authority case. Third Nordic police Research seminar, Umeå (2010)
37. Taylor, S.J., Bogdan, R.: *Introduction to qualitative research methods : a guidebook and resource*. Wiley, New York, N.Y. ; Chichester (1998)
38. Myers, M.D., Avison, D.E.: *Qualitative Research in Information Systems : A Reader*. Sage, London (2002)
39. Van Maanen, J.: *Tales of the field : on writing ethnography*. University of Chicago Press, Chicago (1988)
40. Aspens, P.: *Etnografiska metoder : att förstå och förklara samtiden*. Liber, Malmö (2007)
41. Kvale, S.: *Den kvalitativa forskningsintervjun*. Studentlitteratur, Lund (1997)
42. Yin, R.K.: *Case study research: design and methods*. Sage Publications, Thousand Oaks, Calif. (2003)
43. Walsham, G.: Interpretative Case Studies in IS Research: Nature and Method. In: Myers, M.D., Avison, D.E. (eds.) *Qualitative research in information systems : a reader*, pp. 101--113. SAGE, London (2002)
44. Suchman, L.: Making Work Visible. *Communications of the ACM* 39, 56--64 (1995)
45. Bødker, S.: Scenarios in user-centred design—setting the stage for reflection and action. *Interacting with Computers* 13, 61--75 (2000)
46. Carroll, J.M.: Five reasons for scenario-based design. *Interacting with Computers* 13, 43--60 (2000)

E-maintenance: Challenges and Opportunities

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Abstract. E-maintenance offers various opportunities as well as challenges in contemporary business undergoing transformation. This paper provides an overview of opportunities and challenges in different areas related to e-maintenance. Literature review and empirical findings through action oriented research give way to identify and present these opportunities and challenges. One contribution of the paper is, it finds the opportunities and challenges with e-maintenance in different industries which creates a pathway for future direction in further studies regarding e-maintenance. The findings indicate that there is much potential to study these with respect to technology and business.

Keywords: E-maintenance, condition monitoring, remote diagnostics, action oriented research

1 Introduction

The term ‘E-maintenance’ has been discussed in several times in the past few years in many maintenance related literature. It has been discussed with different perspectives. E-maintenance basically refers to the integration of the information and communication technologies (ICT) within the maintenance strategy or plan [1]. E-maintenance has been discussed one of the four ways: 1) a maintenance strategy (i.e. a management method), 2) a maintenance plan, 3) a maintenance type or 4) a maintenance support [2]. E-maintenance as maintenance type describes replacing traditional maintenance with technological maintenance where predictive maintenance is done with the help of artificially intelligent systems that provide only condition monitoring and predictive prognostic functions [2]. In this paper, e-maintenance is also considered as a maintenance type because our focus is to discuss involvement of ICT in the previously non-ICT based maintenance system to monitor condition, fault detection and diagnosis.

One of the reasons behind the use of e-maintenance in different companies is the competition factor. Smart companies must focus on service innovation and asset optimization for customer intimacy [3]. E-maintenance emerges with globalization and fast growth of the information and communication technologies [4]. Proper implementation of e-maintenance will benefit the manufacturers and users to have process reliability with optimal asset performance and seamless integration with

suppliers and customers [4]. Moreover, e-maintenance enables manufacturing operations to achieve nearly zero downtime performance [4].

Rapid developments in information and communication technologies are providing novel opportunities to the existing cultures of maintenance. Since 2000, e-maintenance has been into considerations and gaining more attention in contemporary maintenance related literature. The competitive environment in manufacturing firms compels most of them to think in advance about the opportunities and associated challenges regarding their future products and services. E-maintenance based on remote diagnostics opens new areas of research [5]. One example is the transformation of the vehicle industry where new opportunities for e-maintenance based on remote diagnostics systems are emerging [6]. Others examples of its applications include power industry [7]; manufacturing and mineral processing industry [8]; chemical process industry [9]; computer Printer [10]; aero planes [11]; jet engines [12]; and warehouse, semi-conductor industry, Ford and Toyota Motor companies [13].

The purpose of this paper is to show the use of e-maintenance in different industries and also discuss the opportunities and challenges that different industries are facing or expect to face with e-maintenance.

At first, a review has been done on different e-maintenance types that are proposed or employed in various industries. This is followed by the research approach to conduct the research. On the basis of collected data and literature, opportunities and challenges regarding e-maintenance have been presented. Concluding remarks with future work end the paper.

2 Research Method

This research is a part of an ongoing project together with a firm in the vehicle industry. This is collaboration between research community and practitioners from the industry as such that it can be characterized as action oriented research ([18], [19], [20]). On the basis of remote diagnostics, an expansion from traditional manufacturing oriented to the manufacturing plus service oriented business has been visioned by top management. The project is aimed at the followings (i) to explore and develop new remote diagnostics technologies, (ii) to develop new digital services, identify the related conceptual business models and its implementation in their business models. The purpose in this paper is to address exploration part of the first aim.

To explore the e-maintenance technologies that are now being employed in different industries, a literature review has been conducted. The key words or phrases used for the literature search were e-maintenance, computer based monitoring, condition monitoring, computer based fault detection in different industries. So, the authors have done search for literature in journals and conference proceedings that discuss about maintenance engineering, expert systems, intelligent agent technology, use of computers in different industries. Information has also been collected from the websites of various companies that have used e-maintenance. It is done in order to know about some industries which are not found in the literature. As the aim was to

get knowledge about e-maintenance technologies in different industries rather than e-maintenance technologies in similar type of industries, the authors have not discussed all the e-maintenance technologies that are being used in a particular type of industry.

After the literature review, as mentioned before, empirical work is also done during an ongoing project with a vehicle company. In the empirical work, In line with action oriented research approaches, the project is organized as a collaborative process in four steps: (i) exploration; (ii) conceptualization; (iii) development; and (iv) implementation and verification. At this point of project, the exploratory study has been done with the purpose to understand and explore the existing technologies and business situation. This will lead to further probe what they can offer to each other. Several activities have been performed in order to gather information by involving important stakeholders. Data was gathered from the workshops, service development and monthly meetings and documents including weekly project reports, meeting minutes, mail correspondences.

In order to ensure that different aspects of value networks were captured in the exploration, several data sources were used to generate a comprehensive understanding. Even though interviews are rich sources of interpretations, they should be supplemented with other sources [21]. In this study we have used a number of different data collection methods including meetings, interviews, workshops, and documents as shown in Table 1.

Collection of empirical material started with the meetings i.e. weekly, on-demand and monthly). These meetings along with the available documentation provided the basis to plan and conduct workshops with different business areas.

Each of the weekly and on-demand meeting lasted between 1-2 hours. These meetings were more concerned with the planning activities, understanding and discussion about potential areas of study of the project in addition to preparing ground for workshops. Meeting notes provided the firm's perspective expectations and coupled with other documents such as project related documents.

Monthly project meetings were 3 hours each, generic in nature and discussed project issues which occurred across the disciplines such as technical, business, service development. Also the cross-disciplinary inputs about opportunities and challenges were collected using notes during the meetings and meeting minutes, afterwards.

Workshops were conducted as full-day activities and included interviewing business area representatives as well as drawing value networks. The main focus was to explore opportunities and challenges during these workshops while performing above mentioned activities. The interviews were designed in a semi-structured way to serve as guides in order to explore the challenges and opportunities. Insights from literature review, meetings notes and other considerations such as research intention served as the basis for designing the interview. Value networks were also drawn with the particular business areas representatives to find out their existing business status.

Table1 below summarizes the data collection activities, the numbers and participants involved in each of the activity.

Table1. Summary of data collection activities

Activities		No.	Informants or Participants
Service Development Meetings	Biweekly	21	<ul style="list-style-type: none"> • Service Developers (2) • Project Manager (1) • Technical Researcher (1) • Informatics Researchers (3)
	On demand		
Workshops		2	<ul style="list-style-type: none"> • Service Developers (2) • Business Area Representative (1) • Informatics Researchers (2)
Monthly Project Meetings		3	<ul style="list-style-type: none"> • Service Developers (2) • Project Manager (1) • Informatics Researchers (3) • Technical Developers (2) • Technical Researchers (3)
Documents	Meeting notes, weekly Project reports, mail correspondence		<ul style="list-style-type: none"> • Service Developers (2) • Project Manager (1) • Technical Researcher (1) • Informatics Researchers (3)

The recorded interviews were one of the major sources of information and were transcribed to interpret data. Value networks were also analyzed to find out the existing as well as new challenges and opportunities in the business.

Different kinds of documents such as weekly reports about project status, field notes, and company documents were collected and analyzed for the common purpose during exploration. A follow-up study was conducted using mail correspondence and additional on demand meetings and the information from those meetings was added to the analysis.

3 E-maintenance in Different Industries: A Review about the Technology

Various types of e-maintenance have been applied or proposed in different industries. After reviewing the literature that describe different e-maintenance types and also searching the web regarding the use of e-maintenance, we have made an overview of those technologies that are either applied in different industries or proposed for implementation in different industries.

Condition Monitoring Multi Agent System (COMMAS) is a system that addresses a new area in intelligent electrical plant monitoring as it supports the use of more than one computational intelligence technique through agent technology, in order to interpret the plant data and derive meaningful conclusions [7]. Mangina et al. [7] describe how the theoretical framework of Condition Monitoring Multi Agent System

(COMMAS) for intelligent data interpretation has been applied and implemented in the identification of partial discharge signal defects of Gas Insulated Substations (GIS). There are lower levels of intelligent functions in COMMAS. Attribute Reasoning Agents (ARA), Cross Sensor Corroboration Agents (CSCA) and Meta-Knowledge Reasoning Agents (MKRA). The data is fed initially to a set of Attribute Reasoning Agents (ARA) which determine if there are any anomalies which must be considered. After performing their intelligent data interpretation, the result is sent to next layer of agents known as Cross Sensor Corroboration Agents (CSCA). These agents attempt to identify sensor problems as opposed to plant problems. Finally, the conclusions of the CSCA agents are communicated to the Meta-Knowledge Reasoning Agent (MKRA) which provides the final interpretation to offer the end user improved condition monitoring information [7]. This agent based approach offers a flexible condition monitoring architecture which can be applied for any plant item. The distribution of the intelligence allows for scalability and ease of integration of new intelligent reasoning modules. Additionally, it allows the reasoning to be performed across a number of processors at a number of locations [7].

For chemical processing industry, a multi-agent based condition monitoring system has been proposed by Sun et al.[9]. The proposed architecture has been designed according to the principles of use of the mechanisms of encapsulation, isolation and local control. Each agent is composed of a control modular, a database, a communication block, a knowledge base, an information processor and a data acquisition and network listening block [14]. The knowledge interchange between the agents is made through the automatic translation languages of messages programmed in Common Knowledge Representative Language, which is based on the C++ programming language. This monitoring technology alarms are triggered whenever fixed thresholds are exceeded [14].

For manufacturing and mineral processing industry, Ebersbach and Pegg [8] have developed an expert system for condition monitoring. It provides a different way of working for the maintenance personnel, since the tradition is to apply the analysis methods manually. It is believed that the use of an expert system could allow comprehensive analyses as well as enabling the maintenance engineer to perform routine analyses. The vibration analysis expert system (VES) uses a knowledge base for fault identification. It has a peak detection algorithm whose objective is to search for the vibration data file of a particular frequency, or the frequency or time domain pattern. Microsoft Visual Basic was selected for implementation due to the requirements of the user interface, allowing ease of use including on-line help screens. The system has 75 rules and is implemented in 'if' loop type statements, in order to diagnose 54 different machine component faults. It was modeled using a pseudo code to implement the flow chart. The VES was successfully tested using vibration data obtained from a laboratory providing the detection of various faults [14]. It is a tool that may potentially be used for both the laboratory and on-site maintenance departments of large manufacturing and mineral processing plants [14].

For pumps, Hardig [15] describes a predictive maintenance system. It is a web-enabled system. This makes it possible for any facility with internet access to establish a world-class predictive maintenance program for less than what it would cost to run an in-house program. We-enabled monitoring systems enable predictive maintenance data collected by a company's designated technician to be uploaded

easily and accurately to a remote web server for trending and analysis by experienced third party professionals. An e-maintenance program provides a standardized approach to managing a predictive maintenance program and integrates all the participants into a team with clearly defined roles, responsibilities [15].

Angeles [13] shows the use of RFID (Radio Frequency Identification) technology as the control and monitoring technology in the logistical operations of several different industries such as cosmetics, biscuits, semi-conductor and cars. RFID is a type of auto-identification technology that uses radio waves to identify individual physical objects [13]. RFID technology uses tags that have both a microchip and an antenna. The microchip is used to store object information such as a unique serial number, which transforms the information on the RFID tag to a format understandable by computers. RFID technology also uses the tag reader. Through the method of inductive coupling, RFID readers communicate with tags. The coiled antenna of the reader creates a magnetic field with the tag's antenna, which subsequently drawn energy from this field and uses this to send back waves to the reader. These waves are transformed into digital information representing the Electronic Product Code (EPC) [13]. In Unilever, the RFID technology is used in the following way for logistical operation: transponders (RFID tags) have been installed at the bay doors of the warehouse to track pallets that pass through them. Thereafter, another transponder transmits that information about the passing transport vehicle to the computer system. This information on the individual pallet weights stored in the computer database is used in comparing the weight of the total load of a truck [13]. As a result of the RFID system, the number of daily pallets handling has increased and the information on the movements of the physical loads has become more reliable [13].

For mining industry, Lewis and Steinberg [16] describe condition monitoring system INTELLIMINE. It facilitates the implementation of a proactive maintenance program. This maintenance management program has seven modules: real-time, reporting, remote condition monitoring, data acquisition and filtering, field interfaces, third party interface and configuration. These modules will provide the maintenance supervisors, planners, reliability engineers, technicians and managers with the information necessary to make educated decisions regarding maintenance activities [16].

Another industry where e-maintenance and e-diagnostic have been proposed is semi-conductor industry and is proposed by Min-Hsiung et al.[17]. A prototype is tested through various operational scenarios. The development process, i.e. the analysis, design, functional requirements and system implementation of the prototype system, is presented [14]. UML is used in the design of the development process. The authors mention that the proposed framework achieves the automation of diagnostic processes and integration of diagnostic and maintenance information under a secure communication infrastructure. Web technologies and web applications based on web services and XML are proposed as baseline technologies [14].

The computer manufacturing company Canon employs e-maintenance for their printers [10]. The functions that the e-maintenance system provides are : instant email notification of faults or performance issues often before the user would even know there's a problems, automatic monitoring of maintenance requirements and performance, the e-maintenance is suitable for most Canon multifunction devices,

Easy consumables management (for example, receive a notification when toner is low), Automated fleet management [10].

In the aero plane industry we can also see the deployment of e-maintenance [11]. Aircraft manufacturer Dassault Falcon recently completed successful testing with Falcon operators based in Europe and the United States on a new maintenance program called 'Falcon E-Maintenance' [11]. The program enables the Falcon Technical Center or a Falcon service center to remotely access an airplane Central Maintenance Computer, or any other aircraft maintenance application, to troubleshoot and diagnose issues. This connection is made through a laptop provided by Dassault with WiFi or satellite capabilities [11].

The maintenance laptop makes it possible for the aircraft technicians, service center and the Falcon Technical Center to work in real time on one common communication platform that is capable of both audio and video. From there, they can share technical documents, transfer files and organize multimedia conference meetings. If needed, it will be possible for an Authorized Service Center or the Falcon Technical Center to remotely access the aircraft's central maintenance computer [11].

4 Findings: Challenges and Opportunities with E-maintenance

In this section, the opportunities of e-maintenance and its challenges/limitations are highlighted. The information are found from the literature review, two workshops, three monthly meetings and many service development meetings with the company staffs and also from various documents such as meeting notes and weekly project reports.

Talking about the opportunities of e-maintenance, with the help of a multi-agent e-maintenance system for power industry the condition monitoring will be more powerful [7]. However, as a limitation it can be pointed out that the e-maintenance system provides results for an application where there are decentralized resources [7]. And also the toolkit is not a commercial toolkit [7].

In chemical processing industry, there is opportunity of e-maintenance with the use of multi-agent systems and web technologies [9]. Diagnostic agents communicate by exchanging messages and both local and global knowledge to solve process abnormal situations [9]. But there are many problems in multi-agent system such as sensor validation, providing explanations for the propagation of faults, possible multiple fault situation handling are the challenging problems in this study [9]. Because of these problems getting the full advantage might be difficult.

There is opportunity of e-maintenance in manufacturing and mineral processing industry where a high throughput vibration analysis condition monitoring is possible with vibration analysis expert system (VES) to be performed by non-expert technical staff [8]. However, as a future requirement, the completion of the system need to facilitate the design of a comprehensive machine condition monitoring expert system utilizing oil, wear debris and vibration analysis techniques [8].

There are several positives of deploying e-maintenance in the pumps [15]. The good points of e-maintenance are: 24-hour surveillance of the pumps, centralized data, i.e., past data from all locations is easily accessed by authorized personnel. Another

positive thing is field support, i.e., the ability to share data among sites and between specialized analysts and field staff equips in-field personnel with access to more complete and accurate data on which to base timely decisions that may impact operation. And the final positive about the e-maintenance is minimized investment. But as a future challenge, a maintenance strategy and risk analysis should be in place before making an investment [15].

There are several opportunities of RFID (Radio frequency identification) as e-maintenance in several industries such as cosmetics, biscuits, cars etc. RFID technology promises process freedom and near-perfect information visibility throughout the supply chain across different industries [13]. However, as a future challenge it needs to be pointed out that more detailed understanding of effective implementation strategies and best practices need to be undertaken [13].

In mining industry, with the use of remote condition monitoring system, the maintenance process can be optimized as in mining industry maintenance related cost is really big [16]. But a limitation is that most of the remote condition monitoring programs have not achieved the return on investment [16].

In semiconductor industry, there exists the following opportunities of e-maintenance : automatically integrating diagnostics, fixing, monitoring of equipment and fault prediction which are necessary to support the e-diagnostics/maintenance tasks in semi-conductor factories [14]. But meeting all the requirements of maintenance/diagnostics systems for the semiconductor industry is the future challenge [14].

From one of the workshops with the staffs from a vehicle company, we have found out the following opportunities of e-maintenance: small scale implementation of remote diagnostic systems in construction equipment at the initial stage to find out fatal errors, deploying remote diagnostic systems in the sub-components where troubles occur regularly, the remote diagnostic system will bring goodwill to the company which will provide this service, it might save good amount of money in maintenance. But the discussants also point out some future challenges: correct information about the errors is required without any chance of misinterpretation, time is a big issue in maintenance; providing the service in time is a big challenge, the information should be tied with instruction for the next step, the business model needs to be reshaped, shifting the thinking from just manufacturing construction equipment to providing additional services to those equipment is the real challenge.

During another workshop, the discussants state that the e-maintenance has the following opportunities: increasing up-time of the vehicles, creating new commercial offerings through the remote diagnostic system. But they were also unanimous that attracting all types of customer groups will be tough and lowering the operating costs will be a challenge.

Table 2 below shows various opportunities and challenges in two major areas i.e. in the technology and in the business and business models. Each of the opportunity is associated with some challenges or limitations that lessen its advantages.

The major opportunities in the area of technology are condition-based monitoring as well as predictive maintenance and diagnostics. Condition-based monitoring as well as predictive maintenance and diagnostics are essential in the industries where critical processes are in place [7] [8] [9] [15] [13]. But the opportunities to provide

these facilities are challenged with number of factors. For example, analysis of meeting notes show us that the people in this area are not sure about which parts are necessary to be embedded with digital capabilities as they cannot provide digital capabilities to all the parts. This will result as a limitation to provide e-maintenance. Moreover, technological limitations related to digital products, communications, managing information and so on also provide various challenges.

In case of business, e-maintenance serve as potential asset for business landscape by providing number of opportunities, such as:

- New services such as monitoring or providing predictive maintenance of equipment for fixed cost may generate revenue for the business.
- Our analysis reflected that most of the large firms in industries are connected through business to business relationship e.g. a vehicle manufacturing firm deal its major customers through dealers. E-maintenance provides the facility for such a firm to establish direct contact with customer for new e-maintenance services while maintaining the existing ones. Another opportunity is to provide e-maintenance through existing dealers.

Table 2. Overview of opportunities and challenges

Sources		Challenges/Limitations	Opportunities
Literature		Provides results for an application where there are decentralized resources. It is not a commercial toolkit.	More powerful condition monitoring
		Sensor validation, providing explanations for the propagation of faults, possible multiple fault situation handling	Multi agent diagnostic system for chemical processes
		Combining the VES expert system with an expert system for oil analysis	Vibration analysis, condition analysis to be performed by non-expert technical staffs
		Maintenance strategy, Risk analysis	24/7 capabilities, centralized data, field support, minimized investment
		More detailed understanding of effective implementation strategies and best practices need to be undertaken.	RFID technology promises process freedom and near-perfect information visibility throughout the supply chain across different industries.
		Most remote-condition monitoring programs have not achieved their expected return on investment	Optimizing the maintenance process
		Meeting the requirements of e-maintenance/diagnostics systems for the semi-conductor industry.	Automatically integrating diagnostics, fixing, monitoring of equipment and fault prediction which are necessary to support the e-diagnostics/maintenance tasks in semi-conductor factories.
Workshops	Workshop 1	<ul style="list-style-type: none"> • Correct information about the errors without any chance of misinterpretation. • Time is a big issue in maintenance. Providing the service in time is a big challenge. • The information should be tied with instruction for the next step. • The business model needs to be reshaped. Shifting the thinking from just manufacturing construction equipment to providing additional services to those equipment is the real challenge	<ul style="list-style-type: none"> • Initially small scale implementation of remote diagnostic systems in construction equipment to find out fatal errors. • Deploying remote diagnostic systems in the sub-components where troubles occur regularly. • The remote diagnostic system will bring goodwill to the company that will provide the service. • It might save good amount of money in maintenance
	Workshop 2	Attracting all types of customer groups will be tough; lowering the operating costs will be a challenge.	Increase up-time of the vehicles, creating new commercial offerings through the remote diagnostic system.
Document	Meeting notes	<ul style="list-style-type: none"> • Choice on parts to be digitized • Technological limitations 	Increased uptime for the services enabled by remote diagnostics.
	Weekly project reports	<ul style="list-style-type: none"> • Managing information • Data storage, retrieval and processing 	

- Time and money has always been important and especially in the contemporary fast growing and highly competitive business environment. E-maintenance is believed to reduce manual efforts and time in addition to low cost maintenance.

- Intangibles are of high strategic importance in the networks where externalities exist [22]. One of the intangible as ‘enhanced goodwill’ is recognized as opportunity for sustainable business by one of the business area manager during our workshops.

- The availability of services to the intended users whenever and wherever needed is considered as uptime for service. E-maintenance is one of the sources to provide services with such characteristics.

But, these opportunities like others are not free from challenges and/or limitations. Some of the identified challenges are:

- Converting business-to-business (b2b) relationships to business-to-customer (b2c) is not an easy task and involves many factors e.g. strategic, political, competitive

- Moreover, attracting customers to change existing relationships is difficult as they are

- Besides other, there is a risk of high cost to establish and maintain new business-to-customer relationships.

- Current business models are based on traditional value chain approach and hence are rigid. The meeting notes show that e-maintenance adds dynamic characteristics to the business; hence a more flexible model is required.

Table 3. Opportunities and challenges in different areas

Areas	Opportunities	Challenges/Limitations
Technology	<ul style="list-style-type: none"> • Condition-based monitoring • Predictive maintenance and diagnostics 	<ul style="list-style-type: none"> • Choice on parts to be digitized • Technological limitations • Managing information • Data storage, retrieval and processing
Business	<ul style="list-style-type: none"> • Introduction of new services in the business • Extending existing b2b relationships to b2c • Establishing new b2c and b2b relationships • Cost efficient with the use of technology as compared to traditional method • Introducing new stakeholder, change roles of existing, and even omitting some from the network • Intangible benefits • Increase uptime for e-maintenance services 	<ul style="list-style-type: none"> • Converting b2b relationships to b2c • Attraction for customers to change existing relationships • Cost of establishing and maintaining new b2c relationships • Providing services whenever and wherever needed • Communication management and cost • Current business models are rigid

5 Conclusions

The point of discussion in this paper is: to find out opportunities and challenges regarding e-maintenance.

Based on the literature review and empirical work we tried to shed light on some of the opportunities and challenges as mentioned in the purpose of the paper. We have made an analysis of these opportunities and challenges and identified two main areas: technology and business.

This paper will serve as the basis for more in-depth study based on extensive literature review and empirical findings. In future work, a study can be done on how e-maintenance can influence business model of an organization.

References

- [1] Li Y, Chun L, Nee A, Ching Y. “An agent-based platform for web enabled equipment predictive maintenance”. In: Proceedings of IAT’05 IEEE/WIC/ACM international conference on intelligent agent technology, Compiègne, France, 2005
- [2] Muller, A., Crespo Marquez, A., Iung, B. “On the concept of e-maintenance: review and current research”, Reliability Engineering and System Safety, Vol. 93, pp. 1165-1187, 2008
- [3] Lee, J. “A framework for next generation e-maintenance system”. In: Proceedings of the second international symposium on environmentally conscious design and inverse manufacturing, Tokyo, Japan, 2001.
- [4] Han, T., Young, B-S., “Development of an e-maintenance system integrating advanced techniques”, Computers in Industry, 57(6), 569-80, 2006
- [5] Lyytinen K. and Yoo Y. “Issues and challenges in ubiquitous computing”, Communications of the ACM, Volume 45, Issue 12, 2002a, pp. 63 -65
- [6] Kuschel, J. “Vehicle services”. PhD Thesis, University of Gothenburg, 2009
- [7] Mangina, E.E., McArthur, S. D. J., McDonald, J. R. “The use of a multi-agent paradigm in electrical plant condition monitoring”, in: Proceedings of Large Engineering Systems Conference on Power Engineering. (LESCOPE’01). Theme: Powering Beyond 2001 (Cat. No. 01EX490), pp. 31-36, 2001
- [8] Ebersbach, S., Peng, Z. “Expert system development for vibration analysis in machine condition monitoring”, Expert Systems with Applications, 4 (1), 291–299, 2008.
- [9] Sun, J. G., Yang, X. B., Huang, D. “Multi-agent based distributed chemical process monitoring and diagnosis”, in: Proceedings of 2002 International Conference on Machine Learning and Cybernetics (Cat. No. 02EX583), vol. 2, 2002, pp. 851–856
- [10] Intelligent Remote Device management, Available at <http://www.canon.com.au/en-au/Business/Software-Solutions/Service/eMaintenance>
- [11] Dassault to Provide Cutting Edge Support Through Falcon 'E-Maintenance' Program, Available at http://www.dassaultfalcon.com/whatsnew/shared/w_prelease_details.jsp?DOCNUM=131145
- [12] Lee J, Ni J, Koc M. “Tether-free technologies for e-manufacturing, e-maintenance and e-services”, University of Michigan, 2001
- [13] Angeles, R. “RFID technologies: supply-chain applications and implementation issues”, Information Systems Management 22(1) pp. 51–65., 2005
- [14] Campos, J. “Development in the application of ICT in condition monitoring and maintenance”, Computers in Industry, Vol. 60, pp. 1-20, 2009
- [15] Hardig, K. G. “Remote Monitoring Signals The Future of PdM”, Available at www.pump-zone.com/articles/4.pdf
- [16] Lewis, M. W., Steinberg, L. “Maintenance of mobile mine equipment in the information age”, Journal of Quality in Maintenance Engineering, Vol. 7, No. 4, 2001, pp. 264-274

- [17] Min-Hsiung, H., Kuan-Yii, C., Rui-Wen, H., Fan-Tien, C. “Development of an e-diagnostics/maintenance framework for semiconductor factories with security considerations”, *Advanced Engineering Informatics*, 17 (3–4) (2003) 165–178.
- [18] Baskerville, R. and Myers D. “Special issue on Action Research in Information System: Making IS Research Relevant to Practice-Forward”, *MIS Quarterly*, Volume 28, Issue 3, 2004, pp. 329 - 335
- [19] Kock, N., and Lau, F. “Special issue on information system action research, serving two demanding masters”, *Information Technology and People*, Volume 4, Issue 1, 2001
- [20] Matiassen, L. “Collaborative practice research”, *Information Technology and People*, Volume 15, Issue 4, pp. 321 - 345
- [21] Walsham, G. “Doing interpretative research”, *European Journal of Information Systems*, Volume 15, 2006, pp 320-330
- [22] Kim E. and Lee B. “An economic analysis of customer selection and leveraging strategies in a market where network externalities exist”, *Decision Support Systems*, 2007, pp. 124 - 133

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Framework and Research Agenda for Master Data Management in Distributed Environments

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Abstract. Master data is the foundation for relating business transactions with business entities such as customers, products, locations etc. These entities are also referred to as domains in master data literature. The integrity, availability and timeliness of master data in single-, and growingly in multi-domain combinations is crucial in eBusiness transactions over the Internet, or in the cloud for multiple stakeholders. Distributed environments set additional challenges for the management of master data. In this idea paper, we first describe master data, management processes, responsibilities and other contemporary master data management practices aiming to ensure master data quality in different domains. Even though these practical means are of help in improving master data quality and managing master data, they are insufficient to capture the underlying root cause of master data problems. We then look into master data management from the IS theoretical viewpoint and finally propose a research agenda for most critical issues in master data management. We suggest that holistic approaches such as enterprise architecting, stakeholder analysis, or business modeling could serve as coherent frameworks in identifying common and specific master data management research themes for global businesses with networked IT environments.

Keywords: Data Governance, Master Data management, MDM, master data organization, Enterprise Architecture.

Introduction

A recent survey conducted in Finland revealed several shortcomings in master data management (Dahlberg, 2010¹). This survey and other studies (e.g. Silvola et al, 2011) indicate that master data required to carry out business transactions is spread over multiple systems and databases in an organization and has become more fragmented with each new information system implementation, with obvious side-effects of duplicate data items, redundancy, performance as well as rework in transaction processing and business reporting.

In a recent IBM Global Chief Information Officer Study (2011) the importance of master data management was stressed in face-to-face conversations with more than 3,000 chief information officers worldwide: Over the next three to five years, the CIOs will mainly focus on customer analytics, product/service profitability analysis and master data management. They see that this requires moving beyond traditional relational database management systems into the next generation of integrated data warehouses. Often, the organization becomes aware of the master data challenge when it engages in enterprise architecture work, in large scale IT projects such as an ERP implementation, in major migrations of the organization's core information systems, or when it wants to grow in eBusiness (Dahlberg 2010). Typically, legacy systems consist of numerous partly or totally overlapping master data sets that were developed for some limited or specific purpose. In addition to dominantly used narrow project focus, over the years conducted mergers and acquisitions with uncompleted integrations have added to the fragmentation of systems, databases and coding schemes of master data. For example, in Dahlberg's (2010) survey, one global company had 54 overlapping ERP systems - and respective master data databases - on five continents. Using the tangled web of incoherent master databases and data coding schemes is a call for trouble. It is not rare that an organization's systems have multiple instances of the same customer or product entity, or variants with only slight attribute variations. Multiple entries of the same data, missing, erroneous and conflicting data values cause doubts on the reliability of managerial reporting and business analytics and lead to functional deficiencies in terms of inefficient operations, excess stocks, inability to gain economies of scale, poor customer relationship management etc. When, in these distributed environments, organizations become involved in various kinds of business networks or consider moving their IT to clouds, there is even more urgent need for holistic management of master data.

¹ Survey consisted of a series of interviews in 10 large organizations with cumulatively over 100 interviewees from senior

With *master data management* (MDM) organizations aim to first improve and then to ensure the quality, consistency and accuracy of the master data. This requires that both technical solutions and organizational processes are managed (Cleven and Wortmann, 2010). Both are demanding, but there are more challenges in the latter (Loshin, 2001, 2008). It appears that in many organizations nobody has responsibility over master data, or they lack the means to execute such a responsibility. The technical solutions and organizational processes are supported with MDM measures such as master data development, master data quality improvement and information architecture. Poor master data management results in missing business and performance objectives, inadequately agreed data ownership (Dyche & Levy, 2006), fragmented data management processes (Mosley, 2008; Dreibelbis et al., 2008) and lack of continuous data quality assurance (Dahlberg, 2010; Silvola et al., 2011).

Even though master data management appears to us as one of the most critical and persistent issues in information system practice at the moment, research on MDM has started only lately (e.g., Google scholar query on articles having words “master data management” in the title provided only 84 hits, and in any part of the article provided 1720 hits), and consequently vagueness characterizes concepts used. At the moment, there are a lot of shortcomings in master data management and hence some studies describe these challenges (e.g. Silvola et al., 2011) and efforts taken to solve them (e.g. Otto and Reichert, 2010). These, and additional practical efforts are represented in a framework of two dimensions – types of data and master data management perspectives to be shown later in the article - to provide a generic background over the phenomenon and approaches used improve master data management.

Although this practice-derived framework sums up the MDM phenomenon and approaches applied to remove the consequences of bad quality master data, we argue that a deeper understanding is needed to understand better the root cause of the problems. We then describe and analyze master data management from the IS theoretical viewpoint and propose a research agenda for master data management to address the practical problems. It is necessary to understand the networked, multi-domain use context of data. It appears that master data – and data in general - started to fragment when the number of information systems grew and new systems were predominantly installed with narrow project, technical etc. focus. Consequently, the information systems’ ontology - and its state tracking and reporting characteristics (Wand and Weber 1989, 1993, 2002) over the isolated systems used in new interdependent contexts – will eventually become fragmented. Hence, we propose that enterprise architecting and ontological information architecting could serve as a coherent basis in identifying common and specific master data management research themes for global businesses and networked governments.

The contributions of this paper are twofold. Firstly, the framework presented as the background for the IS theoretical analysis is a step forward in formalizing understanding on master data management issues and master data management concepts. Secondly, the proposed research agenda based on the architecting and ontological analysis of master data management sets a theoretically solid path for future research from the information systems science perspective and bridge the gap between practical master data management problems and their theoretically sounder solutions.

Types of data and processes

The types of data used in organizations can be defined as the categories of transactional data, master data, meta data and reference data (Cleven and Wortmann, 2010). Master data consists of data items that describe the core entities of an organization. They are typically persistent items of independent business domains, the status of which does not change too often. For example, the master data attributes of vendor, product and customer in an organization tend to change little over time. The weight, size and other attributes of a product are typically considered to remain unchanged throughout the lifecycle of a product. Even those master data attributes that change from time to time, such as standard unit price, remain unchanged between the updates. The idea of master data is to enter and maintain data once and to transfer needed attributes to all tasks where such data is needed. The total number of master data records is also usually rather stable when compared to the seasonal and other fluctuations of business transaction volumes.

Typical examples of master data domains are: parties (customers, employees, vendors), places (customer locations, office etc. sites) and things (accounts, contracts, documents products and services) (White et al, 2006; Cleven and Wortmann, 2010), where party is an abstract high level domain and customer is a concrete lower level domain. Most organizations have a limited number lower of level domains, usually around a dozen (Dahlberg, 2010). Each domain may have several data objects. For example, a typical SAP ERP system installation contains approximately 150 master data objects in the domain of Management Accounting (MA) alone, such as currencies and payment terms (Dahlberg, 2010).

In addition to persistency and rather constant volumes, master data is differentiated from transactional data by its independency of the transactional entities, which in turn are most dependent on master data. As an example, consider sales order (transactional data), which cannot exist without customer (master data), product (master data) and payment term (master data) (Cleven and Wortmann, 2010). Since key master data attributes typically act as the identifiers of data

queries and the basis of sorting transactional data to perform various aggregations and calculations for reporting, the quality of master data has the highest quality requirements and should therefore be devoted a lot of attention to (Loshin, 2008). Since most business transactions are linked to several master data objects and attributes at the same time, one of the challenges of master data management is the simultaneous management of multiple domains – called multi-domain or domain neutral MDM - as opposed to single domain MDM such as Product Information Management (PIM).

Master data is typically also used across multiple business processes and for reporting purposes. For example sales, delivery logistics, after sales and services, spare parts business, billing, accounts receivable and finance, and management through managerial and analytical reporting may all rely on customer data but have at the same time different needs and priorities. Furthermore, some processes may be cross-functional, for example order to cash, whereas other processes or activities are functional, for example recruiting of employees. Balancing the needs of cross-functional and single function activities is another master data management challenge closely related to the domains of master data.

Master Data Management perspectives

Master data management is defined by Smith and McKeen as: “*Master data management (MDM) is an application-independent process which describes, owns and manages core business data entities. It ensures the consistency and accuracy of these data by providing a single set of guidelines for their management and thereby creates a common view of key company data, which may or may not be held in a common data source*” (2008, pp. 65-66).

Joshi (2007) proposed that the eight steps outlined below should be followed to execute MDM successfully:

- Define the master data flow
- Identify the sources and consumers of master data
- Collect business metadata
- Define the master data model
- Define the needed functional and operation characteristics of the MDM tool
- Merge the source data to create a master data list or element
- Collect and maintain the technical and business rules metadata
- Publish the master data or modify the consuming applications

Otto and Reichert (2011) listed the activities of the topmost concerns of MDM shown in Figure 1 and called their figure “*MDM tasks*”. The activities outlined by them concentrate on managing data assets strategically, agreeing upon and maintaining standards and guidelines for design and on handling changes as projects - all this in line with the support from the management.

	Response Percentage
Application management for a master data management software	47.4 %
Business user support	73.7 %
Development and maintenance of the master data strategy	89.5 %
Development and maintenance of standards and guidelines	84.2 %
Master data lifecycle activities (e.g. creation, maintenance, deactivation)	57.9 %
Measurement and reporting of master data quality	78.9 %
Project support	84.2 %
Training of users	73.7 %
Other	10.5 %

Figure 1. MDM Tasks by Otto and Reichert (2011)

As a whole, master data management appears to break down into many perspectives. Dahlberg (2010) has identified the following five perspectives, which are used to improve MDM and master data quality:

Management perspective: This perspective addresses the governance and management aspects of master data. For

example, Dahlberg (2010) classified 28 master data governance and management issues classified into seven managerial task categories by adapting Gartner Group's (2006) "Seven Building Block Model for Enterprise Information Management". Categories, shown also in Figure 2 in the Framework section, are: MDM objectives, MDM road-map, MDM governance, MDM organization, MDM processes, MDM infrastructure and MDM reporting.

Information architecture perspective: Ability to use and manage master data requires that master data is modeled. A standard data modeling approach with the overall model, conceptual model, logical model and physical model levels could probably be applied as master data appears similar enough to other types of data. Since same master data entities are used in multiple processes and/or organizational functions it is also necessary to model the data flows of master data to cover the inheritance of this data. When a new master data record is created some of the data attributes could be controlled against accepted reference data values. For example, the country of a customer could be selected from a drop list of countries. The creation of some other data attributes could be controlled with reference data rules. Reference data management controls and meta data related to master data needs also to be modeled and managed (Cleven and Wortmann, 2010).

Master data quality perspective: The consequences of badly executed MDM typically appear as the poor quality of data. Bad data appears as duplicates, missing attribute values and data value conflicts. Improvements of master data quality require that data is analyzed and cleaned up in a planned way. Migration and harmonization may also be used to improve data quality. When quality-improving changes are made to master data, it is necessary to secure the continuity of data, for example via audit trail and data inheritance checks. One mean to accomplish this is to use so called delta file approach. Setting up rules and other controls to ensure the quality of master data is another data quality management measure. Furthermore, it is necessary to manage the information security of master data. The challenge lies in the organizational and managerial aspects of master data quality.

Technology management perspective: Ideally a specific master data item, such as a customer, is entered and maintained only once and made available to all SOA components / WEB services, legacy applications and other IT components, which use that data. At the moment, very few organizations, however, appear to have clarity on which of their alternative databases serves as the master database – even when the database has a MDM module label on it.

Development Process perspective: The development of master data management could be run as traditional projects or with agile development methods. The development of master data management impacts all layers of enterprise and information architecture as well as organizational processes.

The Framework Combining Data Types and MDM Perspectives

When we combine the categories of types of data and the types of processes where master data is used with MDM perspectives, the result is Figure 2.

Process & data domains → MDM Perspective ↓	Processes (and activities) – MD is used in		Master Data Domains	
	Cross-functional processes (e.g. order to cash, procure to pay, manufacture to delivery)	Functional processes and activities (e.g. sales, procurement, accounting,...)	Multi-domain / domain neutral (e.g. customer & sold product & account, vendor, purchased item & account)	Domain specific (e.g. customers, products, vendors, accounting keys, location, document IDs,...)
Management •Objectives •Road-map •Governance •Organizing •Processes •Infrastructure •Reporting				
Information architecture •Data models (overall to physical) •Data flow model •Controls and rules against reference data, meta data				
Master Data quality •Data analysis, clean up, migration •Delta file, continuity •Control & Rule implementation •MD Information security management				
Technology •MDM applications, modules, databases •Analysis, reporting and dash board tools •Workflow and productivity tools				
Development Process •Development approach •Management perspective •Information architecture perspective •Data quality perspective •Technology perspective				

Figure 2. Master data framework combining types of data and processes and MDM perspectives

The columns of the two-dimensional framework categorize the number of involved master data domains into single and multi-domain categories and functions where master data is used into single-function and multi-function process categories. The rows of the framework describe the various MDM perspectives on how to manage and improve the quality of master data in practice. Thus the framework summarizes and organizes research findings and approached discussed above and provides a holistic description of master data management as a whole. For practitioners it can serve as a starting point in defining the master data management activities. Both the columns and the rows of the framework describe *what* master data is and *how* the quality of master data could be improved with various MDM activities. However, it is not able to explain *why* the quality of master data has become poor and thus how to prevent that happening again. In other words, the framework describes what means in various contexts one could adopt to remove the symptoms of master data problems but does not explain what are the underlying reasons for those problems. Thus, in order to dig into the root causes, in the next chapter we turn to theoretical research on IS, especially viewing master data problems from ontological viewpoint.

IS theoretical explanation of MDM problems

In the light of literature reviewed, MDM appears to be a topic of its own (Smith & McKeen, 2008; Otto & Reichert, 2010) like master data is ideally separate from the transactional data and other concerns of an IS (Cleven and Wortmann, 2010). Yet, any data set or database serves a bigger whole, information systems representing and tracking the behaviour of a purposeful real-world system.

The definition of an information system (Iivari et al., 1998) underlines that this real-world system is typically a human activity system, representing vested interests and dynamic interplay of the socially constructed concepts about the stakeholders and their behaviour for the purpose which the IS is to serve. This can be also considered from a more realist stance (Iivari et al., 1998): An IS describes facts, especially the relevant facts of the technical system derived from the stationary and stable real-world. It is evident that the present way of looking into master data management and master data quality builds on the realist stance, and at the same time omits largely the idealist, or constructivist interpretation. We believe to have a good reason to claim that this is the root cause for those master data problems we have depicted in previous sections. That is, efforts to model and solve master data quality and master data management problems are done as if these problems were stemming from a stable, predictable, uniform and causal world, when the actual problems are more deeply and profoundly related to the fundamental changes in the real world and our perceptions and representations of it.

In master data management practice, the realist stance could lead to harmonization efforts in the name of rationality where the resulting compromise satisfies nobody and cannot be used, because it is not applicable in multiple-domains – granularity is not fine enough for the various purposes. For example, a company could try to harmonize processes and master data used in them to the extent that it serves none of the actual processes and data use situations. Similarly adopting only the extreme reflective stance could lead to a situation where master data is systematically overruled. For example, the unit price of a product inherited from master data could always be overruled by users when used, which will make that data useless as master data.

As Goldkuhl and Lyytinen stated already in (1982), “...information systems can be viewed as “technical systems with social implications” or “social systems only technically implemented”. Both views are valid, even though the contemporary IS researchers distinguish themselves from the rest of the computing and engineering researcher community with the previous statement, as they emphasize the socially constructed nature of the organizational complexities including information systems (Iivari et al., 1998).

We illustrate our argumentation in more detail with the help of the ontological description of the structure of an IS (Wand & Weber, 1989) and its requirements for an information systems methodology, including the subset of databases. According to this approach any IS methodology must represent the ontology of the system with a minimum set of constructs and to map and track the state changes for various purposes of the real world system (Wand & Weber, 1993), including the reporting requirement for various stakeholders of an IS for their anticipated and ad-hoc purposes. In master data contexts, this means that the various user needs of master data in relation to other data types as well as other relevant characteristics of the real world are understood. Only then is an IS development model fulfilling its role properly, that is, it has the necessary representational means for expressing the ontology of the domain completely and clearly but also without overloading constructs and extra constructs which result in redundancy. The goodness of this representational model does not exist in vacuum, but must be able to serve first the ‘needs’ of the state-tracking model, against which the states of the real world are reflected in the IS, and secondly, the ‘needs’ of the reporting, where the states of an information system can be reported for the stakeholders to reflect the corresponding state changes of the real world. The first requirement refers to creating and maintaining all the attributes of master data. Correspondingly, the second requirement describes how the relevant attributes of master data are inherited to the various use situations. These two principles are able to capture both the holistic nature of master data management and the specific use situations of this data, but seldom applied in practice. It is more common to separate the concerns of reporting from that of state-tracking using, e.g., OLAP², an approach not necessarily helping in the master data problems.

Some of the master data problems described in the previous chapters can be restated according to the architectural and ontological IS theoretical explanation as follows:

- There are cases where the **constructs of the ontology are incomplete** because some fundamental concepts are missing. A real case example of this problem is a company that had multiple identities for its vendors, with each new bank contact creating a new vendor record (Dahlberg, 2010). The data model or its implementation did not contain sufficient structure to capture this feature of multiple identities in each vendor data.
- The **constructs of the ontology are overloaded** because planned and implemented concepts cannot distinguish the subtle differences of meanings in the real world constructs. For example, a customer may have multiple roles depending on who is in contact with the customer. If the attributes of customer master data are not able to capture these different roles, the content of the data could reflect the most typical role or could lead to duplicates.
- The **constructs of the ontology are redundant**, or become redundant, e.g., when information system instances are connected to serve wider geographical activities or entire global business. For example, it is not uncommon that the same product has two different codes in two different markets, or ZIP, ZIP+4 and ZCTA codes being ‘about’ the same (which they are not, the former being for deliveries, the last for statistics and analysis). This might just reflect differences in local coding practices forced by local authorities or voluntarily followed by all parties in that local market. Very few data items have globally standardized codes. In this kind of a situation, merging the instances with simultaneous harmonization is not a working option.
- **Mappings are incomplete, or cannot reflect changes in the real world**, because the real world is not or is no longer steady and stable, but is in constant turmoil, at the same time as master data does not change accordingly, is not managed properly or meta data does not reflect changes in a systematic manner. For example, standard unit price is a typical product master data attribute. Standard unit price is often checked at certain intervals and may include a rough fixed cost element. Should the environment change suddenly, so that the fixed cost element changes significantly or prices fluctuate constantly, these practices become insufficient to cope with the real world, especially in OLAP environments, where both the transactional and analytic databases master data must be update in sync with each other.
- **Reporting needs are unanticipated or not taken into account** in the original design of master data coding, data repositories, information systems etc. There can be several reasons for this. Necessary classification codes were not

² Online Analytical Processing

considered or registered and hence are not connected to transactional data. The design methodology could also have been inappropriate. For example, aims to make public master data repositories available to open use with simultaneous protection of privacy data may lead to a dead-end.

- **Forced limitations on ontological clarity and increasing construct redundancy** This may happen if the constructs cannot be designed freely, but must follow socially constructed conventions, standards and regulations limiting the ontological clarity and increasing construct redundancy. Things are almost, but not quite the same, to put it colloquially.

Fundamentally, the separation of master data concerns from the real world social systems in master data management practices – as summarized in Figure 2 in the previous section - leads to the dilemma of not describing master data in the the real world context, but rather trying to improve the management of ‘socially implemented technical systems’ not as ‘technical systems socially implemented’, the way they should be managed.

We think building on the foundations of a good information systems design will serve as a solid basis for proposing a research agenda in the area of master data management. As a whole we propose a more strategic approach into the design and active maintenance of the master data. We urge that in the requirements crafting and design of master data constructs as well as in the problem solving of current challenges researchers and practitioners should not just look at the logical technical designs, but also at the foreseeable changes in socially constructed concepts and at the effects of such changes.

In this context, master data management means those structures, process and mechanisms, which are needed to ensure the quality of designs, state-tracking and reporting requirements collected from many socially relevant sources, i.e., from all the stakeholders of the purposeful systems with related interpretations on the master data ontology and its various uses. This calls for a more holistic approach for master data management, such as enterprise architecting, business modeling, or stakeholder analysis as starting points.

Research Agenda for Master Data Management

We started this article by looking at various types of data and processes where master data is used. We then discussed the current meaning of master data management and its various perspectives, which are used to improve master data quality and MDM. We noticed that MDM practices are good to describe current status but insufficient to understand the underlying nature and root causes of the master data management problems. The necessary depth of analysis was found from the IS theoretical viewpoint, especially from the ontological structure of information systems. In summary motivated by discussion above, we suggest that holistic approaches are needed to serve as coherent frameworks in identifying common and specific master data management research themes for global businesses in networked environments. We furthermore propose, as our Research Agenda, to apply the architectural and ontological IS theoretical perspective to investigate the practical master data management issues covered in Figure 2. Below we offer some selected example research questions for future research:

- How should interoperability requirements (e.g., the same person represented with more than one unique identifiers in a number of databases) be derived from stakeholder analysis, business process modeling and enterprise architecting? This is to tackle the problems of *incomplete design, redundancy, and overloading of the ontology*.
- How could security, access rights, and integrity be ensured, especially for reporting? What kinds of consents are needed to use and combine master data from various sources? What kinds of opt-in or opt-out arrangements are relevant? This is to handle the problem of *unanticipated reporting requirements and forced limitations*.
- Who owns and is responsible for maintaining the distributed master data: data ownership is a major business issue but has not been considered in MDM practices properly. What are the means to accomplish the ownership issues in the design and to secure the participation of all relevant stakeholders? Here we go beyond the original use of ontological limitations. *The mappings are found incomplete* since they should reflect the social construction of the system in its real-world use context.
- How to adapt IT governance principles and build best practices for MDM? How could MDM fit the Evaluate, Direct and Monitor (EDM) presented in ISO/IEC 38500 IT Governance model and the Plan, Do, Check and Act - cycles (PDCA) common to project management and development activities, so that the business management and IT asset management concerns are separate and clear enough? What project management practices are relevant for MDM? Who should bear the responsibility for master data management improvement efforts: business or IT? How does the allocation of development responsibilities impact the outcomes of such development? This is also *beyond the original concerns* of IS ontological design, but reflects the other set of concepts with its interplay of the real-world master data management in practice.
- How should we treat master data in clouds, outsourcing and off-shoring? What are the best ways to to map ‘good’ designs, business needs and the views of the stakeholders including privacy and security? This final category of

activities reflect *the changing environment*: at the time of its invention, the ontologically driven design principles were applied in one organization unit environment.

To summarize, above we sketch a research agenda, where some new research issues are proposed to reflect the changing business design constructs and approaches on the ontological requirements of the good design (the two first bullets points). The three latter areas of MDM research are reflecting the issues emerged with the expansion of real-world beyond the original domain of ontological design, which was within one organization and within pre-defined sets of primary internal users of isolated information systems. Compared to the distributed environment, where the concerns of privacy, security and unanticipated data use are the primary concerns, but not properly modeled or managed, we think these issues are a high priority in Master Data Management research agenda of the 21st century.

References

- Cleven, A., Wortmann, F., (2010). Uncovering four strategies to approach master data management. Proceedings of the 43rd Hawaii International Conference on System Sciences - 2010.
- Dahlberg, T., (2010). The Final Report of “Master Data Management Benchmark Best Practicess Research Project”. Aalto University School of Economics and Solteq Oyj. Helsinki 2010.
- Dreibelbis, A., Hechler, E., Milman, I., Oberhofer, M., van Run, P., Wolfson, D., (2008). Enterprise Master Data Management: An SOA Approach to Managing Core Information. IBM Press.
- Dyche, J., Levy, E., (2006). Customer Data Integration: Reaching a Single Version of the Truth. John Wiley & Sons.
- Goldkuhl, G., Lyytinen, K. (1982). A language action view of information systems, International Conference on Information Systems, 1982.
- IBM (2011). The Essential CIO: Insights from the Global Chief Information Officer Study, a White Paper submitted by IBM at IDGconnect.com
- Iivari, J., Hirschheim R., Kleinm H.K., (1998). A Paradigmatic Analysis Contrasting Information Systems Development Approaches and Methodologies. Information Systems Research, Vol. 9, No. 2. 164-193.
- Joshi, A., (2007). MDM governance: a unified team approach. Cutter IT Journal, Vol. 20, No. 9. 30-35.
- Loshin, D., (2001). Enterprise Knowledge Management: The Data Quality Approach. Morgan Kauffman.
- Loshin, D., (2008). Master Data Management. Morgan Kauffman.
- Mosley, M., (2008). DAMA-DMBOK Functional Framework, v 3.02. Dama International.
- Otto, B., Reichert, A., (2010). Organizing Master Data Management: Findings from an Expert Survey. In Bryant, B. R., Haddad, H. M., & Wainwright, R. L. (Eds.), Proceedings of SAC'10, March 22-26, 2010, Sierre, Switzerland. 106-110.
- Wand, Y., Weber R., (1989). An ontological evaluation of systems analysis and design methods. In: Falkenberg ED, Lindgreen P (1989) (eds). Information system concepts: an in-depth analysis. North- Holland, Amsterdam. 79–107.
- Wand Y., Weber R., (1993). On the ontological expressiveness of information systems analysis and design grammars. Information Systems Journal, 3(4). 217-237.
- Wand Y., Weber R., (2002). Research Commentary: Information Systems and Conceptual Modeling – A Research Agenda. Information Systems Research, 13 (4). 364-376.
- Silvola, R., Jaaskelainen, O., Kropsu-Vehkapera, H., & Haapasalo, H. (2011). Managing one master data – challenges and preconditions. Industrial Management & Data Systems, 111(1). 146-162.
- Smith, H.A., McKeen, J.D., (2008). Developments in Practice XXX: Master Data Management: Salvation Or Snake Oil?, Communications of the Association for Information Systems, 23(4).
- White, A., Newman, D., Logan, D., Radcliffe, J. (2006). Mastering Master Data Management. Gartner Research, ID Number: G00136958.

What Is Clinical Overview – So Far?

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Abstract. This paper outlines the initial work of a research study of how practitioners at an emergency ward conceptualise the constitution of clinical overview. The study is part of a larger research project about IT-support for clinical overview and it takes place at the emergency departments (EDs) situated in Region Zealand, Denmark. The main approach for eliciting empirical data is observations and interviews combined with before and after measurements of effects. The point is that through the intervention of and interaction with technology it becomes more evident what constitutes clinical overview and how to support it. The purpose of the paper is to state what has been done so far and what are the preliminary findings. In closing the paper delineates and reflects upon some work assumptions about the concept of clinical overview and notes some future approaches in the study.

Keywords: Electronic whiteboards; healthcare informatics; organisational implementation.

1 Introduction

Today much attention is focused on health care and IT. Especially within a hospital setting projects involving electronic patient records (EPR) are well known for its influence on daily practices. The present situation in this field is not only that of changing work procedures from a mostly paper-based practice to an IT-based one but also a conformation to an exceeding amount of practices and services which need to be documented. This applies not only to the practitioners at hospitals but to all within the whole health sector, however focus is put on clinical personnel at emergency departments.

This paper takes its point of departure at the emergency departments on several hospitals in Region Zealand, Denmark. The governing agency of the region commenced a project back in 2008 as a joint venture between Roskilde University, Region Zealand, and Norwegian IT-vendor Imatis A/S. The topic of the project is IT-support for clinical overview and the main goal of this project is to implement electronic whiteboards at emergency wards in replacement of old dry-erase whiteboards. Initially, the project had a twofold focus on clinical overview. One focus was on a patient level and the other was at a ward level. These two foci have been defined by the practitioners early in the process and are thereby also the basis for the

planning and proceedings of the on-going process of the project. However, circumstances have made the activities in the project to mainly focus on overview at a ward level. Only preliminary work in relation to patient overview devises has been done. So far this has resulted in working prototypes of the electronic whiteboards at four different wards in the region. I have anonymised the identity of the wards by numbering them ED1-4. The overall challenge and end goal in the research project is to design and develop IT-systems and tools which can structure and order the complexity of the daily work of the practitioners and at the same time support the increasing demand of more efficient treatment of patients and exceeding documentation and quality insurance of these treatments as well as a higher level of digital work practice.

Figure 1. The two electronic whiteboards at the emergency ward at ED2 (one of the first days of use)



My research study is a sub-study of the above-mentioned project and for me it is very important that the study is done in close connection to practice because though the outcome in terms of IT-support is mostly pointed towards practice. However, academia can naturally benefit from such a study too in terms of knowledge and insight into the process of integrating and using the electronic whiteboards in practice as well as the effects of these boards, the understanding of clinical overview, and the influence of the physical space and organisational setting. So the research study focuses on investigating how practitioners at an emergency ward conceptualise the constitution of clinical overview. This is done by viewing clinical overview partly as a phenomenon and partly as a process. As a phenomenon clinical overview is as a state with a beginning, a middle, and an end, and as a process it is practiced in the social space mainly through the articulation among the practitioners. Subsequently,

this also leads to a couple of additional questions, which need to be resolved. One is how to identify the overview situation or more detailed the phenomenon or state of clinical overview? What influences this overview situation and how to investigate it? Another more long-term question is how to support for clinical overview both as a state but also as a process – and especially by the means of IT? Work like this is naturally based on a close partnership with the clinicians and IT-developers to ensure that the developing process support and produce an outcome which is in correlation with the need of the users as well as helping the researchers to define the concept of IT-support for clinical overview.

1.1 Empirical Setting

The research project is organised around a workgroup, which is comprised of representatives from three of the hospitals in the Region, the IT-vendor and the Region. Throughout the project the workgroup has met about once every second week to plan future developments of the system and implementation activities at local emergency wards. The group also takes care of correcting errors, follow-up on progress, and improve the interface and functionality of the electronic whiteboards. Early on, the main role of the workgroup was to gather user requirements from the clinicians and communicate these requirements to the IT-vendor. Lately, the workgroup has also been deeply involved in the implementation process at the research departments, thereby enabling an on-going, iterative, and improvisational change-management process. Besides the members of the workgroup the research project also has a research team consisting of two senior researchers and two PhD fellows affiliated. They attend the workgroup meetings once in a while and conduct research activities at the wards such as observations, effect measurements, interviews etc.

In the following I first describe the empirical method employed in the study. Second, I shortly mention some of the theory that I have worked with. Third, I describe my preliminary findings. Finally, I shortly sum-up upon my findings and look towards the future.

2 Methodological Approach

The main purpose of this whole project is the introduction of new electronic whiteboards as a support of clinical overview. Now, the introduction of these IT-systems naturally interferes with common norms and procedures and in that space of time lays the research focus. This is right from before commencing the use of the boards till the time where the system has been adopted to the degree where it is being used in a daily practise. The emergency wards involved are divided into what is being called the ‘development departments’ and the ‘research departments’. The development departments are involved in the development and the first pilot implementation of the system. At the research departments the evaluation of the use of the electronic whiteboards is conducted and the research activities are to some

extent done at both types of departments. None of the research departments have been directly involved in the development of the electronic boards. They are to receive the boards as more or less finished products for support of their daily practice.

One of the approaches that I have looked into as a way researchers often use to investigate work practises in hospital settings are ethnographical and action research methods [1], [2], [3], [4], [5]. Not surprisingly, these approaches are well suited for eliciting such knowledge as that of how work practise is practised and which concepts it involves. Study approaches with the main focus on the big screens in hospital setting vary from observations and photos to reports and descriptions of what was done or experienced. The approach to fulfil the challenge of the overall research project has been a methodological triangulation of conducting observations, before and after measurements of effects achieved by the introduction and use of the electronic whiteboards, and interviews. We have all in the research team participated in the empirical work regardless whether the focus of the empirical data has been the overall research project or one of the PhD research studies. For instance, the interviews will benefit the effect topics of the overall project as well as the articulation and conception of clinical overview for this study.

2.1 Measuring Effects

The reason for measuring effects stems from the notion that managing IT projects can be done by focusing on the effects that the implementation of a given IT-system should achieve in the daily use practice. This is done through an iterative process with focus on measuring the achievements set forth for the system as well as letting new features and benefits emerge from the first pilot use of the system [6]. The effects measured at the departments in this project have been decide upon at workshops with the practitioners from the development departments in the beginning of the project. These effects are such measures as less noise at the ward - measured by noise readers located at strategic places, fewer daily paces back and forth at the ward - measured by the clinicians' wearing tags, and less mental workload especially related to the role of the coordinating nurse - measured by the use of TLX-schemes. The research team performs these before and after measurements of effects with technical assistance from the IT-vendor, the Region's IT-department (or local IT-department), and in collaboration with the staff at the emergency wards. Though these measurements do not have the primary focus of my study they still seem to bear a value for the study in pointing at certain elements' importance for clinical overview.

2.2 The Observations

So far my primary approach used for collecting data has been observations at the different emergency wards around the Region. The following observations have been conducted so far:

Table 1. Scheme of conducted observations

Location	# of Obs.	Prior	During	After	Period
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ED1	5	1	1	3	Spring 10
ED2	3		3		Spring 10
ED3	9	5		4	Autumn 10
					Spring 11
ED4	5	4	1		Spring 11

For the observations conducted at the development departments during the pilot implementation my fellow PhD colleague and I designed and developed an observation scheme that states the purpose of the observations, time and date, which role and some predefined codes for the focus during the observation.

Table 2. An example of the observation scheme

Purpose of observation:		Location:
		Date:
		Role:
Code for type of observation: A = interaction with touch screen, B = interaction with the system through other accesses, C = interaction with other systems, D = definition of role, E = logistic task, X = other		
Time	Code	Description

The predefined codes were made based on some preconceptions about what we expected to observe in the field and what we expected to be relevant information for the project. The first code (A) Interaction with the touch screen has do with the interaction of the screens that replaces the old dry-erase whiteboards. The interesting part here is to see how the use of and practices around the boards may differ from what we have observed before they were taken into use. The second code (B) Interaction with the system through other accesses steams from the expectations of one of the effects anticipated by the introduction of the system. Here this code represents the effect that should result in fewer paces back and forth at the ward. The third code (C) Interaction with other systems referrers to an illustration of the amount of system accesses needed in the daily practice as well as an indication of which systems to design integration for. The fourth code (D) definition of role serves as an indication of which role performs which work or handles which situations. Throughout, the study and the project we have observed activities based on the different roles of the clinicians at the ward. The fifth code (E) logistic task has to do with which kind of logistic work took place at the board and which did not and if that would change with the use of the electronic whiteboard. The final code (X) Other is self-explanatory. The observation schemes have been supplemented with a field diary in which I have written my immediate impressions, thought, and reflections after each observation session.

Upon the primary approach of using observations I have also done a couple of semi-structured interviews as well as a couple of informal ones either during an observation or right afterwards. As of the time of writing I am planning and making arrangements for some semi-structured interviews at the two research departments concerning the preparation and execution of the implementation of the electronic whiteboards. The interviews are going to be with both participants close to the process and some of those who have not been that close because I also want to talk about the concept of clinical overview and because I also need to have inputs from people outside the inner circle of the project.

2.3 Background For Conducting The Interviews

The purpose of the interviews is to gain insight into the experiences of the practitioners during the course of the implementation. It is also a goal that the interviews can support the observations in answering the question of how practitioners at an emergency ward conceptualise the constitution of clinical overview. For instance by pin pointing some events, which illustrates elements that clinical overview is all about. In that way can the interviews probably be related to the material from the observations. The themes that I want to touch upon during the interviews are derived partly from theory such as awareness viewed upon as a state and as a dynamic process [7]. The themes are as well derived from my empirical studies in relation to my working assumptions e.g. on factors influencing the clinical overview. A factor such as their physical environment has a huge impact on the daily work, which was very evident from the observations at ED4, which will be elaborated upon the Preliminary Findings. Furthermore, the themes have to do with a clear interview technical aspect of interviewing where the interview is viewed as a drama. In this way the interviews will hopefully provide a focus for what constitutes clinical overview. As the intention of the interviews is to support the observations.

The approach of viewing the interview as a drama stems from Myers & Newman [8] where they refer to Goffman's [9] general theory of face-to-face interaction, which could be used to interpret any social exchange and the interview is a social interaction [8].

In this approach the interview is seen as a drama with a stage, props, actors, an audience, a script. It has a beginning and an end and the performance itself. Below is a short description of these elements from the interview as a drama according to Myers & Newman [8].

Table 3. The qualitative interview as a drama [8]

Concepts	Description
Drama	The interview is a drama with a stage props, actors, an audience, a script, and a performance.
Stage	The stage is the setting in which the interview is conducted e.g. an office. Various props might be used such as pens, notes, etc.
Actor	Both the interviewer and the interviewee can be seen as actors.
Audience	Both the interviewer and the interviewee can be seen as the

	audience. The audience can also be seen more broadly as the readers of the research (papers) produced on the basis of the interview.
Script	The interviewer has a more or less partially developed script with questions to be put to the interviewee to guide interview – an interview guide.
Entry	The entry is about impression management particularly first impression.
Exit	Exit is about how to end the interview and probably prepare way for the next interview.
Performance	The performance is the sum of the above. This can be either a good or bad performance, which affects the quality of the disclosure, which in turn affects the quality of the data.

The point of such an interview is to gain an insight into the interviewees' system world by structuring the interview as loose as possible by posing as open and wide an introductory question as possible in order to gain their experience of work practice, the importance of IT, the implementation process, and clinical overview.

3 Theoretical Aspects

Up until now I have been working with overview as the practitioners' definition of mental and visual overview of data generated, collected, and passed on in relation to the status of the patient and the tasks at the ward but also information related to fellow practitioners at the ward. Mental overview is a personal notion or experience of being able to handle these tasks and resources, which makes it very important that the team at the ward has access to simultaneous, distributed visualisation of data and information. This definition of clinical overview has been articulated both at meetings with the research project's workgroup and observed at the ward. When asked practitioners often either described it as just vital values or do not explain it at all.

Right from the beginning of this study I have work with awareness and which role it plays in IT-support (of clinical overview) because the concept of awareness immediately comes to mind when talking about overview as those two concepts are highly related if not one and the same. This has all the way through my project been of concern whether or not it is one and the same. However, it somehow does not seem to be exactly the same, which might have to do with the multifaceted definitions of awareness. Awareness in it self is a highly elastic word which is often accompanied by yet a word to describe which sort of awareness we are talking about. I have found awareness relevant for this project on three different levels; the first was situational awareness, the second was task related awareness, and the third aspect was social awareness. Situation awareness as described by [7] is more focused on the person's situational awareness in interaction with an information system (which can occur in a collaborative setting). Awareness then becomes a state of knowledge obtained by an individual or it is the process of obtaining this knowledge. As a state awareness constitutes certain elements or artefacts, which provide a person the necessary

knowledge to act in the situation. However, the same elements or the same situation does not necessarily provide a person with the same amount of knowledge as it is highly depended on the person's previous knowledge of such situations and experienced in reacting to such a situation [7]. Endsley primarily uses fighter pilots as showcase where in the more experienced the pilot is the more detailed the information he gains from the interaction with the situation or the system.

The process of obtaining situational awareness is a three stepped one where the first level (1) is the perception of the elements in the current situation, the second level (2) is the comprehension of the current situation, and the last level (3) is the projection of future status. This process is viewed in the context of a task to execute provided with some system factors upon which the person makes a decision and acts upon it. Whereas within the CSCW research the term awareness has been studied as a person's awareness of something among and between cooperation actors. The aim has been to study how computer-based technologies could support such situations [11]. In this respect focus is on the awareness of the collaborative situation (probably supported technically) and becomes the person's awareness of fellow colleagues' actions as well as displaying ones own [11]. When Endsley talks about situation awareness in a team it is the degree to which every team member possesses the situational awareness required for him or her to execute their responsibilities. This is very much like the notion of awareness as a social concept. Endsley does not really go into depth with this aspect but continues to elaborate on situational awareness as a process of achieving, acquiring or maintaining knowledge.

Schmidt's [11] critique is turned against the notion of awareness as a passive acquisition of information from just the person being present while other collaborative activities are in progress. In this sense awareness is the alignment and integration of a person's actions/activities to that of others. Bardram et al. [1] e.g. talks about how the usage of whiteboards improves the planning and communication in teams, so the idea is that a combination of big screens providing the information and physical interactive whiteboards will help physicians with creating the mental overview of tasks in relation to the practical, the communicative and the planning/structuring aspects. This type of awareness is labelled task-oriented awareness and in this case is tasks related to the work in the team. We are talking about which tasks are presently being handled, how and where they are being executed, and who from the team is involved in the execution. Therefore, task related awareness is about an overall understanding and knowledge of the team members' tasks and status of these.

Social awareness is about knowing what your colleagues are doing and where they are [12] but it's not sufficient that each member of the team knows what the others are doing. The whole team needs to have a shared knowledge of each other's tasks and whereabouts.

4 Preliminary Findings

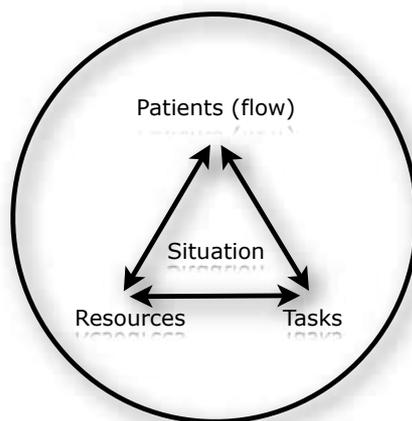
I have been in the field observing daily work practice at two different EDs when they commenced using the system. I have as well observed two other departments in the period right before implementing the system. The daily work at the ward as have

been observed could very well be described as one consisting of a high intensity of verbal communication crosswise everybody on the team and other interacting practitioners – physicians, nurses, secretaries, lab-people, and paramedics etc. As outsider the mayhem of people running to and forth the room with the big whiteboard to note which room patients are placed in, if lab tests have been ordered, if a physician has attended and triaged the patients, and so forth seems overwhelming. I have also observed that a huge amount of time spend is used to coordinate the common effort of attending all the patients and tasks related to the flow of having the patients at the ward. The aim is that patients are not admitted to the ED for more than roughly 1½-2 hours before they are discharged either to their own home or hospitalised at another department.

The first attempts of electronically support a ward overview have already been done at wards in ED1 and ED2. This IT-support has been done by more or less mirroring the setup of the ordinary dry-erase whiteboard onto a big touch screen. Electronic versions of the whiteboard are now hanging in command rooms at wards in ED1, ED2, ED3, and ED4. Though, they may not fully provide the functionalities envisioned, they do however, provide us researchers with a first glimpse of what it entails to “put power to a whiteboard” at a hospital ward. As I have observed the launce of the electronic boards at ED1, ED2, and ED4 and the daily work and planning for introduction of the boards at ED1, ED3, and ED4 I have gained some preliminary insight into or idea of what constitutes clinical overview.

In this setting overview is a question about tasks as well as about resources in relation to the flow of patients at the ward. The hard part of providing this overview falls within three main aspects which are under constant change in conditions and interrelation and which together constitutes an ever-changing situation. This situation has a beginning and an end and to some extent it also has some very specific elements incorporated.

Figure 2. A model of the observed elements of clinical overview



These aspects illustrated above interrelate and thereby creates a situation, which the practitioner has to respond to. My preliminary findings and preconceptions form the following content and division of the three aspects:

- Patient (flow) – is simply related to the number and status of each patient, and these two simple factors are very much influencing and influenced by the two other aspects
- Tasks – are activities related to patients and resources depending on roles (in this relation profession e.g. physicians, nurse, secretary etc.), task execution (doing rounds, estimate triage level etc.) and responsibilities (who are aloud to do what according to law, job description and so forth) and naturally the mix of all three
- Resources – are highly a matter of logistics and communication dependent on and in relation to:
 - Staff
 - Physical space (beds/rooms)
 - Information
 - Data

Depending on which type of situation arises these aspects influence the type and need of information and data, which helps the practitioner to gain his or her overview. The way practitioners organise, coordinate, communicate, and pass on information among each other today is mostly done by the aid of non-electronically artefacts [1] and verbal communication.

Now if clinical overview is more than “just” a phenomenon or the state of a situation then it has to also be a process. The awareness process consists of gaining, maintaining, and loosing, and re-gaining the overview. This process is for the most part as of before the introduction of electronic whiteboards based upon the verbal communication among the clinicians at the ward. This type of communication is often regarded as a push-approach towards obtaining information. However, it often also becomes a matter of delivering information in which case its mostly a matter of delivering one’s own information regardless of whether or not it actually gets received by the attended user. This implies that the clinicians/practitioners often are fed the information, though maybe not at the right time which they compensate by keeping a little handbook in their pocket at all times. Naturally, not all information is provided beforehand and then the clinician needs to gather that information him/her self. Most of that kind of information is related to the treatment of the patient (for clinicians) and is most obvious when dealing with new and inexperienced clinicians. Whereas, the nurses mostly gather information regarding the treating plan for the patient dictated by or worked out in cooperation with the clinician.

4.1 Social Awareness and Physical Environment

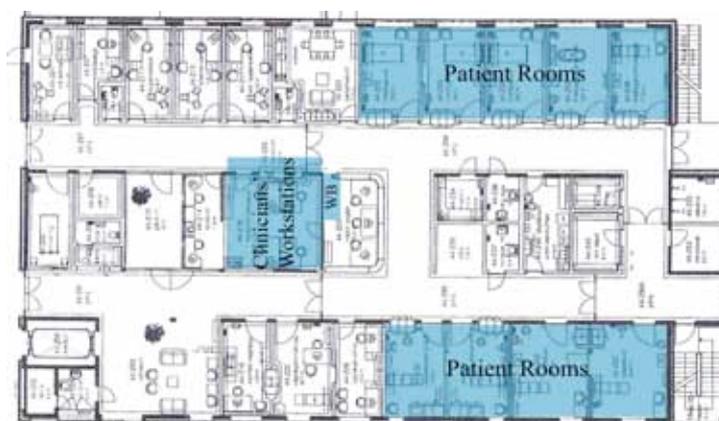
There is something about the physical spaces at the wards which makes it seem to be an important factor in the process of gaining, maintaining, loosing, and re-gaining clinical overview (hereafter just mentioned as the process of clinical overview or the process of overview). I have noticed that the clinicians and nurses often just make a short glance either at the board or the hallway when they are within a (patient)room or when they arrive at the ward at the beginning of a shift. I have talked to a practitioner

from ED3 about what it is that they look for/at but he could not really give me a short answer because it was difficult to explain. He knew that it was something that they do, but he had never given it much further notices so he had not really thought of the purpose of doing so.

From the very beginning of the project I have had a notion that social awareness to some extent would have to influence the practitioners' work. One of my ideas has been that clinical overview also has to do with the knowledge of the whereabouts of your colleagues and the work they are doing. However, my observations so far have not pointed in the direction of a huge need for a geographic locator/location of fellow workers. The knowledge of their present work tasks is more or less displayed on the whiteboards. I did talk to some of the practitioners about it when we were observing at ED1 but at the time it seemed like the old habit of just calling the person you were looking for on the cell phone if you could not find them was sufficient. Now, at ED1 practitioners would be either at the emergency ward or at the fast track, which is further down the hall. Walking back and forth seemed to be such a normal procedure that nobody really took notice of it. Still the act of glancing down the hallway or into either the staff room, the whiteboard/timeout room or the control room before going down to the fast track to locate colleagues was not seen as an unnatural thing to do. Of course knowing what tasks the colleagues were about to do would help that search/location process. This led me to believe that there would not be much future for a social geo/awareness tool for support of the process of clinical overview because it was not such a big deal to gain knowledge about your colleagues. And at that time I did not pay that heavily a notice to the importance of the physical surroundings simply because they did not seem to have that much effect on the overview process and my time spent at ED1 just confirmed that.

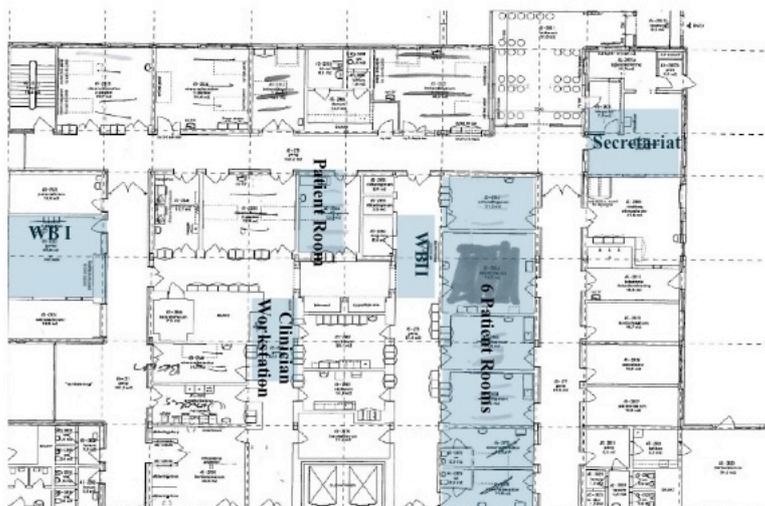
Though, it was actually quite evident at ED3 that the practitioners benefitted from the physical environment. It was possible especially for the coordinating nurse to gain an overview of staffs' whereabouts and occupancy of the patient rooms more or less by just lifting her gaze from where she is positioned. Below is a rough sketch of the blueprint layout of the emergency ward at ED3, which illustrates that the staff actually gained quite an overview with very little effort (as in physically have to move around) from the control centre where the boards are stationed. This experience made me aware that the physical structure of the ward had a beneficial impact on clinical overview but I just did not pay that greatly attention to it until I experienced the quite opposite as it had a very prohibiting effect on the process of gaining information of the whereabouts of colleagues.

Figure 3. A blueprint of the layout of the emergency ward at ED3



My visit to ED4 clearly illustrates the impact factors of the physical environment have on the process of clinical overview. The ward is structured in such a way that you mentally have to spend extra resources on orientation and localisation of patients, colleagues, yourself, rooms, on actually everything.

Figure 4. A blueprint of the layout of the emergency ward at ED4



A fellow research colleague and I talked about how difficult it was to orientate ourselves when we were there the first couple of days. And when I talked to our contact person on our way in the elevator to get white coats she mentioned that not until now was she able to find her way around and she had been there since November 2010. I also overheard a conversation at lunchtime where a nurse mentioned that she finally could find the stairs but the rest was still a mess. During one of my observations right after the nurses had had their tags handed out a nurse at the ward said out loud that it would be nice now if she could just tap her smartphone and get an indication of the whereabouts of her coordinating nurse.

The accumulation of all these episodes has now led me to believe that there is such a thing as factors that influence the process of clinical overview but they are not directly parts of it. They influence not only in a negative way as illustrated at ED4. They also influences in a positive way as observed at ED3. My main point is just that such a factor has an impact whether it is positive or negative on the ability for the practitioners to manage the process of clinical overview. One of the interesting parts of this is that system-wise we can benefit from this notion and try to develop systems that support social awareness in highly physical challenging environments. Research-wise this opens up for a small window into the constitution of the concept of clinical overview and on a low scale it helps me focus on an aspect of clinical overview which I have not pay a focused attention to. This paves the way for a focus for both future interviews and observations.

5 Reflections On The Preliminary Findings and Further Work

Clinical overview as a phenomenon or a process can be viewed through different ontologies (phenomenology and social constructivism), which can set the output for my overall study and investigation and understanding of the concept of clinical overview. This more theoretical view on clinical overview will then need to be merged with the more empirical founded one related to the clinical overview situation(s) comprised of the three elements: Patients (flow), resources, and tasks. Furthermore, an element that has come into play is factors, which I have not really concerned myself with until I did my observations at ED4. There are certain factors, which influence clinical overview and they have tremendous importance for the overview. One of the factors is the physical environment of the clinical setting. The ability to view the on-going activity level at the ward seems to provide the clinicians with information about the location of colleagues, the flow of patients and thereby the load of their own work and possibly even more.

At the time of writing the two research departments are experiencing the same process of introducing the electronic whiteboards into daily practice just with a couple of months apart which in terms make them comparable. Earlier in the study observations of clinical overview before the implementation of the electronic whiteboards were conducted in the autumn of 2010 at ED3 and were terminated ultimo November. In the meantime, ED3 has gotten the electronic whiteboards and taken them into use. The teams at ED4 have just started the preliminary activities of preparing the department for the system and the research team is conducting before-measurements at the ward during this period. The system is scheduled to be up and running primo May 2011. I have just made the first observations of the commencing of the electronic boards at ED4. These observations point at yet another factor which seems to influence the daily practice, namely the organisational setting. At ED4 they have chosen to introduce the electronic whiteboards to the receiving and treatment departments right from the beginning due to their organisation of those departments providing the main medical expertise to the ED. The future avenue of this study is three main empirical activities:

- Conducting 33 interviews with the practitioners involved with this project
- Investigating the organisational factor through observations and possibly interviews too
- Workshops with some of the practitioners on eliciting an understanding and conceptualisation of clinical overview

The workshops have not been described in this paper, as they are a new activity introduced to the study. The reason for bringing them into play is to stay close to practice and through engagement with practice to elicit an understanding of how the electronic whiteboards are used on a daily basis, how the patient trajectory is now, and how we can reach a common understanding of what constitutes clinical overview.

First off, by now ED3 would have had the system for a bit over five months and then the research team has just finished the after-measurements there. This provides the research team with the opportunity to gain an insight to the experiences of the practitioners both in regard to the implementation process but also the system itself and differences in work practices. I can follow and engage with the practitioners on a

close term via observations and interviews during the course of the implementation process from right before the implementation, during it, and in the time after. This will hopefully provide an insight into their understanding of clinical overview through their changed practise. And it will hopefully also provide an insight into the process surrounding the implementation process, which seems a bit odd or at least something out of the ordinary as the primary organiser is the practitioners themselves and not an IT-system consultant.

Acknowledgements. I deeply appreciate the involvement and engagement of the practitioners at the emergency wards in the Region and I value the collaboration with the participants of the project workgroup. I like to thank everyone very much for all their effort.

References

1. Bardram, J.E., Bossen, C.: A web of coordinative artifacts: collaborative work at a hospital ward. In: Proceedings of the 2005 international ACM SIGGROUP conference on Supporting group work, p. 168–176. ACM (2005)
2. Blandford, A., Wong, B.L.W: Situation awareness in emergency medical dispatch. *International Journal of Human-Computer Studies*, vol. 61, pp. 421-452 (2004)
3. Færgemann, L., Schilder-Knudsen, T., Carstensen, P.: The duality of articulation work in large heterogeneous settings—a study in health care. In: ECSCW 2005, p. 163–183. Springer (2005)
4. Xiao, Y: Artifacts and collaborative work in healthcare: methodological, theoretical, and technological implications of the tangible. *Journal of biomedical informatics*, vol. 38, pp. 26-33 (2005)
5. Weerakkody, G., Ray, P.: CSCW-based system development methodology for health-care information systems. *Telemedicine journal and e-health: the official journal of the American Telemedicine Association*, vol. 9, pp. 273-82 (2003)
6. Hertzum, M., Simonsen, J.: Effects-Driven IT Development: Specifying, Realizing, and Assessing Usage Effects. Accepted for publication in: *Scandinavian Journal of Information Systems*, pp. 1-18 (2011)
7. Endsley, M.R.: Toward a Theory of Situation Awareness in Dynamic Systems. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, vol. 37, pp. 32-64 (1995)
8. Myers, M., Newman, M.: The qualitative interview in IS research: Examining the craft. *Information and Organization*, vol. 17, pp. 2-26 (2007)
9. Goffman, E.: PRESENTATION OF SELF IN EVERYDAY LIFE. Doubleday Anchor Books, Doubleday & Company Inc. Garden City, New York (1959)
10. Strauss, A., Fagerhaugh, S., Suczek, B., Wiener, C.: *Social Organization of Medical Work*. Chicago: The University of Chicago Press, 1985.

11. Schmidt, K.: The Problem with 'Awareness'. Computer Supported Cooperative Work 11, pp. 285-298. Netherlands: Kluwer Academic Publishers (2002)
12. Tollmar, K., Sandor, O., Schömer, A.: Supporting social awareness @work design and experience. In: Proceedings of the 1996 ACM conference on Computer supported cooperative work - CSCW '96, pp. 298-307 (1996)

Mitigating Urban-Rural Digital Divide with Renewable Energy Mini Grids – a Research Project

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Abstract. Lacking or unstable electricity access is a factor in sustaining urban–rural digital divides in low GDP countries. It is also a key challenge for implementation of health information systems in remote areas. The paper presents an ongoing project where a renewable energy mini grid extended from a mobile tower is piloted in a remote village in Bangladesh and will discuss preliminary findings of an urban – rural digital divide in this village. An agenda for further research will be presented in the end.

Key words: urban–rural digital divide, renewable energy mini grid, mobile infrastructure, mobile phone, telecenter, HIS, Bangladesh

Introduction

The lack of and unstable supply of electricity is a serious challenge for the implementation of health information systems (HIS) in low GDP¹ countries [3, 8]. It is also causing the population in rural areas to lag behind in uptake of information and communication technologies (ICT), sustaining the urban – rural digital divide [9]. This paper will present an ongoing research project connected to the piloting of a renewable energy mini grid in a remote village in Bangladesh. After a brief discussion of the concept ‘digital divide’, the pilot project “Community power for communication and health” will be presented, emphasizing why it was initiated and what we hope to achieve by it. The main part of the paper will be devoted to a key challenge that the pilot project addresses, the urban – rural digital as it is manifested in the pilot village. Through this discussion I will identify an agenda for further research.

Digital Divide – Theoretical Background

The digital divide refers to the gap between groups of people that have access to digital media and those who do not, or have scarce access. The popular discourse about the digital divide commonly focuses on the gap between the population in developed and developing countries, but there are also digital divides within countries with low GDP. These divides can be analyzed using a variety of variables, such as economy, education, ethnicity, gender and geography [1]. In this paper I will focus on the latter, by describing a case of urban-rural digital divide in a district of Bangladesh.

There is an underlying premise in the discourse of digital divides that increased access to information for the underprivileged people of the world is crucial for their ability to achieve betterment of their life conditions. Through access to market

¹ Gross Domestic Product

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information, they are supposed to be enabled to become informed actors in the market economy, and use this information to improve their economic situation [2,3]. Electronic access to governmental information and improved possibilities for communication with the bureaucracy is meant to empower the individuals as citizens, making them able to claim their civil rights and take more informed choices as voters. Access to health resources and educational content is meant to enable individuals to improve the life situation for themselves and their families [4]. These assumptions are criticized for technological determinism, i.e. taking for granted that the introduction of a technology will lead to social change [5]. Access to information and communication resources does not necessarily mean that people are going to use them, or use them for the purposes for which they were designed. Chrisshanti Avgerou raises the concern that even though every ICT and development study makes assumptions about what development is and how it can be achieved, there is far too little explicit focus on what is understood by ‘development’:

“Without diligent grounding on theory regarding development processes, studies of the developmental potential of ICT lack analytical bearings and rely on common sense or popular assumptions about what desirable developmental effects are and how they can be achieved [6, p. 12].”

Although being an important issue to address, an extensive discussion is out of the scope for this paper. I will not further problematize the notion of digital divide or discuss which notions of development influence the planning and execution of this pilot project. I will describe and discuss the differences in ICT practices in the pilot village compared to ICT practices observed in urban and semi-urban areas of Bangladesh, and I will conceptualize those differences as an urban – rural digital divide. I will first present the pilot this research project is a part of.

The Pilot Project “Community Power for Communication and Health”

In October 2010 the Bangladeshi telecom operator Grameenphone and University of Oslo launched a pilot project where a renewable energy electricity grid is installed in a remote village. The name of the project is “Community power for communication and health”, and as the name indicates, there is a focus on electricity for communication and health related purposes in this project. I will in the following elaborate on the connection between access to electricity and urban – rural digital divide. Then I will present how mobile towers can be utilized to bring electricity to remote communities, combining the ambition of mobile companies for expansion in rural markets with the desire of rural communities for access to electricity and the need of health authorities for access to electricity to apply health information systems in areas not connected to the national electricity grid.

Lack of Electricity and Urban – Rural Digital Divide

During the last decades there has been many initiatives aimed at finding ways of utilizing ICTs to improve the health situation in the global south. Health workers in the field are equipped with mobile phones so they can call get immediate advice in difficult cases. District health staff can direct field workers as the need arises, for instance in the breakout of an epidemic. Mobile phones have also become central devices in various HIS because they enable electronic data collected at the field level.

A well functioning system of health data reporting is important for several reasons. Regular and reliable reporting of health data is essential for planning, and facilitates efficient use of scarce resources [20]. A reliable health reporting system is also crucial for low GDP countries to meet the reporting needs of international development agencies. How the countries score on the Millennium Development Goals² has become an important indicator of development, and a well functioning HIS is necessary to generate data on the corresponding health indicators [21, 7].

When implementing HIS in countries with low GDP, a recurring cause of failure is the lack of access to electricity. Non-existing or dysfunctional electricity grids are especially a problem in rural areas. Frequent power outages stop the servers from running, causing data to be lost. In health information systems where mobile phones are utilized, lack of access to charging is an obstacle for data reporting [3, 8].

Lack of electricity is also a hindrance for uptake and use of ICT by the population in remote areas, and contributes to create an urban – rural digital divide [9]. When electricity is available through generators, the transportation cost of the fuel adds to the price of electricity. Less access to electricity either due to lacking infrastructure or high cost is thus a factor that obstruct rural uptake of ICT compared to urban.

Building a Renewable Energy Mini Grid Based on Mobile Infrastructure

The connection between uptake and use of ICT and access to electricity is not only a concern of the HIS community; it has also in the recent years caught the attention of the telecom industry. After years of rapid expansion, the growth in the mobile market in many low GDP countries are slowing down as the markets are coming closer to saturation. To expand their markets, the telecom industry is setting up base stations (mobile towers) powered by generators or renewable energy systems in areas not covered by the national electricity grids. Renewable energy has proved to be viable alternatives to powering base stations with fossil fuel generators. However, increased mobile coverage does not lead to increased uptake of mobile telephony unless the population in the newly covered areas is able to charge their handsets, and the average revenue per user (ARPU) will stay low unless the population have sufficient economical surplus to spend on communication. A response to this challenge is to build local electricity grids that channel surplus electricity from the base station to the local community. The size and functionality of the grid varies from project to project, but may include light, electricity for various kinds of production as well as access to

² The official United Nations site for the Millennium Development Goals Indicators including child and maternal mortality can be inspected at <http://unstats.un.org/unsd/mdg/Default.aspx>

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handset charging. The telecom company will benefit by increased coverage and mobile traffic in the area, and they can utilize the project in their Corporate Social Responsibility-strategies [9].

The first phase of the pilot

A village in one of the most remote areas of Bangladesh is chosen as the first pilot site in the project “Community Power for Communication and Health”. It is located in a *haor*, which is a vast wetland area. The fluctuating water level makes transportation from the nearby towns very challenging, and the village lacks amenities such as a road from the nearest town, electricity grid and health facilities. The administrative unit has a population of approximately 20.000 people, but the settlement is spread over a large area. The mini grid is located in the densely populated area around the main market, and when I write ‘the village’ in the following, it is this area I am referring to. Locals estimate the population of this area to be approximately 5000 people. The village has some access to electricity through generators that run on kerosene, mostly in the market. Some enterprises have solar home systems, consisting of a solar panel on the roof, but this is not widespread as it is very costly in relation to the average economic capacity.

Grameenphone has a solar energy powered base station, and a mini grid is built in connection to this. It currently provides electricity for one light bulb in 140 households at night. During daytime the grid powers a Grameenphone Community Information Center equipped with a computer with internet access, printer, scanner and a mobile charging booth. In the next stage we aim at connecting more households. We will also investigate the opportunities for supplying enterprises, such as shops or workshops, with electricity, but since the capacity of the system is limited at this stage, we prioritize lights in households, as that will benefit more people. We aspire to expand the pilot to cover the local electricity needs of an ICT based HIS that is planned for the district. During the pilot period we will test configurations of technologies, business models and models of ownership and local involvement will be tested order to arrive at a model that is both locally viable and scalable.

Pilot projects that involve intervention in local communities require ethical reflection. One concern is the distribution of access to the electricity. The system does not have the capacity to electrify the whole village. There is a risk that our interventions may lead to conflicts motivated by jealousy. The entrepreneur we have chosen to be in charge of the local administration and maintenance of the grid has as part of this agreement got his telecenter equipped and refurbished. This gives him an advantage in relation to his competitors, and by this we are intervening in the local conditions of business. However, our aim is to develop a self-sustaining system, a system that over time will not be dependant on outside funding to sustain. In order to achieve this we have to start with a small grid and expand the capacity gradually in accordance with local conditions, and in this process some households and businesses will necessarily be favored.

Manifestations of Urban-Rural Digital Divide in the Pilot Village

After presenting the pilot project; the challenges it seeks to solve, the first phase and ambitions for further expansion, I will focus on a key challenge addressed by the pilot project, the urban – rural digital divide, and present preliminary findings of how such a divide is manifested in the village. The term ‘rural’ will in this paper refer to conditions in the pilot village. This village is very remote, and the ICT practices found there may not be representative for most rural villages in Bangladesh.

The research is in an early stage and the data gathered so far is limited. Hence the following section should not be understood as results of extensive data gathering and systematic analysis, but as an outline of preliminary data aimed at arrival at an agenda for further research.

Methods

The data the following section is based on is qualitative data gathered during field visits to the pilot village and the nearest town. I also rely on insight about ICT practices that I have gained conducting several market research projects in urban and semi-rural Bangladesh from 2005 to 2010, and literature about Grameenphone Community Information Centers in Bangladesh.

During October – December 2010 I spent altogether five days in the village and four days in the town. My methods for data gathering have been participant observation, informal interviews and observation. In the village I conducted informal interviews with the staff in seven telecenters. With ‘telecenter’ I mean facilities for community access to ICT. I did several hours of observation of interaction between customers and staff in one of them. I also participated in an information meeting for the village population and in several meetings with our local partner. I took part in a three-day training session about computer use for our local partner and his assistant. In addition I conducted informal interviews with a number of villagers, including the college principal, an NGO worker, business owners, homeworking women and students. The interviews were informal and explorative, and aimed at generating an understanding of the current ICT practices of the informants and their aspirations, if any, for future ICT use. I also sought to uncover communication practices and needs that can potentially be supported by ICTs.

In the town I did participant observation and informal interviews with a group of young men associated with a computer-training institute. I also visited a Grameenphone Community Information Center and talked to staff and users there. I had a lengthy discussion about ICT practices and aspirations for future ICT use with a businesswoman, and short conversations about the same issues with homeworking women and a female student that I met while visiting two households and a shop.

In the following section I will present urban – rural differences observed in mobile ownership and use and in computer practices. Through this I will identify issues to be explored further in my research project.

Urban – Rural differences in mobile ownership and use

Studies of mobile telephony in low GDP countries in the first decade of this century highlighted that mobile phones were commonly shared with family and friends, and not primarily used by only one individual, as is common in high GDP countries [11, 12]. In Bangladesh mobile sharing practices has declined at a national basis. This development can be clearly seen in the story of Grameen Telecom’s Village Phone program, which started in 1997 [13]. Rural women got micro credit to buy a handset for renting out to people for making phone calls. This was considered a great success during the first years [14]. But with increased mobile penetration, there is now very little demand for the public phone services offered by the village phone ladies [13]. People I talked to in the town said that each family member now owns a mobile phone, and that all women have mobile phones these days. Regardless of this being a broad generalization, it is interesting to compare this description of reality with what women in the village told me. They said that they did not personally own a phone, but borrowed from male family members when they needed to. So even though there is an overall trend in Bangladesh towards individual use of mobile handsets, in the pilot village mobiles are shared within the family [13]. Further research will clarify whether the national trend of less sharing will be emulated in the village.

In the recent years internet use on mobile phones has picked up in low GDP countries [15]. Compared to computers, mobile phones are cheaper, less vulnerable to break down due to virus attacks or unfavorable weather conditions and require less skill for using [16, 17]. It may turn out that the digital divide will be bridged by mobile phones rather than by computers. In addition to being the first internet device of many people, the mobile handset is also for many their first and only media player. In the pilot village it is common not only to play music, but also to watch full movies on mobile handsets. When I discussed this practice with people in the town, they said that town people do not watch full movies on their handsets, they only download music videos and selected movie scenes. Further research is needed to establish whether this is the case or not, but the difference in access to electricity suggest one possible explanation as to why this may be the case. The scarcity of electricity and the extra expense incurred by fuel transportation costs constitute an extra barrier for buying and using a TV for people in the village. A conversation I had with a woman in the village illustrates this. She said that her family has a TV, and they used to watch it using a car battery. Now they cannot afford to use it anymore. For those who cannot afford to use a TV, let alone buy one, the mobile phone is an alternative media player also for collective watching.

The scarce access to electricity in the village has implications for women’s access to mobile use in particular. With a few exceptions such as access to car battery or an individual solar panel, people have to go to the market to have their handsets charged. The market is a predominately male space. Women do enter the market from time to time, especially in connection with holidays, but they do not go to the market at a regular basis. In rural Bangladesh, notions of purity and shame govern women’s movement in public space, and acting in conflict with these norms is met with social sanctions [18, 19]. Even if village women did have their own handset, they would still

not be in full control over the use situation, as they would be dependent on men and children to go to the market and get it charged.

The research conducted this far point to certain urban – rural differences in mobile use. Whereas shared use of mobile handsets has had an overall decline in Bangladesh, the findings suggest that sharing within the family is common in the pilot village. The use of mobile handsets as media players is extensive in the village. The lack of electricity in the households is likely to be a contributing factor to this. Given the norms sanctioning women’s movement in public space, they cannot gain full control over their mobile use without access to mobile charging in the households, even though they become owners of handsets.

Urban – Rural Differences in computer practice

Telecenters vary a great deal in terms of equipment as well as business models. There are purely commercial telecenters and there are subsidized telecenters. Here I will not distinguish between the different kinds, but will understand all facilities that offer ICT access in a community a telecenter. The services offered in telecenters in Bangladesh vary from offering access only to providing assistance in using the equipment. Video conferencing with family members who work abroad is a popular service in Grameenphone Community Information Centers. Seeking entertainment is also an important driver, and groups of young men can often be found gathering around a computer to download music or browse the internet for entertaining content [10].

Searching for and consuming entertainment content is also a common activity in the computer-training institute I visited in the nearest town. It offers computer classes, but it also function as a regular telecenter where people can use the computers as they wish. During my visits they were used for a variety of purposes from entertainment such as gaming and manipulating photos to practicing computer skills such as word processing. Those I talked to all consider themselves to be experienced computer users. They have e-mail accounts, although they said that they do not use them frequently. They regularly use internet for downloading films and games and for manipulating photos in Photoshop. Some of the men I talked to have tried to earn money by doing data entry jobs that one can sign up for at various websites. This had not been entirely successful so far, as they had not been able to find a way to cash out the money that they had earned according to their site account.

We have seen that the computer practice in the urban and semi-urban telecenters I have visited includes internet browsing, communication, entertainment activities and money making activities. In the pilot village the situation is different. Differences are found in internet use, in what the computers are used for and in how the users interact with the computer. I will elaborate on this in the following.

There are approximately 13 telecenters in the village. They are all located in the market, and offer computer access in addition to a variety of goods for sale. I visited 7 of these and conducted informal interviews with either the owner or an employee. All of these telecenters are occasionally connected to the internet, either using a mobile handset as a modem or through usb modem. However, internet use as commonly understood by the term (e.g. browsing, e-mailing or downloading entertainment

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content) does not take place in these telecenters. Internet is solely used for downloading anti-virus software.

The computers are mainly used for transferring films, music and ringtones to the mobile handsets of the customers. The content is not downloaded from internet, but enter the computer through usb sticks and mobile memory cards. Apart from selling music, films and ringtones, some of the telecenters are also equipped with a digital camera and a color printer. ID photos are needed for a number of purposes such as enrolling in micro credit programs, taking part in the governmental food for work program and buying SIM-cards.

Many telecenter customers in Bangladesh do not have the skills to operate a computer, and need assistance. However, in all the telecenters I have visited in urban and semi-rural areas the computers are set up in a way that invites the customer to handle it themselves. This is not the case with the telecenters in the village. Here the computer is placed at the counter with the screen turned away from the customer. The placement of the hardware discourages customer interaction with it.

I observed several customer sessions in one of the telecenters. In all of them, the customers bought content for their mobile phones. The sessions started with the staff inserting the memory card of the customer's handset into a memory card reader, plugging it into the computer and erasing the films and music already there. Then he played snippets of music and films that the customers could choose from. Occasionally the customers appeared to be requesting certain artists, songs or films, but the staff also seemed to a large extent to be choosing which content to play. Every now and then the customer signaled that he wanted to buy that song or film. The sessions I observed were fairly lengthy, lasting up to half an hour. The customers looked at the screen from time to time, some appearing to be eagerly watching how the staff handled the equipment and others appearing to be interested in watching the film snippets only. The customers did not touch the hardware in any of the sessions.

How the equipment is arranged and what it is used for reveal that the computer is a different artifact in the village than in the town. In the village telecenters the computers are a combination of vending machines for digital content and photo printers. It should be noted, however, that there might be incoherence between how the computers are used and how they are perceived. Many of the villagers I have talked to desire to start using internet, and show by this that their perception of computers is not only based on how they are used locally.

Our partner has received training in computer and internet use, as well as basic training in how to develop and maintain a viable business. It remains to be seen whether his enterprise will remain primarily a point of sale for digital content, and to which extent information and communication services like browsing, social media use and chatting will be taken up by the customers. We will monitor this throughout the pilot process, and we will investigate to which extent the customers will start handling the computer themselves. Changes in the enterprise of our local partner may inspire changes in the other telecenters in the market, and we will do follow-up interviews in order to uncover that.

Tangible trajectory of digital content

Entertainment content is popular in the village as well as in urban and semi-rural telecenters. However, when we investigate how the digital content enters the local computers, an urban-rural digital divide is revealed. In the urban and semi-rural telecenters I have visited, entertainment content is downloaded from the internet. This is not the case in the village telecenters. Here the digital content enters the computers through a trajectory involving a number of tangible carriers. It starts with the telecenter owner or his assistant traveling to the town to buy supplies and conduct meetings with business partners. One of his activities will be to visit a telecenter and buy music, films and ringtones that he stores in memory sticks and mobile memory cards. Then he starts his journey back to the village. He will have to use a combination of transport means, depending on the season. This may include bicycle rickshaw, auto rickshaw, bus, motorbike, mini bus and boat. When he arrives in the village he will upload the content to his computer. Later the content is transferred to the customers' handsets using a memory card reader, before the handset owner, his friends and his family finally consume it gathering around the handset.

In addition to depend on a variety of tangibles, the trajectory of the digital content also relies on the management of a number of human relations. The relations to the vendors of digital content need to be managed, and the transport to the village is also a matter of human relations, especially since there is sometimes need for improvisation, for instance if the road is washed out or if the water level is higher or lower than expected and the boat cannot reach the shore as planned.

We will explore whether the trajectory of digital content will change during the pilot period. Will the villagers start using the internet for downloading digital content, and if so, will this eventually replace the tangible trajectory altogether? In the case of our local partner, the access to the solar mini grid and a customized data traffic price plan may motivate him to download content from internet instead of buying it in the town. But one can also imagine a number of reasons for maintaining the tangible trajectory. The cost of data traffic may be considered too high compared to the cost of buying digital content while tending to other business in the town. Buying digital content from a long-term business relation may be considered valuable in itself. Buying the content in the town will also include advice about which music and films are popular right now, and this access to market intelligence may be considered to be worth the journey.

Summary of Findings and Agenda for Further Research

The preliminary findings from the pilot village suggest that there is an urban – rural digital divide in mobile ownership and use. Whereas mobile sharing practices have declined in the last years looking at the country as a whole, the findings indicate that shared mobile use is common in the village. In my further research I will investigate how common mobile sharing is and how sharing is practiced, and provided I gain the sufficient access I will compare the use of individually used handsets with the use of shared handsets with a particular focus on notions of privacy. I will also examine the

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relation between electricity and mobile use. I will investigate if women's access to mobile charging can be facilitated in a locally accepted way within the pilot project and follow whether the use of mobile phones as media players change during the pilot period.

The comparison of village telecenters with urban and semi-urban telecenters revealed differences in what the computers are used for and how the users interact with the computers. I have also found that digital content have a tangible trajectory to the village telecenters instead of being downloaded directly from internet. I will investigate to which extent and how this will change as villagers become actively exposed to internet through the Grameenphone Community Information Center that is connected to the mini grid.

Renewable energy mini grids based on mobile infrastructure represent a new approach to mitigating the urban – rural digital divide. A further challenge will be to develop a model that allows for the necessary adaption to local economic, organizational and cultural conditions while being sufficiently standardized to be scalable within a region.

References

1. Norris, P.: Digital Divide: Civic Engagement, Information Poverty an the Internet Worldwide. Cambrigde: Cambridge University Press (2001)
2. Andrade, A.D., Urquhart, C.: The affordances of actor network theory in ICT for development research. *Information Technology & People* Vol. 23, No. 4 (2009)
3. Wilson, G., Heeks, R. Technology, poverty and development. In: Allen, T., Thomas, A. (eds.): *Poverty and Development into the 21st Century*, pp. 403-424. Oxford, UK: Oxford University Press (2000)
4. Avgerou, C. Information Systems in Developing Countries: A Critical Research Review. *Journal of Information Technology* (23) (2008)
5. Gunkel, D.J.: Second Thoughts: Toward a Critique of the Digital Divide. *New Media Society* (5) (2003)
6. Avgerou, C.: Discourses on ICT and Development. Research Paper. USC Annenberg School for Communication & Journalism. Vol. 6, pp. 1-18 (2010)
7. Wilson, R.: Using Computers in Health Information Systems. In: Lippevold, T., Sauerborn, R., Bodart, C. (eds.). *Design and Implementation of Health Information System*. WHO, Geneva (2000)
8. Asangansi, I., Braa, K.: The Emergence of Mobile-Supported National Health Information Systems in Developing Countries. *Proceedings from the 13th World Congress on Medical and Health Informatics MedInfo 2010*. Cape Town, South Africa (2010)
9. GSM Association: *Green Power – Using Mobile to Extend the Grid*. GSM Association White Paper (2010)
10. Roldan, G, Z., Due, B.: *Locating ICTs in Asia's Low Income Communities: Private Sector Initiatives to Address Digital Divide*. Telenor R&I Centra Asia Pacific, Telenor R&I, Norway (2008)
11. Steenson, M.W., Donner, J.: *Beyond the Personal and Private: Modes of Mobile Sharing in Urban India*. In: Ling, R., Campbell, S.W. (eds.): *The Reconstruction of Time and Space. Mobile Communication Practices*. Transaction Publishers, New Jersey (2009)

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12. Fjuk, A., Furberg, A., Geirbo, H.C., Helmersen, P.: New artifacts – new practices: Putting mobile literacies into focus. *Digital Kompetanse*. Vol. 3, pp. 21-38 (2008)
13. Schaffer, R.: *Unplanned Obsolescence*. Published September 1, 2007 in *Fast Company Magazine* (2007) Retrieved from <http://www.fastcompany.com/magazine/118/unplanned-obsolence.html>
14. James, J., Versteeg, M.: Mobile Phones in Africa: How Much Do We Really Know? *Soc. Indic Res* vol. 84, pp. 117-126 (2007)
15. International Telecommunication Union: *The Future Internet*. ITU-T Technology Watch Report 10 (2009)
16. Wade, R.H.: *Bridging the Digital Divide: New Route to Development or New Form of Dependency*. In: Avgerou, C., Ciborra, C., Land, F. (eds.): *The Social Study of Information and Communication Technology Innovation, Actors and Contexts*. New York: Oxford University Press (2002)
17. Rashid, A. T., Elder, L.: *Mobile Phones and Development: An Analysis of IDRC-Supported Projects*. *EJISDC* Vol. 36, pp. 1-16 (2009)
18. Rozario, S.: *Purity and Communal Boundaries: Women and Social Change in a Bangladeshi Village*. Dhaka: The University Press Limited (2001)
19. Geirbo, H.C., Imam, N. *The Motivations Behind Giving and Taking Dowry*. Research Monograph Series No. 28. BRAC Research and Evaluation Division, Dhaka (2006)
20. Gething, P.W., Noor, M.N., Gikandi, P.W., Ogara, E.A.A., Hay, S.I., Nixon, M.S., Snow, R.W., Atkinson, P.M. *Improving Imperfect Data from Health Management Information Systems in Africa Using Space – Time Geostatistics*. *PLoS Medicine*. Vol. 3, 6 (2006)
21. Braa, J., Hedberg, C.: *The Struggle for District-Based Health Information Systems in South Africa*. *The Information Society* 18 (2), pp. 113-127 (2002)
22. Wolsink, M. *Social acceptance of distributed generation within smart (micro-) grid configurations: sustainable energy as a common pool resource*. Paper presented at the MILEN international conference 'Visions and strategies to address sustainable energy and climate change', November, University of Oslo, Norway (2010)

The walking video interview (WVI) as potential technique to tap into the everyday experiences of ICTs

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Abstract.

As all aspects of life is increasingly ‘digitalized’, how humans live and experience everyday life is fundamentally transforming and new lifestyles are created. Today information and communication technologies (ICTs) include ever more features and are increasingly mobile, like laptops, smart phones and I-Pads, and being used across a variety of everyday contexts and life environments, like home, school and public spaces. These shifts may require both new lines of inquiry and new methods and techniques for studying them. This paper addresses the need for new methods and techniques by exploring how contemporary, technology infused everyday life could be studied empirically in order to capture the intertwined and entangled nature of human-ICT relationships and what they mean for the people involved. The paper introduces a form of walking video interviewing (WVI) as a potential technique to empirically capture the sociomateriality of contemporary life. The paper combines lessons learned in the domestication, new media and communication research, mobile ethnography and the use of video for studying the interaction of the social and material, thus contributing to the IS and organizational literature, in particular in the area of sociomateriality and experiential computing in a empirical-methodological way. The paper evolves in the context of a currently on-going research project on individual ICT landscapes of working adults and reports on experiences from a test interview in this project.

Keywords: Information and communication technology, qualitative method, sociomaterial, everyday life, video interview, experiential computing, technology as experience, ICT landscape

1 Introduction

As all aspects of life is increasingly ‘digitalized’, how humans live and experience everyday life is fundamentally transforming and new lifestyles are created (Bradley 2006, Lesnard 2005, Frissen 2000). Today information and communication technologies (ICTs) include ever more features and are increasingly mobile, like laptops, smart phones and I-Pads. New uses of ICTs increasingly cover private and leisure activities, such as communicating and socializing with friends, playing games, displaying and sharing photos and videos, in addition to using other Internet services, like GPS, shopping, banking, planning travel, reading news, accessing public service and finding information, both locally and globally (e.g. Gripenberg 2002). This not only enable ICT use across a variety of everyday contexts and life environments (work, home, school, and public and private spaces), but increasingly blurs the boundaries between them (Avery & Baker 2002, Hernes 2004, Shumate & Fulk 2004, Peters & Allouch 2005), for example, by transforming how work, organizations, and employer-employee relationships may be organized across time and space (e.g. Wajcman et al. 2008, Avery and Baker 2002). The expanding use of ICTs outside work contexts is a rather new but very rapidly expanding phenomenon¹, also among ever younger users (Katz and Aakhus 2002, Haddon 2004, Kraut et al. 2006, Parjo et al. 2008, Carrington and Robinson, 2009).

While computing technologies are becoming ubiquitous and new users of computing are constantly emerging the need for increasing our understanding of these transitions, how they occur and what they mean for human life is all the more pressing (e.g. Bradley 2006, Yoo 2010). New lines of inquiry as well as methods and techniques may be required, as the traditional way of studying single ICTs (like mobile phones, PCs, Internet) or single phenomena (like technology acceptance, learning, use) in single contexts (like home, leisure or work) is far too limiting to understand contemporary transitions and the intertwined and entangled nature of humans and ICTs (e.g. Dahlbom, 1996, Wise 1997, Rose & Jones 2005, Orlikowski 2010) and what they mean for the people involved (e.g. Yoo 2010). Therefore, this paper argues that, in addition to analytically distinguish technology-as-artifact and technology-as-practice (Orlikowski 2000), we need to study *technology-as-experience* to tap into the sociomateriality (Orlikowski & Scott 2008) of ICT infused everyday life. Further, by combining lessons learned on multi-method approaches in the domestication, new media and communication research, with recent developments in mobile ethnographic methods, and the use of video for studying the interaction of the social and material, the paper introduces a form of walking video interview as a potential technique to empirically capture the sociomateriality of contemporary life, with particular focus on the experience of ICTs.

The paper evolves in the context of a currently on-going research project on individual ICT landscapes aiming at increasing the understanding of how ICTs are used and experienced in combination and across contexts in everyday life and how working adults are coping with the increased technological complexity, as well as how it effects their well-being and sense of life control (e.g. Anderson 2004, see also Gripenberg, 2010).

¹ For example, currently 99% of the population in Finland (15-79 years old) has a mobile phone (Bureau of Communication, 2010). In 2009 the Internet access rate in Finnish households was 68% and as high as 96% in households with children aged under 18 (ibid.), whereas in spring 2009 82% of 16-74 year olds reported having used Internet during the past three months (Statistics Finland 2009). The number of wireless internet access in Finnish households has grown from one to 15 % in two years from year 2007 to 2009 (Bureau of Communication 2009 and 2010). In 2009 65 % of the population had Internet access trough broadband (ibid 2010). In households with people under 45 years, 90 % have access through broadband (ibid).

The paper first reviews the emerging literature that identifies the complexity of contemporary human-ICT relationships by empirically including several ICTs and/or their use in several contexts and identifies some research gaps and the need for more study in the proposed area of IS/IT research. The paper then contrasts prevailing perspectives in the study of ICT as *artefacts* or as *practice* with the need for viewing technology as *experience*. The paper then discusses how experiences of human-ICT relationships has and could be studied using multi-method approaches, combining walking interviews with video techniques into the 'walking video interview'. Lastly, the paper reports on the experiences of a test interview based on the suggested technique and discusses some practical issues that need to be considered when using the technique.

2 Empirical research on the sociomaterial nature of human-ICT relationships

A majority of studies focusing on ICT use have focused on a single technology, such as the PC, the mobile phone, or a certain IS, and/or single context, like organization, work or home, perspective.² At present a small but emergent body of socio-cultural ICT research where empirical studies have integrated the use (and included also non-use) of several ICTs (e.g. Internet, mobile phones, or more complex information systems) and/or different contexts (e.g. work, home) into the same study can be identified. This body of research has studied the role of ICTs for changing, mediating, or relaxing time and/or space constraints (e.g. Green 2002, Anderson 2007, Schwanen and Kwan 2008, Wajcman 2008), on work-family or work-home divisions and boundaries (e.g. Avery & Baker 2002, Peters and Allouch 2005, Wajcman et al. 2008,) on quality of everyday life (e.g. Frissen 2000, Leung and Lee 2005, Lee et al. 2008, Jokinen 2005) or work-life (Korac-Kakabadse et al. 2001), on personal/work identity (e.g. Walsham 1998, Brocklehurst 2001, Lamb and Davidson 2005,) and on non-use of ICTs to better understand the complexity of 'use' of ICTs (Punie 1997, Selwyn 2003).

Indeed a few studies consider the range and conditions of specific technologies even though this is a growing feature of contemporary ICT use. How are various ICTs integrated and used in connection and across contexts? Or how do people potentially experience such use of multiple ICTs across contexts, as has been suggested in the work context (e.g. Korac-Kakabadse et al. 2001)?³ Further, as households are potentially becoming ICT-supported workplaces, little attention has also been given to how the home context interferes with the employer-employee relationship, or how ICT-enabled remote work interferes with household practices (Avery & Baker 2002); or on how, through mobility, public spaces intertwine with the relationship. The role of ICT for identity construction and potential role conflicts (Walsham 1998, Brocklehurst 2001) is also a rather neglected area.⁴ Although this is not an exhaustive review, it highlights the need for more systematic empirical research on the

² For review on IT in the home context see National Science Foundation, 2001 and Haddon 2004&2006 and for reviews on IT in work organization see e.g. Liker et al. 1999 and Orlikowski and Scott, 2008.

³ On experiencing the use of computers in the work context see also e.g. Gripenberg (2004) and in the home context: e.g. Habib & Cornford (2001), Gripenberg 2002, Gripenberg (forthcoming). On negative consequences of mobile phones, see Moisiu (2003).

⁴ For interesting single technology studies and identity, see e.g. Katz & Sugiyama 2006 (mobile phone), Alvarez 2008 (Enterprise system) and on role conflict when work and home are collocated, Shumate and Fulk (2004).

individual-level impacts of the increasing infusion of ICTs in the home and public contexts (in addition to the organizational) in combination with the constant development, convergence and mobility of contemporary ICTs (see also Yoo 2010 for a more systematic agenda of the research opportunities in the area of experiential computing in IS). My aim is to offer some suggestions on how the sociomaterial nature of human-ICT relationships could be studied on the individual level in practice. This is what I turn to next.

3 'Individual ICT-landscapes' and 'Technology-as-experience'

How can we empirically study the research problems exemplified above to better capture the sociomaterial nature of human-ICT relationships? While *practice* has become a dominant lens for studying the recursive sociomaterial relationships between humans and technology in the work and organizational setting (e.g. Suchman et al. 1999, Orlikowski 2000, Boudreau & Robey 2005), *practice* (as it is predominantly applied in these studies) does not seem to readily capture what goes on in the human-ICT relationship where work is not the only or predominant activity of the ICT user, but it is combined also with other, e.g. leisure related activities. In contrast, *domestication* has become the dominant lens through which human-ICT relationships are studied in the home context (e.g. Lehtonen 2003, for review see Haddon 2004&2006), capturing to a greater extent how technology is experienced, rather than enacted and used or even adopted. In an effort to accommodate these different conceptualizations of recurring human-ICT relationships and to integrate these literatures, I have offered the lens of '*individual ICT landscapes*' (Gripenberg, 2010) as a context within which to empirically study human-ICT relationships as they unfold across settings (e.g. home, work, travel). By the empirical study of individual ICT landscapes it is possible to capture the use of various ICTs as they are used across settings and in combination (e.g. laptop-mobilephone) or as substitutes (e.g. Skype instead of phone, or landline instead of mobile phone). Building on Orlikowski's (2000) work, I further offer here three analytical distinctions to guide the empirical study of individual ICT landscapes: *technology-as-artifact*, *technology-as-practice*, and *technology-as-experience*. These are briefly outlined below.

While developing the 'practice' lens to technology, Orlikowski analytically distinguishes between the artifactual character of a technology and its use, as in her view in both research and practice these two aspects of technology are often conflated. She uses the concepts of technological artifact and technology-as-practice to highlight the distinction. A *technological artifact* is:

an identifiable, relatively durable entity, a physically, economically, politically, and socially organized phenomenon in space-time. It has material and cultural properties that transcend the experience of individuals and particular settings. ... [It] appears in our lives as a specific machine, technique, appliance, device or gadget. (Orlikowski 2000:408)

At first sight then in the study of individual ICT landscapes, an individual's ICT landscape comprises of ICTs as artifacts: machines, devices and gadgets that surrounds the individual in his or her life contexts, e.g. at work, at home and those that are portable and thus transcend various contexts in time-space. These are identifiable and may consist of PCs, smart phones, I-Pads, Black Berries, digital cameras, modems, printers, fax machines, memory sticks, telephones, discs etc and they are usually supported by a power source, like electricity or batteries. Further they are usually connected

to each other or larger networks (e.g. intranets, Internet, companywide IS systems, phone networks) through cord, antennas and radio waves, or they are somehow otherwise physically connected e.g. through insertion (like CDs or memory sticks). They are acquired and maybe at some point discarded of – they represent the material. The first potential contribution of empirically studying individual ICT landscapes through the concept of ICTs-as-artifacts is a better understanding of how individual users manage these increasing connections between ICTs across contexts, how they get the technologies fit together and ‘talk to each other’, the ‘archeological layering’ (Suchman et al. 1999) of ICTs that are piling up in the individual ICT landscape of any ICT user. Further, the approach highlights the further connections, the embeddedness of ICTs in larger infrastructural networks of e.g. power supply, radio coverage, and technological support.

The second distinction, *technology-as-practice* Orlikowski defines:

[U]se of the technology involves a repeatedly experienced, personally ordered and edited version of the technological artifact, being experienced differently by different individuals and differently by the same individuals depending on the time or circumstance. ... [It] refer[s] to the specific structure routinely enacted as we use the specific machine, technique, appliance, device, or gadget in recurrent ways in our everyday situated activities. (Orlikowski 2000:408)

Understanding ICTs without considering how they are used is still rather impossible which is why the use of ICTs in the individual ICT landscape, *technology-as-practice*, would have to be considered as well. In the individual ICT landscape, *technology-as-practice* would thus turn up as the particular ways in which the technological devices and gadgets are used, what they are used for and why. Looking at technological artifacts from a *technology-as-practice* point of view, some uses are often already indicated in the technologies (c.f. affordances), like calling people with a mobile phone, while how and why they are used are not equally obvious, like developing signalling systems and not answering the mobile phone or how it is used in combination with a laptop. The approach would further allow for an analysis of how devices are used in combination or in supplementary ways. While Orlikowski (2000) and much consequent work focus mainly on *technology-as-practice*, or how technology is enacted in practice and much less on technology as artifact or the relationship between the two (Hanseth et al. 2004, see also Gripenberg, forthcoming), using an individual ICT landscapes approach, make both the aspects of technology, and how they interact possible to study in depth. More in-depth studies of individual ICT landscapes would provide for a better understanding of for example how seemingly similar or different ICT landscapes are appropriated and used, or enacted (Suchman et al 1999, Boudreau & Robey 2005, Orlikowski 2007) by the individual. Understanding the relationship between technology as artifact and technology as practice, or the phenomena that emerge when technical and social systems interact (sociomateriality) is a central concern e.g. in the IS field (e.g. Hanseth et al. 2004).

In my view *technology-as-artefact* and *technology-as-practice* is, however, not enough to capture the essence of the sociomaterial nature of human-ICT relationships. Drawing on the literature of domestication, media consumption and my own work on emotionally experiencing ICTs (e.g. Meyrowitz 1985, Lehtonen 2003, Haddon 2006, Gripenberg forthcoming), I would add a third distinction to Orlikowski’s original two: *technology-as-experience*. *Technology-as-experience* encapsulates both to how we experience a technological artifact, as well as how we experience our use and the consequences of the use of that artifact. Again, this is an analytical distinction to sensitize us to recognize the experience, as it is empirically interwoven with the experience of the artifact, its use, and the spatio-temporal context within which this experience occurs (see also Yoo 2010 on

experiential computing). Technology-as-experience entails both emotional involvement and sensemaking of the experience (Gabriel 1995, Sturdy 2003, Weick et al. 2005) and thus displays some of the values that emerge and prevail in the human-ICT relationship (e.g. Orlikowski and Iacono 2001). Values that are not only merely instrumental (leading to an emphasis on usability, usefulness, task-technology fit, productivity, user satisfaction of technology), but inherent in the experience, like listening to music or enjoying a game (Yoo 2010). Understanding technology-as-experience is thus vital for increasing our understanding of the sociomaterial nature of human-ICT relationships, i.e. what it means to live with ICTs (e.g. Orlikowski & Iacono 2001); how ICTs are reshaping everyday life, for example in terms of well-being and identity construction. These are fundamental and existential questions that have to a greater extent informed the domestication research (e.g. Haddon 2006) in new media and consumption, but are, in my view, increasingly needed to inform also the information systems research more broadly (see also Yoo 2010). A question remains though: how can we empirically capture the sociomaterial nature of human-ICT relationships across spatio-temporal contexts (ICT-landscapes) and use the analytical distinctions of technology-as-artifact, -practice and, -experience? In effect, what kind of techniques can we use to study the spatio-temporal and sociomaterial experience of ICTs and their use?

4 Approaches to study experience of human-ICT relationships in everyday life

As studying experience of ICT use in everyday life is only just being called for in the mainstream IS field (e.g. Yoo 2010), I here turn to other disciplines that are more familiar with the study of everyday life experience in general and of ICT use in particular to find examples of how experience could be studied. I will begin with a review of literature in the domestication, new media and communication fields, where the need for multi-method approaches to study experience of ICTs has been recognized. I then turn to look at recent developments in the area of ethnographic research, with a particular focus on mobile ethnographic methods like shadowing, go-alongs and the walking interview.

4.1 Multi-method approaches

Several authors in the fields of domestication, new media and communication⁵ have reported studies that include the use and experience of different ICTs throughout the various contexts one individual is moving through in his or her daily life. These existing studies have shown that there is a need for including multi-method approaches, triangulating various data gathering methods (e.g. Frissen and Punie 1998) in order to better understand the sociomateriality of everyday life with ICTs; how this is experienced and what meanings the use of ICTs across contexts and in combination means for the individual. One reason for the need of multi-method approaches is that it has proven difficult for respondents to talk about their everyday use of media and ICTs and especially their underlying communication needs (Frissen 2000). A way to solve this problem has thus been to use a variety of methods to contextualize the respondent's use and needs as much as possible. These studies illustrate

⁵ For introduction into this literature see e.g. Haddon 2004&2006, Katz & Aakhus 2002, Katz 2008, and Green & Haddon 2009.

the criteria that techniques for empirically studying human-ICT relationships should fulfill in order to successfully capture the inherent sociomateriality of everyday life.

In her study of ICT use of dual career families in the Netherlands, Frissen (2000) used some successful methods for contextualizing as much as possible the ICT use of the studied family members. Frissen combined in-depth interviewing and observation, with semi-structured questionnaires, ICT-use diaries, mental mappings of the house (to visualize the physical space in which ICTs were placed), and network diagrams (to make visible the social networks the households were embedded in). Her method proved particularly successful in explaining the role of ICTs for solving everyday problems in people's lives, and for understanding people's needs, practices, experiences, and problems as ICT users. Also Jokinen (2005) used a mental mapping method in her study on the everyday lives of Finnish adults. Venkatesh (2001) also demonstrated how in-depth ethnographic research in combination with survey techniques, time diaries, and focus groups, provide a rich context for asking questions and for yielding entirely new ways of conceiving and understanding the role of ICTs in the home. A very recent study has studied the ICT landscapes of students successfully using a method Riddle and Howell (2008) call 'The day experience method'. In this method students have been cast the role of co-researchers as they themselves collected data using different means, such as disposable cameras, structured diaries, and voice recorders, to record their ICT use during the course of one entire day (Riddle and Arnold, 2007). After the day experience, selected students were brought together in focus groups to show their photographs and describe their day.

In a study on domestication of new technologies, Lehtonen (2003) used a method of interviewing people in their homes, including demonstrations. He could probe into more detail around the appliance while the interviewee was showing the appliance and how and what he or she used it for. This method seemed especially successful for getting at various stages and trials in the adoption and domestication process. In a study of 50 families' experiences with a new PC in their homes (Gripenberg 2002, forthcoming), written essays proved to be especially successful for revealing both rational and emotional sentiments (e.g. Sturdy 2003, Gabriel 1995), as well as the meaning of experiences in the forming and unfolding of new human-ICT relationships. As Gabriel (1995:480) notes: "the storyteller is not concerned with 'fact-as-information' but with 'fact-as-experience'." Distinguishing like this between information and experience emphasize the meaning of an experience that the storyteller can engage with when constructing a story in which he or she makes sense of everyday experience (Gabriel 1995, Weick et al. 2005).

Common to the first set of studies reviewed above is, first, the use of multiple methods to capture the sociomateriality of everyday life experience with ICTs, but also the demonstrated need to visualize and contextualize the studied situations using techniques that capture these visualizations effectively. In the second set of studies presented the emphasis is on the need to verbalize events to get at the meaning of an experience. While the use of stories seems to be a fruitful mean of eliciting experience and meaning in the human-ICT relationship, the use of observation may reveal 'real time' emotions. Using stories and observation in combination, then seems to reveal an even richer picture and deeper understanding of the sociomaterial nature of human-ICT relationships. In sum, a combination of visual and verbal methods seems to be most successful for understanding the sociomateriality of the ICT infused, contemporary everyday life.

4.2 Mobile ethnography

In the effort to understand everyday life, ethnography is a common research method to choose, traditionally relying on data gathering techniques such as observation and interviewing. Recent critique is that these techniques are limited for understanding the experience of everyday life in two ways (Kusenbach 2003). First, observational methods are limited in that people do not usually comment on 'what is going on' while acting in their everyday life contexts, thus making their experiences unaccessible. Second, sit-down interviews usually keep participants from engaging in 'everyday activities' as interviews are typically conducted outside the context where these everyday activities occur, thus making it difficult to grasp what participants are 'talking about'. In both cases important aspects of the lived experience may be left out, in particular when the research interest is in the stream of experiences and practices as participants move through and interact with their physical (i.e. material and spatial) and social environment (Kusenbach 2003). To address these limitations a variety of mobile ethnographic techniques have been suggested, like shadowing, the go-along and the walking interview.

Shadowing is a form of ethnographical data gathering technique commonly used in organization research, where a researcher closely follows a member of an organization, for a longer period of time taking detailed notes on actions and behavior and prompting the participant for a running commentary throughout the shadowing period. It is a technique that is concerned with the direct study of contextualized action: it gives insight into the specific experience of the shadowed individual with minor interpretation and constrains on the part of the participant (McDonald 2005). As compared to other qualitative methods, like participant observation or interviewing, shadowing has the ability to capture the varied and fragmented nature of e.g. organizational life, and, because of its capacity to link actions and purpose, to address important *why* questions, instead of what and how questions (McDonald (2005). Commonly shadowing focuses on the individual, rather than e.g. departments companies, or functions and it is concerned with the direct, first-hand nature of experience, instead of second-hand accounts of actions, such that may be gained by interviewing, or formal representations that in organizational contexts may be gained by documentary analysis (McDonald 2005). Shadowing is a holistic approach suitable for studying *one actor* involved in multiple organizational issues and processes, as opposed to studying processes and issues that attract many actors. Further, as McDonald (2005:469) point out:

Any enquiry where the unit of analysis is not just the individual, but also the network of activity and relationships, or organizational context that surrounds them would also benefit from the use of this data-generation method.

Another related ethnographic data-gathering technique, commonly used in sociological and geographical research, that focuses on the lived experience *in situ* bringing greater phenomenological sensibility to ethnography (Kusenbach 2003), is the go-along (e.g. Kusenbach 2003) or walking interview (e.g. Evans & Jones 2011, Jones et al 2008). When conducting go-alongs, the researcher accompany individual participants in their everyday activities and outings and, through asking questions, listening and observing, they explore their subject's stream of experience (Kusenbach 2003). Kusenbach (2003) identifies five thematic potentials of go-alongs: perceptions, spatial practices, biographies, social architecture, and social realms. Go-alongs can (Kusenbach (2003:466):

- unveil the complex layering and filtering of *perception*, thus helping ethnographers reconstruct how personal sets of relevances guide informants' experiences of the social and physical environment in everyday life
- offer insights into the texture of *spatial practices* by revealing the subjects' various degrees and types of engagement in and with the environment.
- provide unique access to personal *biographies* by highlighting the many links between places and life histories, uncovering some of the ways in which individuals lend depth and meaning to their mundane routines
- illuminate the *social architecture* of natural settings, such as neighborhoods, as they make visible the complex web of connections between people: various relationships, groupings and hierarchies, and how informants situate themselves in the local social landscape
- facilitate explorations of *social realms*: the distinct spheres of reality that are shaped by varying patterns of interaction.

In essence, the go-along method makes “visible and intelligible how everyday experience transcends the here and now, as people weave previous knowledge and biography into immediate situated action” Kusenbach (2003:478).

While a range of techniques (as presented above) that have proven successful are readily available for the in-depth studying of individual experiences of everyday life – with or without ICTs – and their meanings for the individuals experiencing them, it is surprising that video has not been a common way to gather contextual data on human-ICT relationships in everyday life.⁶ Filming people's ICT use while walking along and interviewing them would allow for demonstrations where the use can be captured in context and probed into simultaneously. Filming people using ICTs in and across different contexts would also visualize what may have become the ‘obvious’, i.e. how ICTs have become mundane and taken for granted in our surroundings and therefore not so much critically reflected upon or even possible to verbalize, yet having a great impact on how we conduct and experience our lives. I will elaborate on the inherent potential but also practical considerations that the use of video interviewing may have for sociomaterial research in the next section.

5 The walking video interview

With contemporary technology the use of video recording for gathering data has become a feasible option for social scientist (Knoblauch et al. 2008, Schnettler and Raab 2008). As video does not only record picture but also sound, with a little practice, the use of video allows for both observing and interviewing in the stream of real time events, where both social and material cues can be obtained simultaneously on the video and audio recording (e.g. Downing 2008). To gain insight into how video could be used to study the sociomateriality of everyday life with ICTs, I draw here on examples from sociological research that has used photo and video successfully to contextualize and visualize the materiality of everyday experiences and their meanings – not in relation to ICT or even technology, but to other materialities.

⁶ Video has certainly been used in HCI research to capture for example facial expressions and eye movements while interacting with computers, but not in a more ethnographically oriented and contextualizing manner as suggested here.

Using video for interviewing and observing opens up for fully new ways of studying human-ICT relationships, in particular with a focus on lived experiences (e.g. Downing 2008), emotional bond construction (e.g. Konecki 2008), and in the making of places (e.g. Pink 2008). Using video and interviewing and observing people in their real-time context or while on the move allows the subject to reflect on their experience right there and then, but it also allows for post reflection, as the video can be watched and contemplated again and again together with the researcher and other subjects in the study. Kolb (2008) reports on a similar method using photos, which she has termed “photo interview”, where subjects are involved in taking photos of specific subjects in their social and material surroundings that relate to the research question and that are meaningful to them. These photos are then verbalised and reflected upon in an interview with the researcher and possibly in collaboration with other participants. In the analysis, photos, interview transcripts and observations are analysed. (This method is similar to the day experience method described earlier.) Video, in turn, allows the interviewer to ask about objects or settings in the context while filming/interviewing that would be difficult to explain verbally. It allows the interviewer to capture the context in real time while on the move – an impossible task for other visual techniques. It also allows the researcher to capture an answer to otherwise impossible questions like, ‘can you show me how you do X, or what you do with Y, or how you use Z ?’ It is thus possible to simultaneously show something and talk about it and even tell a story about some other event that is related to or associated with the object at hand, as “[v]ideo invites informants to produce narratives that interweave visual and verbal representation” (Pink 2004:62, cited in Downing, 2008). Using video for research purposes seemingly provides potentially successful ways to capture the interaction with the material and the social simultaneously while for example touring and individual’s ICT landscape, hence I propose the WVI as a technique to capture the sociomaterial nature of human-ICT relationships and experiences in everyday life.

5.1 Practical considerations while video interviewing

Video interviewing requires a number of considerations to be made along the research process in the areas of: generating video data; analysing and interpreting video data, and in presenting results from video-based data (e.g. Schnettler and Raab 2008). For example one should avoid thinking that video represents the ‘real-world-as-it-happens’, as video is just another way of representation of the world. The influence of the camera on the behavior of the subject also has to be considered (Schnettler and Raab 2008), giving that video may not be considered “natural data”, i.e. recorded in situations affected as little as possible by the researcher (Silverman 2005, cited in Schnettler and Raab 2008). However, video can record “natural situations”, sympathising strongly with ethnography. This strand of video analysis can reasonably be referred to as “videography” (Schnettler and Raab 2008, see also Pink 2008).

Given the richness of the combination of video and audio data, analysis is demanding. One reason is the sheer complexity of the data that requires clear analytical and methodological frameworks to help deal with the complexity (Schnettler and Raab 2008). A clear advantage of video in turn is the inherent sequentiality in the unfolding of recorded events and interactions. Data give way to moment by moment scrutiny e.g. using slow motion, focusing on a particular part of the picture, amplifying the size etc. that digital and high definition technology allows for (e.g. Schnettler and Raab 2008). Transcription of the combination of video and audio data, however, may pose challenges and needs careful consideration, as it forms a major part of the analysis in qualitative research (Schnettler and Raab 2008). One way is to transcribe the audio part and make reference to interesting visual cues in

the transcript. This can be done by entering the time in which the cue appears in the video recording. It is also possible to edit the footage into shorter clips that are then coded, using video editing software. Unfortunately the file formats of cameras and computer software for video editing are not always easily made compatible, which means deciding on analysis and checking software and hardware compatibility is advisable to do before actual video data gathering.

There are also very hands-on and practical considerations that have to be made by the researcher while collecting the data, for example on how to engage with subjects and perhaps following an interview script while filming and perhaps even moving around at the same time (e.g. Downing 2008). The researcher also has to consider what to focus on while filming: who or what should be in the picture frame and what should be left out? Other practical considerations may involve, for example, what camera angle to use, at what distance to film, is there sufficient lighting, and does the microphone adequately capture the sound? Downing (2008) thus suggests that the researcher should be comfortable with one's equipment beforehand and have an open mind throughout the process. Practicing, testing and piloting the research design may thus be pivotal for using video successfully in social research in general and in WVIs in particular.

Filming in “real life”-settings like the home or the workplace also involves ethical considerations, as one may capture overheard conversations or witnessed situations on video that may be particularly sensitive or somehow critical to the subject. Gaining access and building relationships may thus be a challenge and may require time to develop. Therefore, it is also important to continuously concern for the establishing and maintaining of good and trustworthy relationships with subjects under study. This can be achieved e.g. by informed consent on what will and will not be in the film, how the data will be used, stored, presented, and reported, and how anonymity of subjects' identities and sensitive information will be guaranteed.⁷

5.2 Experiences from the first test WVI

In this section, I report my experiences from a first test of the WVI. The focus is on the preparation and execution of the interview and on the practical considerations and choices that were made during the interview. I will not report on the results or the analysis in this paper, as this was just a test.

To test the proposed WVI technique, the husband of one of my colleagues had agreed to let me do a WVI with him in their home. In my planned design of the study I would do WVIs with subjects in their home, in their workplace, and as a go-along outside these two contexts. As this was a test and my informant usually works from home, only on walking video-interview in the home context was planned. For the study I had prepared a brief information sheet about the project, a form of consent, a brief background questionnaire, and an interview guide (see Tab. 1 for interview themes).⁸ With me to the interview I had a camcorder and a voice recorder for back-up. I did not know in advance that the informant's wife (alas my colleague) was working from home that day, so she was also present in the apartment. Their dog was also there.

Interview themes	Analytical levels
Background information (gender, age, education etc.)	
Amount of money spent on ICTs and operator	Technology-as-artifact & technology-as-

⁷ Sample documents for how to do this in practice can be found e.g. in Riddle and Arnold, 2007.

⁸ All available in Swedish upon request from the author.

costs yearly	practice
ICT in the home & use (video tour & demonstrations)	Technology-as-artifact & Technology-as-practice, Technology-as-experience
Acquiring, problem solving & ‘warm experts’	Technology-as-practice & Technology-as-experience
Meaning of ICT, relationship to ICTs	Technology-as-experience
Mobile ICT use, over various contexts	Technology-as-practice, Technology-as-experience
ICT at work	Technology-as-practice, Technology-as-experience

Table 1. Interview themes & analytical levels

Before the interview I had two scenarios or scripts for how the WVI could be conducted. In both scenarios, I would ask the informant to walk and guide me through their home introducing me to the ICT-landscape of the home. However, I had quite a few questions and probes to ask about the various ICTs in the home, but also of how they were taken care of, disposed of, liked, and how new ones were acquired etc. to analytically get beyond the technology-as-artifact towards the technology-as-experience level. In the first scenario I would first do the walk as a guided tour where I would ask questions about use of particular ICTs while filming and then I would do a traditional interview on the other questions after the tour. In the other scenario I would do the entire interview while on the tour and filming. Although the second scenario would be more in line with how I had envisioned the WVI to be like, it also seemed more demanding, as I would have to juggle the camera and keep track of the interview guide for quite a long time. The benefits of the second scenario were that it would provide me with better opportunities to ask for demonstrations and perhaps would open up for more and wider associations to stories in relation to the different ICTs on the tour – stories that could unwrap the experience of these ICTs.

As it was a test interview, I would have liked to test if I could manage the second scenario of the video-interview, but as the wife was there and she was working in the living room, I decided in the end to go with the first scenario, which would disturb her less. We started the interview in the kitchen going through the information sheet, consent form and background questionnaire, which the informant all had received in advance. We then started the video-interview tour in the kitchen where my informant was working by his laptop and next to him he also had his I-phone. We talked a while about how he uses these devices for work, and about where he works and how with the ICT. Then we went on the tour beginning in the living room, looking at their server, printer, TV, DVD-player, two game consoles etc. During the first part of the interview it turned out that my informant was an *IT* consultant (I had known that he was an entrepreneur and consultant, but not that it was specifically in IT) and was quite ahead of things compared to how most people probably manage ICTs in the home. In the livingroom he had a big, square, padded stool that also served as a storage box (you could take off the padded lid). This was the place where he stored all the spareparts and extra cables etc. We then went on to the bedroom to look at cameras, old mobile phones, an MP3 player with a docking station etc. The wife seemed reluctant to show me the childrens’ room, so I did not enter there. After the tour we went back to the kitchen to conduct the rest of the interview. I then turned off the camera and used the voice recorder instead. With a tripod I could have used the camera also while we were sitting down. The tour and the interview lasted for about one hour, which was shorter than I had actually expected.

All in all the first testing of the WVI gave me new insights into the method, but I was also a bit disappointed in how it turned out in the end. First, I wasn't able to test the scenario I would have wanted to where I would have a more active WVI during the ICT-landscape walking tour, instead of a tour and an interview afterwards. The way it turned out however confirmed that the second scenario probably would be a better choice in the future, but that it really depends on the situation of whether it is doable in practice. Second, as the purpose of my study is to study working adults and their relationship with and how they experience ICT in everyday life, for the sake of testing the interview guide, I would have liked to interview someone who was less knowledgeable about IT than an expert in the field, but for the purpose of testing the technique itself this didn't make that much of a difference.

6 Discussion and conclusions

This paper set out to explore how contemporary, technology infused everyday life could be studied empirically in order to capture the intertwined and entangled nature of human-ICT relationships and what they mean for the people involved. The paper argued for the need to understand technology-as-practice and introduced a form of video-interview tour of individual ICT landscapes as a potential technique to empirically capture the sociomateriality of contemporary life. The paper combined lessons learned in the domestication, new media and communication research, mobile ethnography and the use of video for studying the interaction of the social and material in the context of human-ICT relationships in everyday life. The paper also provided a brief example and experiences from a test WVI tour in an individual ICT landscape.

While the paper draws on existing research in a variety of areas, I claim that the WVI technique in the form of a guided tour by the informant through his or her individual ICT-landscape and with a particular focus on the experience of ICT, is novel to the IS field and a contribution to the study of experiential computing in particular. The technique seems particularly well suited to the first research opportunity in experiential computing as identified by Yoo (2010):

How does the entanglement of two aspects of sociomateriality—digital and physical—influence the contour and possibilities of digitally mediated experience in everyday life? How does sociomateriality shape, and how is it shaped by, the distributed agency in spatiotemporal and social contexts? How does the use of multiple and heterogenous digital artefacts in the *durée* of everyday life shape digitally mediated experiences? How do digitalized environments affect our experience of time and space? How do digitally mediated experiences transform the meanings of familiar, everyday activities? (Yoo, 2010:223)

Further, Yoo proposes that *desirability* will be a new and important criteria against which digitalized artifacts in the experiential computing paradigm will be evaluated, including attributes such as ethics, aesthetics, ergonomics and environmental responsibility. At face value, the proposed video-interview technique provide ample opportunity to explore such issues. Yoo also highlights the need for considering issues of infrastructural convergence between digital, physical, and cultural infrastructures as information and communication technology moves deeper into everyday life. Also here video-interviewing could provide one means to capture this. By proposing a specific technique to capture the sociomaterial nature of human-ICT relationships the technique is also a contribution to the perspective of sociomateriality and may yield further results, for example in relation to sociomaterial agency, in that area as well.

In conclusion then, although the WVI technique, in particular in the form of guided tours through individual ICT landscapes, needs to be further tested in practice, it seems like a promising way to empirically capture the sociomateriality of contemporary life – a quest that will occupy IS research for a considerable time in the future if Yoo’s call for research in this areas is taken up on by the community.

References

- Alvarez, R. (2008): Examining technology, structure and identity during an Enterprise System implementation. *Information Systems Journal*, (18): 203-224.
- Anderson, B. (2004): Information society technologies and quality of life – a literature review. *Chimera Working Paper 2004-09*. Ipswich: University of Essex.
- Anderson, B. (2007): Using time use data to analyse macro and microsocial change in an e-society: Full research report. *ESRC End of Award Report*, RES-341-24-0004. Swindon: ESRC
- Avery, G.C. and Baker, E. (2002): Reframing the informed Household-workplace. *Information and Organization*, (12): 109-134.
- Boudreau, M-C. and Robey, D. (2005): Enacting integrated information technology: A human agency perspective. *Organization Science*, (16: 1): 3-18.
- Bradley, G. (2006): *Social and community informatics: Humans on the net*. Abingdon: Routledge.
- Brocklehurst, M. (2001): Power, identity and new technology homework: Implications for ‘new forms’ of organizing. *Organization Studies*, (22: 2): 445-466.
- Bureau of Communication (Finland) (2009 & 2010): Telepalveluiden käyttötutkimus 2008 and 2009 Available 28.1.2010 at: <http://www.ficora.fi/index/tutkimukset/yleinenmarkkinatieto.html>
- Carrington, V. and Robinson, M. (2009): *Digital Literacies: Social learning and classroom practices*. London: Sage/UKLA
- Dahlbom (1996): The New Informatics. *Scandinavian Journal of Information Systems*, (8:2) (15.5.2003 at <http://iris.informatik.gu.se/sjis/Vol8No2/Dahlbom.htm>)
- Downing, M.J. Jr. (2008): Why video? How technology advances method. *The Qualitative Report*, vol. 13, No. 2, June, pp. 173-177.
- Evans, J. and Jones, P. (2011): The walking interview: Methodology, mobility and place. *Applied Geography*, 31: 849-858.
- Frissen, V. (2000): ICTs in the rush hour of life. *The Information Society*, (16): 65-77.
- Frissen, V. and Punie, Y. (1998): Never mind the gap. Integrating qualitative and quantitative methods in ICT-user research: The case of busy households. In R. Silverstone and M. Hartmann (eds.) *EMTEL working paper no. 5. Methodologies for media and information technology research in everyday life*, pp. 73-94. Brighton: University of Sussex.
- Gabriel, Y. (1995): The unmanaged organization: Stories, Fantasies and Subjectivity. *Organization Studies*, (16:3): 477-501
- Green, N. (2002): On the move: technology, mobility, and the mediation of social time space. *The Information Society*, (18): 281-292
- Green, N. and Haddon, L. (2009): *Mobile communications: An introduction to new media*. Oxford & New York: Berg.
- Gripenberg (forthcoming): The role of emotions in technology uptake: A study of how human-ICT relationships form.

- Gripenberg, P. (2002): Living with IT: Uses and interpretations of computers in the home and family context. *Proceedings of the Xth European Conference on Information Systems*, June 6-8.2002, Gdansk, Poland, pp. 1261-1272.
- Gripenberg, P. (2004): 'Virtualizing the office: micro-level impacts and driving forces of increased ICT use' in T. Heiskanen, and J. Hearn (eds.) *Information society and the workplace: Spaces, Boundaries and agency*, London and New York: Routledge.
- Gripenberg, P. (2010): Individual ICT landscapes: A lens on human-ICT relationships in transforming everyday lives. *Proceedings of the Information systems research seminar in Scandinavia (IRIS33)*, 22-24.8.2010, Aalborg, Denmark.
- Habib, L. and Cornford, T. (2001): Computers in the home: Domestic technology and the process of domestication. *Proceedings of the European Conference on Information Systems*, Bled, Slovenia, June 27-29.
- Haddon, L. (2006): The contribution of domestication research to in-home computing and media consumption. *The Information Society*, (22): 195-203.
- Haddon, L. (ed.) (2004): *Information and communication technologies in everyday life: A concise introduction and research guide*. Oxford: Berg.
- Hanseth, O., Aanestad, M. and Berg, M. (2004): Guest editors' introduction: Actor-network theory and information systems. What's so special? *Information Technology and People*, (17:2): 116-123.
- Hernes, T. (2004): Studying composite boundaries: A framework of analysis. *Human Relations*, (57:1): 9-29.
- Jokinen, E. (2005). *Aikuisten arki*. (The everyday life of adults) Helsinki: Gaudeamus
- Jones, P., Bunce, G., Evans, J. Gibbs, H. and Ricketts Hein, J. (2008): Exploring space and place with walking interviews. *Journal of Research Practices*, 4(2).
- Katz, J.E. (ed.)(2008) *Handbook of Mobile Communication Studies*. London & Cambridge: The MIT Press.
- Katz, J.E. and Aakhus, M.A. (eds.) (2002): *Perpetual contact: Mobile communication, private talk, public performance*. Cambridge University Press.
- Katz, J.E. & Sugiyama, S. (2006): Mobile Phones as fashion statements: evidence from students surveys in the US and Japan. *New Media & Society*, (8:2): 321-337.
- Knoblauch, H., Baer, A., Laurier, E., Petschke, S. & Schnettler, B. (2008): Visual analysis. New developments in the interpretative analysis of video and photography. Introduction to special issue. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, vol. 9, No 3, Art. 14, September.
- Kolb, B. (2008): Involving, sharing, analysing – Potential of the participatory photo interview. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, vol. 9, No 3, Art. 12, September.
- Konecki, K.T. (2008): Touching and gesture exchange as an element of emotional bond construction. Application of visual sociology in the research on interaction between humans and animals. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, vol. 9, No 3, Art. 33, September.
- Korac-Kakabadse, N., Kouzmin, A. and Korac-Kakabadse, A. (2001): Emerging impacts of on-line over-connectivity. *Proceedings of the European Conference on Information Systems*, Bled, Slovenia, June 27-29.
- Kraut, R., Brynin, M. and Kiesler, S. (2006): *Computers, Phones and the Internet: Domesticating information technology*. Oxford University Press.

- Kusenbach, M. (2003): Street phenomenology: The go-along as ethnographic research tool. *Ethnography*, 4(3): 455-485.
- Lamb, R. and Davidson, E. (2005): Information and communication technology challenges to scientific professional identity. *The Information Society*, (21): 1-24.
- Lee, P., Leung, L., with Venhwei, L. and Chengyu, X. (2008): The perceived role of ICTs in Quality of Life in Three Chinese Cities. *Social Indicators Research*, (88:3): 457-476, September.
- Lehtonen, T-K. (2003): The Domestication of New Technologies as a Set of Trials. *Journal of Consumer Culture*, (3:3): 363-385
- Lesnard, L. (2005): Social change, daily life and the Internet. *Chimera Working Paper*, 2005-07. Colchester: University of Essex.
- Leung, L. and Lee, P.S.N. (2005): Multiple determinants of life quality: the roles of Internet activities, use of new media, social support, and leisure activities. *Telematics and Informatics*, (22): 161-180.
- Liker, J.K., Haddad, C.J. and Karlin, J. (1999): Perspectives on technology and work organization. *Annual Review of Sociology*, (25): 575-96.
- McDonald, S. (2005): Studying actions in context: A qualitative shadowing method for organizational research. *Qualitative Research*, 5(4): 455-473.
- Meyrowitz, J. (1985): *No sense of place: The impact of electronic media on social behavior*. Oxford: Oxford University Press.
- Moisio, R.J. (2003): Negative consequences of mobile phone consumption: Everyday irritations, anxieties and ambiguities of Finnish mobile phone consumers. *Advances in Consumer Research*, (30).
- National Science Foundation (2001): *The application and implication of information technologies in the home: Where are the data and what do they say?* NSF 01-313, Project Director, Eileen L. Collins, NSF/SRS; Author, Maria C. Papadakis, Virginia polytechnic Institute and State University; and The Science and Policy Technology Program, SRI International (Arlington, VA 2001), February.
- Orlikowski, W.J. (2000): Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, (11): 404-428.
- Orlikowski, W.J. (2007): Sociomaterial practices: Exploring technology at work, *Organization Studies*, (28): 1435-1448.
- Orlikowski, W.J. (2010): The sociomateriality of organisational life: Considering technology in management research. *Cambridge Journal of Economics*, (34): 125-141.
- Orlikowski, W.J. and Iacono, C.S. (2001): Research commentary: Desperately seeking the "IT" in IT research – A call to theorizing the IT artifact. *Information Systems Research*, vol. 12, No. 2, June, pp. 121-134.
- Orlikowski, W. and Scott, S. (2008): Sociomateriality: Challenging the separation of technology, work and organization. *The Academy of Management Annals*, (2:1): 433-474.
- Parjo, L., Sirkiä, T. Viherä, M-L. (2008): *Information and communication technology in everyday life: Interview results on ICT use in Finland in 2007*. Helsinki: Statistics Finland.
- Peters, O. and Allouch, S. (2005): Always connected: A longitudinal field study of mobile communication. *Telematics and Informatics*, (22) 239-256.
- Pink, S. (2008): Mobilising visual ethnography: Making routes, making place and making images. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, vol. 9, No 3, Art. 36, September.

- Punie, Y. (1997): Rejections of ICT in Flemish households. The why-not question. In R. Silverstone and M. Hartmann(eds.) *EMTEL working paper no. 3. Media and Information technology: Regulating markets & everyday life*, pp. 46-72 Brighton: University of Sussex.
- Riddle, M. and Arnold, M. (2007): *The Day Experience Method: A resource Kit*. Accessed 30.11.2009 at: http://www.matthewriddle.com/papers/Day_Experience_Resource_Kit.pdf
- Riddle, M. and Howell, C. (2008): You are here: Students map their own ICT landscapes. In Hello! Where are you in the landscape of educational technology? *Proceedings ascilite Melbourne 2008*. Accessed 30.11.2009 at <http://www.ascilite.org.au/conferences/melbourne08/procs/riddle.pdf>
- Rose, J. and M. Jones (2005): The Double Dance of Agency: A Socio-Theoretic Account of How Machines and Humans Interact. *Systems, Signs & Actions, An International Journal on Communication, Information Technology and Work*, (1: 1): 19–37
- Schnettler, B. and Raab, J. (2008): Interpretative visual analysis: Developments, state of the art and pending problems. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, vol. 9, No 3, Art 31, September.
- Schwanen, T. and Kwan, M-P. (2008): The Internet, mobile phone and space-time constraints. *Geoforum*, (39): 1362-1377.
- Selwyn (2003): Apart from technology: understanding people's non-use of information and communication technologies in everyday life. *Technology in Society*, (25): 99-116.
- Shumate, M. and Fulk, J. (2004): Boundaries and role conflict when work and family are collocated: A communication network and symbolic interaction approach. *Human Relations*, (57:1): 55-74.
- Sturdy, A. (2003): Knowing the unknowable? A discussion of methodological and theoretical issues in emotion research and organizational studies. *Organization*, (10:1): 81-105.
- Venkatesh, A. (2001): The home of the future: An ethnographic study of new information technologies in the home. *Advances in Consumer Research XXVIII*, M. Gilly & J. Meyers-Levy (eds.), Valdosta, Georgia: Association for Consumer Research, 2001, pp. 88-96.
- Wajcman, J., Bittman, M. and Brown, J. (2008): Families without borders: Mobile phones, connectedness and work-home divisions. *Sociology*, (42:4): 635-652.
- Walsham, G. (1998): IT and changing professional identity: Micro-studies and macro-theory. *Journal of the American Society for Information Science*, (49:12): 1081-1089.
- Weick, K.E., Sutcliffe, K.M. and Obstfeld, D. (2005): Organizing and the process of sensemaking. *Organization Science*, (16:4): 409-421.
- Wise, J.M. (1997): *Exploring technology and social space*. Thousand Oaks: SAGE Publications.
- Yoo, Y. (2010): Computing in everyday life: A call for research on experiential computing. *MIS Quarterly*, vol. 34, No 2, pp.213-231.

The Impact of Culture on the Principles of Authority in the Context of Persuasive Systems Design

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Abstract: According to the literature culture has implications on information systems development. This has received little of attention and this paper pursues to contribute for filling this gap. This paper studies the affect of culture on the persuasion principle of authority. It approaches the phenomenon through positivist survey analysis of Finnish and Korean students. The results show that authority plays bigger role in Korea than in Finland, thus supportint the claim that culture should be considered in persuasive systems design.

Keywords: Authority, Culture, Finland, Korea, Persuasive Systems Design

1 Introduction

As we have gained deeper understanding about the field of persuasive technology, the expectations for persuasive designs have also increased. This is especially evident in competitive markets such as Web 2.0, e-business and the mobile domain. When designing solutions for these kinds of environments, the designers must have a thorough understanding about the various persuasion, motivation and influence strategies for gaining competitive advantage.

Persuasive systems can put use to either computer-mediated persuasion or computer-human persuasion (Oinas-Kukkonen and Harjumaa, 2008). According to Fogg (1998) because computers do not have their own intentions; it is the ones who create, adopt or distribute the technology, who have the intention to affect someone's attitudes or behavior. Nass et al. (1994) propose that even though computers may not communicate equally as humans, some studies (see eg. Nass et al., 1994; Fogg and Nass, 1997) suggest that computer-human persuasion can utilize at least some patterns of interaction uniform to social communication, whereas computer-mediated persuasion stands for that people are persuading others utilizing computers, e.g. e-mail, discussion forums, blogs, instant messages, or social network systems.

The recent hot topic of globalization can be described as the major social transformations caused by the enhancement of global consciousness and the increased

interconnectedness of various societies (Walsham 2002). Leidner (2010, pp. 69) describes how globalization “*encompasses the exchange of production materials, the substitution of production processes, the relocation of services, the redistribution of resources, and the diffusion and infusion of cultural norms, artifacts, and values*”. Organizations are starting to share their processes and become increasingly intertwined to operate more efficiently, thus their respective cultural levels become convergent and act as catalysts for change. This is where information communication technology (ICT) and culture play a pivotal role. ICT is can be seen as the enabler of concurrency in organizations communication and culture as the restraint for ascertaining seamless supply chain. The difficulty in implementing global systems is that it includes an assumption that the best for one business unit automatically equates to good of other business unites (Leidner, 2010).

The need to understand information systems related to issues caused by the cultural context has been recognized by several authors (see e.g. Myers and Tan 2003, Leidner 2010, Walsham 2002). In different cultures the relationship between behaviour and interpretation varies, thus individuals use their meanings to make sense of their realities (Adler 1986). Hence if an information system developer does not know the developed system’s focal culture it is not possible to know what its implications are for one, also if the developer does not know his own culture it is not possible to acknowledge what is typical for the developer’s own behaviour.

Some of the areas, likely connected to persuasive systems, where cultural context appears to have an impact are: perceptions of IS design techniques (Kumar et al. 1990), user experience (Dey & Abowd, 2000; Orlikowski et al.,1995; Kettinger et al. 1995), user requirements (Tuunanen et al. 2006) and system use (Myers and Tan 2003). Leidner and Kayworth (2006) have found that studies concerning culture and information systems design are affected by variations in cultural values, furthermore these different values may lead to different approaches how to develop information systems in respectively varying cultures.

The role of culture has been has received little attention in persuasive technology research. In our literature review on the persuasive technology conferences, we were only able to find eight articles. Thus, we consider that the role of requires more attention. In this paper, we wish to argue that culture plays a major role in persuasive system design as well. This paper is based on Finland and Korea, which were chosen as research subjects mainly because the countries culture differs considerably (see eg. Hofstede, 2001).

2 Theoretical Background

According to Kahn (1989, pp. 13) “*culture is contested, temporal and emergent*”, hence culture can be seen as a dynamic construct. Consequently, culture is a very intricate construct and there have been numerous attempts to define it. One widely referred definition was set by sociologists Namenwirth and Weber (1987, pp. 8), who perceived culture as “*a system of ideas*”, which constitutes “*a design for living*”. In this research, culture is understood as a system of values and norms that are shared among a group of people. According to Hill (2008) values are abstract ideas about what group believes to be good, right and desirable, whereas norms are the social

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rules and the principles that predispose the proper behavior toward others. Fan (2000) suggests that culture can be studied at international level, national culture level, regional culture level, subculture level, business culture level and organizational culture level. Myers and Tan (2002) invite scholars to use Fan's (2000) categorization in global information systems research as a method for a more elaborate research design. Due to its scope and focus, this study is limited to the national culture level. A more thorough capture of the phenomenon would enable research to evaluate the cultural context better on as many levels as possible.

Hofstede and Bond (1988) note that the impact of the Confucian values clearly manifest in the Korean organizations in which the social mutuality is important, the division into inner and outer circle is apparent, personal relationships are particularist, rituals are being respected, personal and public relationships are overlapping. Yum (1988) regards the Confucianism as a factor still strongly presiding in the Korean society. Often Confucianism is not considered as real religion at all, but a world view, a doctrine or a social philosophy based on moral lessons. The ideal for Confucianism is society structured as possible in where people in certain positions handle the responsibilities given to them for the sense of mutuality (De Mente 2004, Kim 2007). The goal is to bring up the person as a good member of a good community. Therefore Confucianism includes rather moral principles than the conceptions of the God and the Afterlife. Moral principles regard interpersonal relationships as personal relationships, especially the family relationships, are the foundation for the society according to the Confucian philosophy. (Yum, 1988; Hofstede, 2001.)

Principles of Confucianism describe the five human relationships, which are regarded as the foundation for the society and following whom is seen to be promoting concord and harmony in homes, towns and cities nationwide. These relationships regard the ruler and the subordinate, the father and the son, the husband and the wife, elder and the younger brothers and additionally elder and the younger friend. There is a definite hierarchy relating to these relationships where the younger shall respect the elder, the servants respect the rulers and the women respect men. According to the Confucian perceptions the stability of the society is based on inequality, in where the one with the lower position shall respect the ones with the higher positions, but where still the ones with the higher positions shall take care of the ones with the lower positions. Therefore idealistically hierarchy does not equal to domination, but instead its basis is the request for mutuality: the servant shows loyalty and the ruler shows good will, the son shows respect and the father love, the wife is obedient and the husband is righteous, younger brother is humble and the elder brother is noble; the younger friend shows trust and the older friend shows loyalty. (Crane, 1999; Yum, 1988; Kim, 2007.)

In Finnish culture hard work has been highly valued not only to earn a living, but rather to measure one's worth in the society (Virtanen, 1994). According to Virtanen (1994) this modern ethos has its roots in the 17th century protestant ethics, where ascetic life and sedulousness were highly valued. Finland is a country with harsh climate and scarce resources. Consequently, survival in agrarian communities required individuals to help each other, but ultimately everyone was alone responsible for his/her survival (Virtanen, 1994). In its far individualism Finland can be considered as a very opposite to Korean society where utmost objective is to strongly bind one to groups by reaching the feeling of togetherness through harmony and

hierarchy. Individual is not important before he has found his place in the hierarchy (Kim 2007).

Indeed, one of the most dominant features of Neo-Confucian Korean culture is the hierarchy. It penetrates all levels of society and manifests itself equally in friend relationships as in organizations and the language. Basic definition for hierarchical personal relationships is that the other side is always ranked higher in the ranking. Hofstede (2001) designates the cultural dimension relating to the hierarchy as power distance. It describes how big differences are accepted in people's positions. Ergo how people accept the unequal distribution of power, appreciation and wealth. In cultures of high power distance the power is often concentrated to few and its benefits are easily abused. Instead in the cultures of low power distances the power is based on expertise and it should only be used within the limits set by legislation. (Hofstede, 2001; 2003) According to Hofstede's study, Korea is a culture of high power distance, whereas Finland is a culture of moderate power distance.

In the countries of high power distance the hierarchical pyramid is strict and older superiors are always respected more than the younger ones. The hierarchical relationship between subordinate and superior always manifests as great emotional distance so that subordinates will not approach their superiors, but the superior is presumed to contact his subordinates when needed. Subordinates will not criticize the decisions or opinion of their superiors, not to even talk about getting into an argument or conflict with him. In low power distance cultures it is normal that subordinates take part into the decision-making and impugn the situation when they feel it is unreasonable. In the countries of high power distance managers and superiors are clearly unequal and this also shows in the decision-making process where higher ranked simply dictate the course of action. (Hofstede 2001; Merkin, 2006.)

Cialdini (2003) has presented six methods of how individuals persuade one another. The six principles are reciprocity, commitment and consistency, social proof, authority, liking and scarcity. Previous studies (Kaptein, Eckles) have shown that users react differently to different persuasive principles. Reciprocity works better for some users while commitment and consistency works better for others. In this paper, we will focus on the principles of linking, authority and social proof.

According to Cialdini (2003) the principle of liking means that people like those people who like them and that people are more easily persuaded by people they like. To demonstrate the power of liking Cialdini (2003) uses a Tupperware party as an example. Typically in Tupperware parties the participants buy not only to please themselves but to please the hostess as well. Research has shown that there are two factors that are especially compelling – similarity and praise. Similarity helps to create an aura of goodwill and trustworthiness between people. Praise both charms and disarms us (Cialdini, 2003) and it works even if the reasons for it were untrue.

The principle of authority states that people defer to experts (Cialdini, 2003). When people do not know what to do, they are likely to comply and follow the lead of a renowned expert. The principle of authority works as a shortcut in many situations: an expert is supposed to know what to do and following his/her advice should be correct in most cases.

The hypotheses of this study are as follows. The principle of authority stated that people defer to experts. People obey authority figures even if they are asked to

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perform questionable tasks. We assume that in Korean culture authority plays a bigger role than in Finland. Thus we hypothesize the following:

The principle of authority works better with the Korean group

The research model of this study shown below in Figure 1.

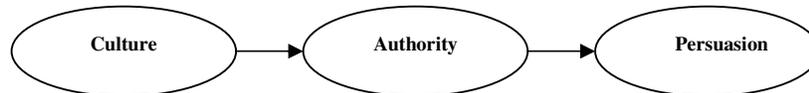


Fig. 1. Research model

In the next section we will present the case, followed by the analysis of the results.

3 Research methodology

This research was built on positivistic approach. We used survey to collect the data from the research subjects. We collected the data from 15.3.2011 till 23.3.2011. The data set was 108 answers consisting of 57 Finnish answers and 51 Korean answers. Finnish answers came from the students of Oulu University of Applied Sciences and Korean answers came from the students of Yonsei University's East Asia International College. We calculated independent samples t-tests to compare Korean and Finnish students. The five statements evaluated in this study were: *I appreciate my parents' opinions*, *My grandparents have an effect on my behavior*, *I don't often question the opinions of my senior students*, *I always follow my teachers instructions and I obey older people*. The statements were part of bigger a set of statements and questions; however the other statements and questions were omitted, because they are outside the scope of this paper.

The reason Finland and Korea were chosen as research subjects is because the countries culture differs considerably (see eg. Hofstede, 2001), in addition authors were with familiar them and had access to carry out data gathering in both of them.

The questions were answered by using a Likert scale of 1 (completely disagree) to 5 (completely agree) with a "not applicable" option as a sixth choice. The not applicable option could be chosen e.g. with questions asking about students grandparents if they were deceased. The missing answers and answers to "not applicable" were omitted while analyzing the data. The questions were formulated based on Cialdini's principles and the ones evaluated in this study were based on authority, furthermore the previously stated viewpoints how culture differs in Finnish and Korean cultures were taken into consideration.

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4 Results

With the first question, it appears that the Finnish students respect their parents more than Korean students. Nevertheless, as we can see from the table the significance score concerning this question are barely under 0.05. Nevertheless this is opposite to what we had hypothesized.

With the second question, there is no significance difference. With this question there is always the possibility that not all students had their grandparents alive or interacted with their grandchildren.

The third question implicates that Finnish students respect senior students more than Koreans do. This contrasts to the hypothesis set. A feasible explanation is the difference between Korean and Finnish school systems.

With the fourth question, it seems that Koreans obey teachers much more than the Finns do ($p < 0.001$). This matches the hypothesis of this study. Indeed, teacher is in a position where he has authority over students.

In the fifth question, it appears that the hypothesis of this study are supported again. Korean students do seem to obey elderly people much more than Finnish students do.

Table 1. The questions asked in this study.

Question	Culture	n	mean	sig.
1. I appreciate my parents' opinions	Finnish	57	2.84	0.19
	Korean	51	2.47	
2. My grandparents have an effect on my behaviour	Finnish	55	2.58	0.152
	Korean	49	2.20	
3. I don't often question the opinions of my senior students	Finnish	55	1.78	0.006**
	Korean	51	2.39	
4. I always follow teacher's instructions	Finnish	56	2.98	0.000**
	Korean	51	3.65	
5. I obey elder people	Finnish	57	3.09	0.000**
	Korean	45	3.78	

5 Discussion and Conclusions

The results were interesting and somewhat surprising in a sense that authority did not appear to play salient role as expected. Statistical significance was apparent in three of the statements, of which two statements (Q4 and Q5) support our hypothesis and one statement (Q3) contradicts to our hypothesis. Thus, we argue that culture should, indeed, be considered while designing persuasive technology systems. An example of this might be what one should consider while designing a social media platform in Korea or in Finland.

The found results seem to uniform the viewpoints of IS design techniques (Kumar et al. 1990), user experience (Dey & Abowd, 2000; Orlikowski et al.,1995; Kettinger

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et al. 1995), user requirements (Tuunanen et al. 2006) and system use (Myers and Tan 2003).

However, it seems like the statements were open to more interpretations than meant by the authors. As an example, parents are older people who can be obeyed, but it does not necessitate that their opinions are appreciated.

Also the surprising difference with regard to our hypothesis on how parent's opinions were perceived might have related to that in Finland people usually move away from home after high school, while in Korea it is common for them to live within the same house with their parents until they get married. Thus having a closer relationship might lead to a more rebel consideration towards their opinions.

It seems that it would be worthwhile to redo the survey by first formulating and testing the statements on test audience. By validating that, the questions measure what they are meant to measure, and should thus bring better insight to the intended research aspect.

There are several limitations to the results received. Considering the implications of culture only by comparing Finnish culture environment and South Korean culture environment leaves room for improvement. It is very hard to control the meaningful variables and it is possible that comparing university students does not enable a fair comparison to the whole of each country's other population. Leidner and Kayworth (2006) suggest that all individuals within the same cultural unit may not follow conformity expected and suggest that culture should be considered on a more individualistic level. Similarly, Myers and Tan (2003) argue that the concept of national culture in IS research is a very simplistic way to consider culture and suggest that more research on the issue is called for. In addition the sample size is not big enough even to make generalization inside the student population. As previously mentioned, the question formulation for this research is prone to various interpretations.

More research is required to validate whether culture has salient role in persuasive system design. If positive correlation can be verified to a reasonable amount a feasible path for incoming research could be how culture inflicts persuasive systems design process. Future research might also include how the development of the research methodology alongside more carefully formulating and testing the survey questions and statements.

This paper has shown that related literature implicates that culture has effect on the development of persuasive systems; however the results received from the empirical research have a dissonance with hypothesis led from the related literature. Ergo, more research is needed to reach a more coherent result regarding to culture and its implications for persuasion.

References

1. Adler, N. (1986). International dimensions of organizational behavior. Boston, Mass.: Kent publishing company.
2. Cialdini, R.B. (1993). Influence: Science and practice. 3rd ed. New York, HarperCollins.
3. Crane P.S. (1999). Korean Patterns – A Royal Asiatic Society-Korea Reprint of the 1978 edition. Seoul: Seoul Press.

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4. De Mente, B. (2004). *Korean Business Etiquette*. Singapore: Tuttle Publishing.
5. Dey, A. and Abowd, G. (2000). Towards a better understanding of context and context-awareness. 2000, pp. 304-307.
6. Fan, Y. (2000). A classification of Chinese culture. *Cross Cultural Management* 7(2), pp. 3-10.
7. Fogg, B.J. (1998) "Persuasive computers: Perspectives and research directions" in *Proceedings of the CHI 98*
8. *Conference on Human Factors in Computing Systems*. Los Angeles: ACM Press/Addison-Wesley Publishing Co, pp. 225-232.
9. Fogg, B.J. and C.I. Nass (1997) "Silicon Sycophants: The Effects of Computers that Flatter", *International Journal of Human Computer Studies*, (46)5, 551-561.
10. Harjumaa, M. and H. Oinas-Kukkonen (2007) "An analysis of the persuasiveness of smoking cessation web sites" in
11. *Proceedings of the Second International Symposium on Medical Information and Communication Technology*, Oulu: CWC, University of Oulu, electronic publication.
12. Hill, C. (2008). *International Business – Competing in the global marketplace (7th edition)*. London: McGraw-Hill.
13. Hofstede, G. F. (2003). *Geert Hofstede™ Cultural Dimensions*. Itim International. <http://www.geert-hofstede.com/>. Cited 10.3.2011.
14. Hofstede, G. F. (2001). *Culture's Consequences: Comparing Values, Behaviours, Institutions, and Organizations across the Nations (2nd edition)*. Thousand Oaks: Sage.
15. Hofstede, G. F. & Bond, M. H. (1988). The Confucius Connection: From Cultural Roots to Economic Growth. *Organizational Dynamics* 16, 4–21.
16. Kahn, J.S. (1989). Culture: Demise or Resurrection? *Critique of Anthropology* 9(2), pp. 5-25.
17. Kim, C.S. (2007). *Kimchi and IT*. Seoul: Ilchokak.
18. Kettinger, W., Lee, CC., (1995). Global measures of information service quality: a cross-national study. *Decision Sciences* 26 (5), pp. 569-588.
19. Kumar, K., Bjorn-Anderson, N., King, R. (1990). A cross-cultural comparison of IS designer values. *Communications of ACM* 33 (5), pp. 528-538.
20. Leidner, DE. (2010). Globalization, culture and information: Towards global knowledge transparency. *Journal of Strategic Information Systems* 19, pp. 69–77.
21. Leidner, DE., Kayworth, T. (2006). Review: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict. *MIS Quarterly* 30 (2), pp. 357-399.
22. Merkin, R. (2006). Power Distance and Facework Strategies. *Journal of Intercultural Communication Research* 35, 139–160.
23. Myers, M., Tan, F. (2003). Beyond Models of National Culture in Information Systems Research. *Advanced Topics in Global Information Management*, 10 (2), pp. 1-19.
24. Namenwirth, JZ., Weber, RB. (1987). *Dynamics of culture*. Boston: Allen & Unwin.
25. Nass, C.I., J. Steuer, and E.R. Tauber (1994) "Computers are social actors" in *Proceedings of the SIGCHI conference on Human factors in computing systems: celebrating interdependence*, New York: ACM Press, pp.72-78.
26. Orlikowski, W., Yates, J., Okamura, K. and Fujimoto, M. (1995). Shaping electronic communication: the metastructuring of technology in the context of use. *Organization Science*, 6 (4), pp. 423-444.
27. Tuunanen, T., Peffers, K., Gengler, C., Hui, W. and Virtanen, V. (2006). Developing Feature Sets for Geographically Diverse External End Users: A Call for Value-based Preference Modelling. *JITTA: A Journal of Information Technology Theory & Application*, 8 (2), pp. 42-51.
28. Yum, J. O. (1988). The Impact of Confucianism on Interpersonal Relationships and Communication Patterns in East Asia. *Communication Monographs* 55(4), 374–388.

The Impact of Culture on the Principles of Authority in the Context of Persuasive Systems
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29. Walsham, G. (2002). Cross-cultural software production and use: a structural analysis. *MIS Quarterly* 26 (4), pp. 359-380.

There is more to IT portfolio management than top-management making the right decisions: A review of the IT PM literature.

Organizations experience ongoing challenges in managing their portfolio of Information Technology (IT) as IT expenses are becoming a major part of the budget. Hence, organizations implement a wide range of IT portfolio management (IT PM) arrangements to increase value from IT.

The literature vastly emphasizes the organizational benefits of establishing IT PM when managing IT investments. Only a minor part of the literature emphasizes the unintended and negative consequences of IT Portfolio Management. Thus, this paper aims to answer two research questions. First, how is this bias discursively constructed in the IT PM literature? Second, how can we provide a path for future research?

The literature regarding IT PM is an interdisciplinary discipline spread across various research fields and IT PM research within Information Systems (IS) is less mature compared to related research fields (Kumar et. al 2008). To utilize this more developed knowledge outside the field of IS, we conduct a concept-based search process for relevant articles that spans across research disciplines. We use the framework by Deetz (1996) to classify the articles into one of four scientific discourses. Each discourse holds a distinct set of epistemological assumptions, and the discourses are named: the normative, the interpretive, the critical, and the dialogic discourse.

Our findings show the literature reviewed to be dominated by articles using the normative discourse applying the epistemological assumption that IT PM consists of rational top management decisions that are executed in a friction-free environment and top-down manner. Only a few articles in the literature review use one of the other discourses. This epistemological monism unjustifiably leaves out issues that research could and most probably should be investigating. To shed light upon the arguments from the less developed discourses, we investigate an exemplary article from each discourse acknowledging that each discourse has its strengths and weaknesses highlighting some important issues and ignoring others. To provide a path for future research, we develop four metaphors, each highlighting the potential and limitations of the different discourse in IT PM.

1. Introduction

Organizations experience ongoing challenges in their management of their portfolio of Information Technology (IT) as IT expenses constitute a major part of the organizational budget (Jeffery and Leviveld 2004). Hence, organizations implement a wide range of IT portfolio management (IT PM) arrangements to gain value from IT investments (Kumar et. al. 2008). However, research shows that a vast amount of organizations are less successful in showing how IT PM provides value to the organization (Jeffery and Leviveld 2004; Singh 2009). Within the field of Information Systems (IS), IT PM has been on the agenda for more than three decades (McFarlan 1981), but may be regarded as less mature compared to portfolio management in other fields, e.g. portfolio management in finance, portfolio management in research and development (R&D) and portfolio management in new product development (NPD) (Kumar et. al. 2008). To address this challenge literature reviews can be seen an essential feature developing a research field by accelerating the accumulated knowledge gained in this field (Webster and Watson 2002). Our research only found one literature review of the IT PM literature within the field of IS, Kumar et. al (2008), utilizing the knowledge from the more mature traditions regarding portfolio management mentioned above and developing these to fit IT PM concepts. However, it is less discussed in Kumar et. al. (2008) and in the IS literature in general, how IT PM connects the decisions taken at the organizational strategic level to the lower organizational levels (Fonstad and Robertson 2006), and what unintended consequences IT PM causes. Instead, it is vastly assumed that IT PM is a discipline conducted at the higher organizational levels and that the decisions are carried out in the organization by rational law-like mechanisms.

Despite the growing importance of IT PM in practice, the field of IS only contains few studies regarding IT PM (Kumar et al. 2008). More knowledge about IT PM is needed. To secure progress,

the IT PM literature must be developed towards a more coherent system of concepts and theories, and reviews analyzing the literature are needed to support this development (Webster and Watson 2002). The purpose of this paper is to contribute to the development of the field by conducting an interdisciplinary literature review of 107 articles. The argument for doing an interdisciplinary literature review is to ensure a high quality by including related literature outside the field of IS (Webster and Watson 2002)

Our method for conducting the literature review is inspired by the way Schultze and Leidner (2002) conducted their research of IS knowledge management literature and their use of the framework by Deetz (1996) to surface how the knowledge management literature is biased towards a Top-management perspective. Analogous, we use the framework by Deetz (1996) to categorize the literature according to the four discourses; the normative, the interpretive, the critical, and the dialogic discourse (Deetz 1996). This provides a tool to discursively construct that IT PM is biased towards a top- management approach and vastly ignoring issues such as conflicts and social dilemmas, and disguised suppression of interests.

In the following section we discuss the lack of knowledge and definitions regarding IT PM and show the criteria we have used to select the IT PM literature. In section three, the framework by Deetz (1996) is presented. In section four we present the methods used to find the relevant articles for our review. In section five, we present the literature review findings. This is followed by a discussion of the implications for research and practice. Finally, in section six we conclude on the research findings.

2. The literature

An important part of a high quality review is to delineate the boundaries of the research (Webster and Watson 2002). In our study an applicable definition of IT PM is needed. We searched among our predecessors in the field of IS (e.g. McFarlan 1981, Jeffery and Leviveld 2004, Bardhan and Sougstad 2004, De Reyck et. al 2005, Bonham 2005, Kaplan 2005), but no explicit definition of IT PM was found. First, we use the work by Kumar et. al. (2008) to clarify a distinction between managing three different types of IT portfolios, viz.: management of the IT infrastructure portfolio (e.g. Broadbent et al. 1999, Dei et. al. 2007), management of the IT application portfolio (e.g Weill and Vitale 1999), and management of the IT project portfolio management (e.g Bonham 2005, De Reyck et. al. 2005). The management of each type of IT portfolio management includes different activities and is handled by different groups in the organization (Kumar et. al. 2008). The IT project sub-portfolio focuses on the organization's IT development activities and involves the employee facilitating the creations of a unique product, service or result; whereas managing the portfolio of IT architecture and IT applications involves employees securing the current systems running (Weill and Ross 2009).

We define our research-scope to portfolio management conducted by IS managers such as: the Central Information Officer (CIO) (Bonham 2005), the IS development groups (Kumar et. al. (2008) the managers from the organization's Project Management Office (PMO) (Singh et. al. 2009). Table 1. at page 4, summarizes the three types of sub-portfolio management in IT PM.

Characteristic of the portfolio	IT application portfolio	IT infrastructure portfolio	IT Project portfolio (IT PPM)
Actors	Support Groups (e.g. Kumar et. al. 2008). Senior managers of business units assess the health of the portfolio of IT applications (e.g. Weill and Vitale 1999).	IT architects (Kumar et. al. 2008). Employees in the IS department (e.g. Dei et. al. 2007). IS executives and champions of business process change (e.g. Broadbent 1999)	IS developments groups (e.g. Kumar et. al. 2008), and the Central Information Officer (CIO) (e.g. Bonham 2005). Managers from the organization's Project Management Office (PMO) (e.g. Singh et. al. 2009).
Definition	Managing and assessing the existing portfolio of the organization's IT applications (e.g. Weill and Vitale 1999).	Supporting, planning and facilitating the development of the organization's IT architecture (e.g. Kumar et. al. 2008).	Management of a group of [IT] projects that are carried out under the sponsorship and/or management of a particular organization. These [IT] projects must compete for scarce resources (people, finances, time, etc.) available from the sponsor, since there are usually not enough resources to carry out every proposed [IT] project which meets the organization's minimum requirements on certain criteria such as potential profitability, etc (Archer and Ghasemzadeh, 1999) ¹

Table 1: Three types of IT portfolios inspired by Kumar et. al. (2008).

3. Deetz's framework

The term “discourse” has been used by former researchers to describe different assumptions in organizational science research (Deetz 1996). As shown in fig. 2. P. 6, Deetz (1996) distinguishes between two fundamental dimensions in research, the first dimension being consensus vs. dissensus and the second dimension being a local/emergent research-focus vs. an elite/a priori research-focus. The Consensus vs. Dissensus dimension discusses the researcher's relation to the existing social order, meaning the dominant way of structuring social relations and identities (Deetz, 1996). The researcher's orientation can be either in line with this social order, or the researcher can be critical towards this order (Schultze and Leidner 2002). The local/emergent vs. elite/a priori addresses the question: Where do the concepts investigated appear from? Deetz (1996) argues that one pole of the

¹ Braces inserted by the authors

dimension develops its concepts in negotiation with the empirical settings (Deetz 1996), meaning that the researcher is greatly influenced by the empirical findings. A researcher using the elite/a priori perspective is greatly influenced by the accumulated knowledge developed in the academic society. The knowledge used in the elite/a priori perspective is mostly stored in theories and models. For example, a researcher is defined as being normative, when he or she is placed at the elite/a priori pole in one of Deetz's dimensions, and is placed at the consensus pole in the other of Deetz's dimensions.

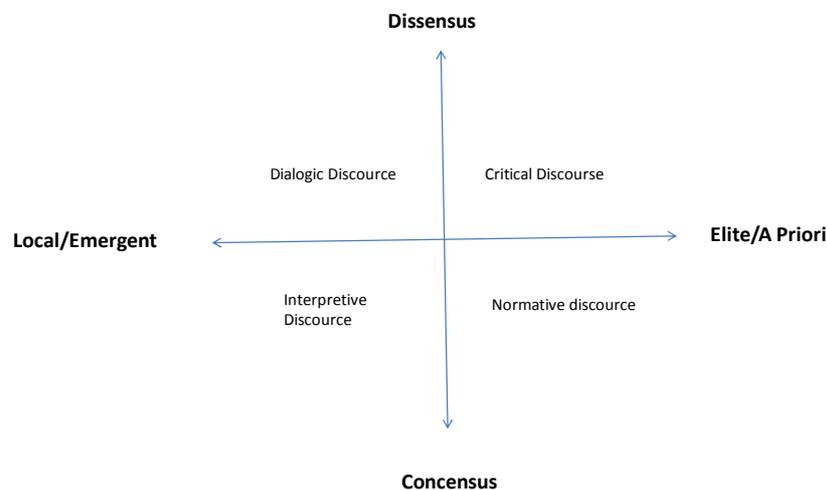


Figure 2: The four Discourses by Deetz (1996)

According to Deetz (1996) the normative discourse searches for universal truth and regularity in organizations. Organizational mechanisms are, according to the normative discourse, market-like mechanisms preventing organizational conflicts by offering the most rational solution. The normative discourse generally takes the perspective of senior management assuming their rational decisions will be implemented in a top-down and frictionless manner. Researchers using the normative discourse primarily use theory to guide their search for independent variables explaining which organizational behavior provides the most efficient outcome.

The interpretive discourse assumes that organizations are social communities and gives preference to social issues in organizational mechanisms assuming that organizational mechanisms are deflections of human intentions and interpretations. Consequently, researchers applying the interpretive discourse favor empirical investigation aiming at understanding why people in organizations use the mechanisms they do. These organizational mechanisms will, from the viewpoint of the interpretive discourse, be considered as subjective phenomena, because the mechanisms will be interpreted in different ways by different people (Deetz 1996).

The critical discourse emphasizes political struggle and domination in organizations, assuming conflict is a universal and intrinsic reality in organizations. According to the critical discourse different organizational-groups have different predetermined interests about the distribution of resources and power in the organization. The privileged groups in the organization will try to suppress conflicts challenging their interests. These mechanisms will, according to the critical discourse, damage the basis for making appropriate decisions and result in significant waste and inefficiency. When researchers apply the critical discourse, they will most likely start investigations with a priori assumption about who is dominating who and by which media domination is done (Deetz, 1996).

The dialogical discourse assumes, similar to the critical discourse, that organizational mechanisms are power relations, but defines power as dynamic - as a situational phenomenon constantly changing. Researchers must, according to the dialogical discourse, emphasize the analysis of empirical data because power appears in different forms and disguises. The role of theories in the dialogical discourse is to describe and deconstruct a carnival of social mechanisms at the empirical

level. This is, according to dialogical discourse, done by searching for the means of domination by unpacking hidden power-relations in the social order (Shultze & Leidner, 2002).

Table 3. below shows how the four discourses differ regarding features such as: the metaphors used to conceive organizations, what problems each discourse addresses, and last how each discourse understands organizational mechanisms.

Dimension	Normative	Interpretive	Critical	Dialogic
Organizational metaphor	Marketplace	Community	Polity	Carnival
Problems addressed	Inefficiency, disorder	Meaningless, illegitimacy	Domination, consent	Marginalization conflict-suppression
Organizational mechanisms	Economic	Social	Political	Mass

Table 3: Typical discursive features in organizational and management literature: Adopted from Deetz (1996)

3. Methodology

Webster & Watson (2002) argues that an effective literature review creates a foundation for advancing knowledge. It facilitates theory development, closes areas where research is well developed, and shows areas where more research is desirable (Webster and Watson 2002). According to Webster and Watson (2002) literature reviews are important efforts to create development in a field or discipline. Due to the lack of knowledge about IT PM within the IS field, and the more developed research in related fields (Kumar et. al. 2008), we expand our search to go beyond the boundaries of the IS field. This interdisciplinary review-approach emphasizes that a high quality review covers related literature outside the field of IS (Webster and Watson 2002). To secure this interdisciplinary research focus, we use a concept-based search process (Webster and Watson 2002). We used the definition of IT PM, as discussed in section 2, to delineate the boundaries of the research. After defining the research topic, Webster and Watson (2002) suggest a structured approach to determine the source of material included in the review, and a structured

approach in three steps is applied. Fig. 4, p. 9, named The literature selection process, shows the three steps in our search for relevant literature, and the text below describes each step in greater detail.

First step: search in Web science

Used search-string:
Portfolio and (Information systems or Information technology or governance) or IT PM or IS PM.
Search limed to articles

Second step: scanning the search result:

Second step: The titles and abstracts of the articles were scanned and related

Third step, backward tracking

By reading the following sections in the 83 articles: the introduction, the literature-review section, and other parts where important references could be expected to be found.

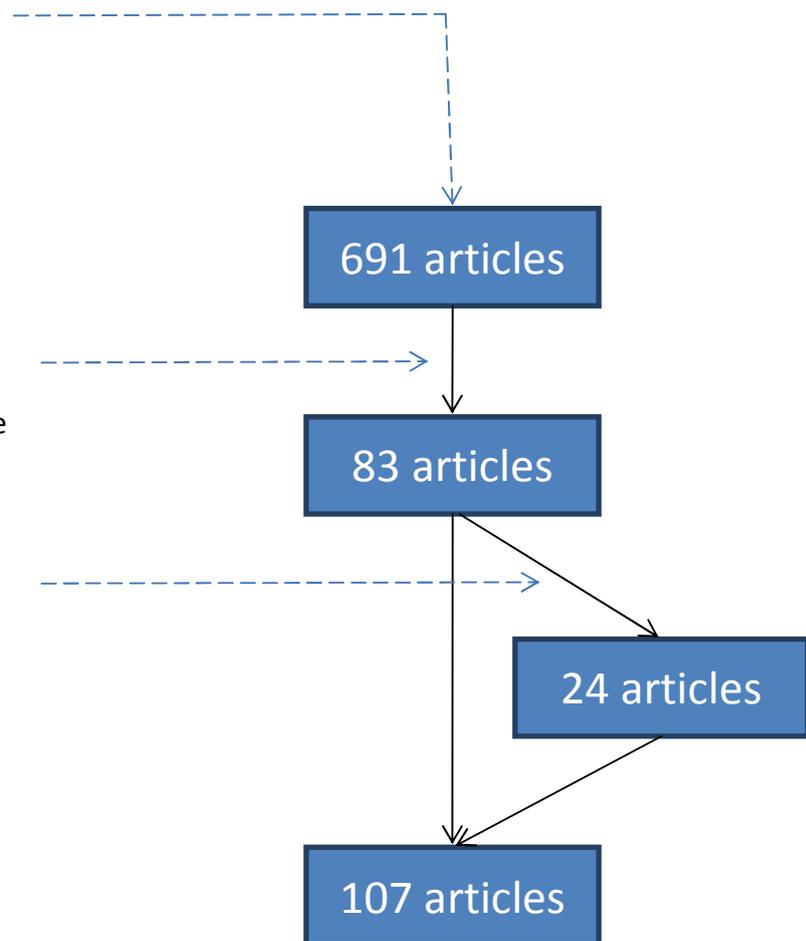


Figure 4: The literature selection process

First step, defining the key-words: Our exiting knowledge of the topic guided the process of defining the keywords for the following search for relevant literature. We developed the following search-string: Portfolio and (Information systems or Information technology or governance) or IT

PM or IS PM. We used “The Web of Science” article database as source, and limited the search to journals published in the period from 1980 to November 2010, this query provided a stock of 691 articles.

Second step, scanning the search results: The article titles and abstracts were scanned and irrelevant articles were excluded. This step was a comprehensive and non-trivial task due to the following reasons. First, the search-string contains quite generic words such as: portfolio, IT, IS and project, and captures a wide range of topics more or less relevant such as articles from: economic theory (e.g. investment models for portfolios of stocks and bonds), mathematics (e.g. mathematical models providing solutions to theoretical problems), defense (e.g. portfolios of weapon systems), the medical industry (e.g. portfolios of drugs), and the education sector (e.g. portfolios of learning). Second, the scanning process was challenging, because IT PM consists of a range of sub-techniques like: risk management, cost benefit analysis, etc., (De Reyck et. al) thus we had some considerations as to whether or not such articles should be included in the review, however, in this process our definition of IT PM proved to be useful. For example, we excluded articles regarding risk Management, (e.g. Benaroch et.al 2006, Lyytinen et. al 1998), because risk management is considered as sub-discipline in IT PM and the inclusion of discipline of risk management will demand inclusion of a range of other sub-disciplines included IT PM which according to De Reyck et. al. (2005) can be: financial analysis, mathematical models for optimizing portfolios, techniques for involving stakeholders, techniques for improving team and top executives skills. Furthermore, research papers (e.g. literature reviews) were also excluded from our stock. In total, the scanning of the 691 abstracts narrowed down to 90 relevant articles, primarily representing the field of New Product Development (NPD), the field of Research and Development (R&D), and the field of project management.

Third step, backward tracking: In the effort to spot major contributions not captured by the search-string, backward tracking was conducted (Webster & Watson, 2002). The 90 articles were reviewed with the purpose of finding major contributions not included in our stock. This was done by reading the introduction and the literature-review section of all 90 articles. Our review revealed that less than two decades ago, organizations did not find it urgent to centralize and formalize IT PM. Conversely, they regarded each IT project as a relatively isolated endeavor with minor dependencies to the other IT projects of the organization (e.g. Kirsch 1997). Not until we entered the new millennium, the development of IT PM-concepts and research gains speed. However, the backward tracking revealed a stream of relevant articles from the International Journal of Project Management that has a long tradition for dealing with similar concepts (e.g. Payne 1995). These articles were not found by our search-string, since it was not until April 2007 this journal was added to the Web of Science database. However adding these, the process of backward tracking included 24 articles from various journals, and the three steps in searching for relevant literature resulted in a final stock of 107 relevant articles.

In the process of classifying the articles according to the four discourses by (Deetz 1996), we follow the method used in the article by Shultze and Leidner (2002), where they classify and describe IS knowledge management discourses. We argue that IT PM and IS knowledge management are similar in the sense, that they are both management disciplines, that are broad into the field of IS and therefore may be studied using the same methods. Following the approach of Shultze and Leidner (2002), we start classifying each of the 107 articles in our stock using Deetz's (1996) two criteria: the elite/local dimension and the consensus/dissensus dimension. We coded the 107 articles

in a literature reference tool named RefWorks, and to secure reliability of the coding, we made a review of the codes, which resulted in the recoding of 12 articles.

The vast amount of the 107 articles was uncomplicated to code, because the articles were obviously normative. These articles typically use theoretical and mathematical models and emphasizing to describe these models, they devote less space discussing how the models suggested were empirically supported. However, approximately twenty articles were more difficult to classify representing more than one discourse in each article. We have thus chosen to classify each article as belonging to the discourse most predominant. Appendix A shows the references of the 107 articles classified in the four discourses and the next section will discuss our findings.

Findings

Our findings show the IT PM literature to be vastly placed in the fields of Project management and R&D. Appendix B shows that the International Journal of Project Management is the greatest contributor with 27 articles to our sample, and the journal of Research Technology Management contributes with 11 articles. 37 of the articles in our sample are placed within the field of IS, mostly represented in the journals with a technical and strategic scope e.g. IEEE Transaction on Engineering Management (with 7 articles) or Journal of Strategic Information Systems (with 4 articles).

Taking an overall look on our sample of 107 articles, cf. fig. 6, p.13, it shows that 97 of the 107 articles in our stock may be classified as belonging to the normative discourse, and only 10 articles may be categorized as belonging to one of the three other discourses. This distribution signifies a strong bias in both dimensions in the framework by Deetz. A similar pattern may be identified in the 37 articles within the field of IS as is seen in fig. 9, in Appendix C, showing the specific distribution of IT PM within the field of IS. To provide a more a comprehensive foundation for the

following analysis, we have included all 107 articles in our sample, regardless of the research field each article is representing.

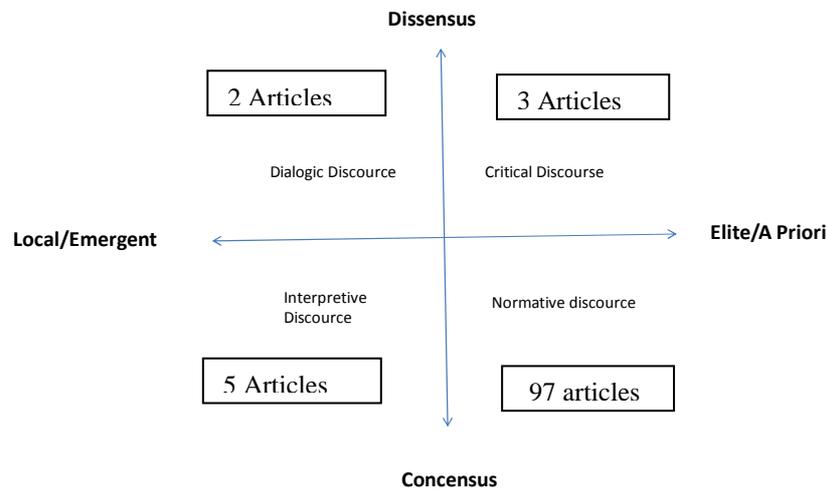


Figure 6: Distribution of IT PM articles in the four discourses

First, the dissensus vs. consensus dimension; only five articles are representing the dissensus pole, viz; two articles from the dialogical discourse and three articles from the critical discourse. Consequently, this denotes a lack of articles using approaches highlighting the unintended consequences of IT PM.

Second, the local/emergent vs. elite/A priori dimension is dominated by articles using an elite/a priori approach. Thus, local and emergent phenomena in IT PM are only investigated by six articles, viz.; two articles representing the dialogical discourse and four articles representing the interpretive discourse. Thus, IT PM research has little empirical knowledge about what is going on when real life organizations conduct IT PM.

We argue that this epistemological monism in the IT PM literature constitutes a genuine problem as research primarily relying upon one discourse faces the danger of leaving out issues that should be

investigated (Shultze and Leidner 2002). To illustrate, in the following section we show how each of the four discourses provides forceful arguments and different insights regarding IT PM.

An example from the normative discourse

The articles representing the normative discourse are primarily inspired by economics and mathematics. Verhoef (2002) regards IT PM as: *an approach where decisions on whether or not to invest in IT are based on potential return, and decisions to terminate or make additional investments are based on performance much like an investment broker is measured and rewarded based on managing risks and achieving results* (Verhoef 2002). The article emphasizes how the right decisions are calculated by mathematical models. A key argument, by Verhoef (2002), is that IT investments (IT projects) impose long term costs on the organization. This is because new IT applications demand recourses for maintenance and IT applications are difficult to phase out. Thus, organizations should pre-calculate how the current IT investments affect future budgets. Otherwise, organizations can be flooded by tsunamis of deflected costs. The calculations in the article by Verhoef (2002) are impressive and comprehensive, but little space is devoted to describing how the IT PM mechanisms may underpin these decisions. Instead, Verhoef (2002) implicitly assumes these mechanisms to be objective and law like mechanisms working in a frictionless environment.

The Interpretive discourse

The article by Blichfeldt & Eskerod (2008) has a clear interpretive style. It is explicitly assumed that people behave on the background of their individual interpretations and their ability to make sense of their specific situation. This means that IT PM mechanisms are less predictable and packed with dilemmas. For example: on the one hand, the senior executives need an overview of all

projects and activities in the organization to be efficient. On the other hand, it is socially unacceptable if management conducts micro-management of all activities as it is apt to demotivate the employees. Blichfeldt & Eskerod (2008) see implicitly social harmony as the natural state in organizations and assume that the dilemmas may be solved by making a social integration of the different organizational levels and units. This assumption may be criticized for giving a too naïve and optimistic description of IT PM in organizations. In particular if this assumption is compared to the definition of IT PM put forward by this paper, stating that: “[IT PM] is a competition for scarce resources available from the sponsor, since there are usually not enough resources. It can be argued that different organizational levels and units hold fundamental different interests that cannot be solved by social integration.

The Critical discourse

Platje and Seidel (1993) argue that IT PM has intrinsic mechanisms creating vicious circles of planning and control. IT PM management involves three parties holding conflicting interests: the organization’s senior executives, the employees in organizational IT projects, and the respective organizational departments. The senior executives aim at centralizing and formalizing the mechanisms of IT PM. However, this aim may have the unintended consequence that it decreases motivation and involvement of the departments and the employees participating in the IT projects. Furthermore, the different parties tend to cocoon their interests and disrupt open communication forms. As a countermove, senior management tends to increase the degree of formalization and control. Now, the vicious circle of bureaucracy rolls and creates even more frustration: The project managers and departments are frustrated by the rigid process not stimulating organizational flexibility, the senior executives are frustrated by the lack of control despite the fact that IT PM provides detailed information and formalized processes (Platje and Seidel 1993). A critique raised against research applying the critical discourse is a critique regarding the assumption that it is made

a priori. How does the researcher know, before doing the fieldwork, which conflicts will arise, and who will be involved in these conflicts? The following section presents the dialogical discourse addressing this critique.

The dialogical discourse

In contrast to the critical discourse a static notion of conflict is dominant, thus the dialogical discourse considers domination as situational having a fluent and dynamic notion of domination in organizations (Deetz 1996). The article by Kirsch (1997) has some of these characteristics describing how stakeholders in IT PM use different forms of formal and informal control. The formal modes of control are about controlling via output and formal behavior. The informal modes of control are concerned with exercising control through informal norms and control based on the goals set by the individual as well as individual empowerment. Describing how a real life organization performs control, Kirsch (1997) reveals that the end-user influence is suppressed. The argument is that even though the end-users may not have the formal organizational authority to do so, they possess highly specialized technical skills that are necessary in IT projects. This short example illustrates how the dialogical discourse reveals new aspects of IT PM by its ability to show hidden points of resistance, complexity, and taken-for-granted assumptions (Deetz 1996). One point of critique raised against the dialogical discourse is its lack of ability to suggest what organizations should do to improve IT PM. The dialogical discourse is less ambitious by only describing ex ante what the organization did.

5. Discussion

This paper has explored each of the four discourses by Deetz (1996) and finds that each discourse has its advances. The literature is vastly based upon the normative discourse which advances by offering a range of techniques and methods to provide solid information to decisions makers. The downside of the normative discourse is its lack of emphasis on transforming models and calculations into a complex real life context. The interpretive discourse advances by shedding light on the dilemmas IT PM is causing people in the organization, but its assumption regarding the absence of different interests within IT PM seems unrealistic. The critical discourse shows how IT PM results in negative outcomes when people in organizations act from self-interests, but the heavy reliance upon a priori assumptions may be problematic. The dialogical discourse shows how real life organizations use different control mechanisms in IT PM, however, providing only ex ante explanations.

Discourse	Normative	Interpretive	Critical	Dialogic
Metaphor of IT PM	Stock-broker choosing the most profitable projects	Social dilemmas	Polity between different interests	Changing and disguising power relations
Considers portfolio management mechanisms	Assumes the presence of law-like mechanisms between organizations, senior management, and the management in local IT projects	Assumes mechanisms are causing social dilemmas to employees	Assumes mechanisms are political processes between different interests in an organization	Assumes mechanisms are power-relations that can be in disguise and are frequently changing

Table 7: Different metaphors in IT PM portfolio management imply the use of different mechanisms.

The above table 7 highlights the metaphors and views used by each discourse to explain IT PM. The metaphors are developed on the background of our reading of the articles in each discourse and the mechanisms illustrate how each discourse assumes that IT PM is conducted in organizations.

The insights gained from each discourse are not believed to be mutually exclusive, but believed to be complementary explanations: IT PM may in some situations consist of law-like objective mechanisms, in some situations social dilemmas, in some situations political mechanisms, and in some situations mechanisms of disguised and changing power-relations.

This provides a path for future research by showing what aspects in IT PM each discourse reveals. Practitioners may use these metaphors to consider whether their efforts to improve IT PM mediate the aspects that each metaphor articulates. We use the analogy used by Jaspersen et. al. (2002) to illustrate the problem: Eskimos living in an environment of ice and snow have a great need of a vocabulary describing different aspects of snow and ice. This ability to perform sophisticated descriptions and understanding a wide range of aspects of these conditions are essential to the survival of the Eskimos. Similarly, as the need of IT PM becomes urgent in organizations and IS research, a more complex understanding of IT PM is called for. Explicit use of the four discourses by Deetz (1996) in IT PM research seems a fruitful path.

6. Conclusion

The purpose of this paper is to investigate the literature regarding IT portfolio management (IT PM). We find the literature to be placed in an interdisciplinary field and utilizing existing knowledge across different fields. Thus, we conduct a concept-based review of relevant articles published in various journals representing various research disciplines. We use the framework by Deetz (1996) to classify the articles into one of four scientific discourses. Each discourse holds a distinct set of epistemological assumptions.

We find the literature reviewed dominated by articles using the normative discourse applying the epistemological assumption that IT PM mechanisms are rational, top management decisions executed in a friction free and top-down manner. The underlying assumptions in these articles

imply that unintended consequences and conflicts are ignored. Only a few articles in the literature review use the other discourse. This epistemological monism unjustifiably leaves out issues that research could and, most probably should, be investigating. On this background, we argue that IT PM is not only about making senior management taking the right decisions regarding IT and these aspects can be studied by using the research lenses from the less exploited discourses. Therefore, we develop a metaphor from each discourse to make it more explicit to show: firstly, how each discourse may provide forceful arguments about important aspects in IT PM. Secondly, how epistemological monism makes research overlook important insights and have the ability to potentially cause organizations to engage in costly misunderstandings.

The implication for research is to highlight the potential of applying other discourses in IT PM research. Furthermore, we emphasize that the field of IS could benefit from more research regarding IT PM, because this topic is less mature than portfolio management in related fields. The implications for practice are to raise awareness about the fact that there is more to IT PM than making senior management choosing the right projects. We argue that IT PM simultaneously consist of: law-like relations, social dilemmas, polity between different interests, and changing and disguising power relations. The results of our study are limited towards the fact that our stock of articles covers a very wide range of journals not putting specific attention to the IS literature. Thus, we encourage future research to focus on the situation and development of IT PM in the IS literature. We are aware of this literature may consist of concepts explaining the same phenomena. Thus, we encourage future research to conduct more literature reviews investigating the IS literature for relevant keywords and concepts not included in this research.

References

- Agarwal, R., Roberge, L. & Tanniru, M.R. 1994, "Mis Planning - a Methodology for Systems Prioritization", *Information & Management*, vol. 27, no. 5, pp. 261-274.
- Agresti, W.W. & Harris, R.M. 2009, "Practical Profiles for Managing Systems Engineering R&D", *IEEE Transactions on Engineering Management*, vol. 56, no. 2, pp. 341-351.
- Andersen, E.S. & Jessen, S.A. 2003, "Project maturity in organisations", *International Journal of Project Management*, vol. 21, no. 6, pp. 457.
- Angelou, G.N. & Economides, A.A. 2008, "A decision analysis framework for prioritizing a portfolio of ICT infrastructure projects", *IEEE Transactions on Engineering Management*, vol. 55, no. 3, pp. 479-495.
- Archer, N.P., Ghasemzadeh, F. 1999, "An integrated framework for project portfolio selection", *International Journal of Project Management*, vol. 17, no. 4, pp. 207.
- Bai, Y. & Pigott, R. 2004, "Assessing outcomes using program assessment portfolio approach", *Journal of Professional Issues in Engineering Education and Practice*, vol. 130, no. 4, pp. 246-254.
- Barczak, G., Griffin, A. & Kahn, K.B. 2009, "PERSPECTIVE: Trends and Drivers of Success in NPD Practices: Results of the 2003 PDMA Best Practices Study", *Journal of Product Innovation Management*, vol. 26, no. 1, pp. 3-23.
- Bardhan, I., Bagchi, S., Sougstad, R. 2004, "Prioritizing a portfolio of information technology investment projects", *Journal of Management Information Systems*, vol. 21, no. 2, pp. 33-60.
- Benaroch, M., Lichtenstein, Y. & Robinson, K. 2006, "Real Options in Information Technology Risk Management: an Empirical Validation of Risk-Option Relationships", *MIS Quarterly*, vol. 30, no. 4, pp. 827-864.
- Bitman, W.R. & Sharif, N. 2008, "A conceptual framework for ranking R&D projects", *IEEE Transactions on Engineering Management*, vol. 55, no. 2, pp. 267-278.
- Blichfeldt, B. & Eskerod, P. 2008, "Project portfolio management - There's more to it than what management enacts", *International Journal of Project Management*, vol. 26, no. 4, pp. 357.
- Bonham, S. 2005, "IT project portfolio management" *Artech House, Boston & London*
- Bredillet, C. 2008, "Learning and acting in project situations through a meta-method (MAP) a case study: Contextual and situational approach for project management governance in management education", *International Journal of Project Management*, vol. 26, no. 3, pp. 238.
- Broadbent, M., Weill, P. & St Clair, D. 1999, "The implications of information technology infrastructure for business process redesign", *Mis Quarterly*, vol. 23, no. 2, pp. 159-182.

- Canez, L. & Garfias, M. 2006, "Portfolio management at the Mexican Petroleum Institute", *Research-Technology Management*, vol. 49, no. 4, pp. 46-55.
- Caron, F., Fumagalli, M. & Rigamonti, A. 2007, "Engineering and contracting projects: A value at risk based approach to portfolio balancing", *International Journal of Project Management*, vol. 25, no. 6, pp. 569.
- Chou, T., Chou, S.T. & Tzeng, G. 2006, "Evaluating IT/IS investments: A fuzzy multi-criteria decision model approach", *European Journal of Operational Research*, vol. 173, no. 3, pp. 1026-1046.
- Choudhury, V. & Sabherwal, R. 2003, "Portfolios of control in outsourced software development projects", *Information Systems Research*, vol. 14, no. 3, pp. 291-314.
- Cline, M.K. & Guynes, C.S. 2001, "A study of the impact of information technology investment on firm performance", *Journal of Computer Information Systems*, vol. 41, no. 3, pp. 15-19.
- Coman, A. & Ronen, B. 1995, "Information Technology in Operations Management - a Theory-Of-Constraints Approach", *International Journal of Production Research*, vol. 33, no. 5, pp. 1403-1415.
- Cooper, K.G., Lyneis, J.M. & Bryant, B.J. 2002, "Learning to learn, from past to future", *International Journal of Project Management*, vol. 20, no. 3, pp. 213.
- Cooper, R.G. & Edgett, S.J. 2003, "Overcoming the crunch in resources for new product development", *Research-Technology Management*, vol. 46, no. 3, pp. 48-58.
- Cooper, R.G. 2006, "xManaging technology development projects", *Research-Technology Management*, vol. 49, no. 6, pp. 23-31.
- Cooper, R.G., Edgett, S.J. & Kleinschmidt, E.J. 2000, "New problems, new solutions: Making portfolio management more effective", *Research-Technology Management*, vol. 43, no. 2, pp. 18-33.
- Cooper, R.G., Edgett, S.J. & Kleinschmidt, E.J. 2002, "Optimizing the stage-gate process: What best-practice companies do - II", *Research-Technology Management*, vol. 45, no. 6, pp. 43-49.
- Cooper, R.G., Edgett, S.J. & Kleinschmidt, E.J. 2004, "Benchmarking best NPD practices-II", *Research-Technology Management*, vol. 47, no. 3, pp. 50-59.
- Costa, H.R., Barros, M.d.O. & Travassos, G.H. 2007, "Evaluating software project portfolio risks", *Journal of Systems and Software*, vol. 80, no. 1, pp. 16-31.
- Cullen, S., Seddon, P.B. & Willcocks, L.P. 2005, "IT outsourcing configuration: Research into defining and designing outsourcing arrangements", *Journal of Strategic Information Systems*, vol. 14, no. 4, pp. 357-387.

- Dai, Q., Kauffman, R.J. & March, S.T. 2007, "Valuing information technology infrastructures: a growth options approach", *Information Technology & Management*, vol. 8, no. 1, pp. 1-1
- De Reyck, B., Grushka-Cockayne, Y., Lockett, M. & Calderini, S.R. 2005, "The impact of project portfolio management on information technology projects", *International Journal of Project Management*, vol. 23, no. 7, pp. 524.
- Deetz, S. 1996, "Describing Differences in Approaches to Organization Science: Rethinking Burrell and Morgan and Their Legacy", *Organization Science*, vol. 7, no. 2, pp. 191-207.
- Demaio, A., Verganti, R. & Corso, M. 1994, "A Multi-Project Management Framework for New Product Development", *European Journal of Operational Research*, vol. 78, no. 2, pp. 178-191.
- Dickinson, M.W., Thornton, A.C. & Graves, S. 2001, "Technology portfolio management: Optimizing interdependent projects over multiple time periods", *IEEE Transactions on Engineering Management*, vol. 48, no. 4, pp. 518-527.
- Doerner, K.F., Gutjahr, W.J., Hartl, R.F., Strauss, C. & Stummer, C. 2006, "Pareto ant colony optimization with ILP preprocessing in multiobjective project portfolio selection", *European Journal of Operational Research*, vol. 171, no. 3, pp. 830-841.
- Eden, C., Williams, T., Ackermann, F. & Howick, S. 2000, "The role of feedback dynamics in disruption and delay on the nature of disruption and delay (D&D) in major projects", *Journal of the Operational Research Society*, vol. 51, no. 3, pp. 291-300.
- Elonen, S. & Artto, K.A. 2003, "Problems in managing internal development projects in multi-project environments", *International Journal of Project Management*, vol. 21, no. 6, pp. 395.
- Eskerod, P. 1996, "Meaning and action in a multi-project environment: Understanding a multi-project environment by means of metaphors and basic assumptions", *International Journal of Project Management*, vol. 14, no. 2, pp. 61.
- Eveleens, J.L. & Verhoef, C. 2009, "Quantifying IT forecast quality", *Science of Computer Programming*, vol. 74, no. 11-12, pp. 934-988.
- Fernandes, E. & Valdiviezo, L.E. 1997, "Total cost management of interdependent projects", *International Journal of Technology Management*, vol. 13, no. 1, pp. 15-24.
- Florice, S. & Ibanescu, M. 2008, "Using R&D portfolio management to deal with dynamic risk", *R & D Management*, vol. 38, no. 5, pp. 452-467.
- Fonstad, F. N., Robertson, D., 2006 "Transforming a company, project by project: The IT engagement model", *MIS Quarterly Executive Vol 5. No. 1 (1)*
- Geraldi, J. 2008, "The balance between order and chaos in multi-project firms: A conceptual model", *International Journal of Project Management*, vol. 26, no. 4, pp. 348.

- Ghasemzadeh, F. & Archer, N.P. 2000, "Project portfolio selection through decision support", *Decision Support Systems*, vol. 29, no. 1, pp. 73-88.
- Ghasemzadeh, F., Archer, N. & Iyogun, P. 1999, "A zero-one model for project portfolio selection and scheduling", *Journal of the Operational Research Society*, vol. 50, no. 7, pp. 745-755.
- Girotra, K., Terwiesch, C. & Ulrich, K.T. 2007, "Valuing R&D projects in a portfolio: Evidence from the pharmaceutical industry", *Management Science*, vol. 53, no. 9, pp. 1452-1466.
- Glickman, T.S. 2008, "Program portfolio selection for reducing prioritized security risks", *European Journal of Operational Research*, vol. 190, no. 1, pp. 268-276.
- Gokhale, H. & Bhatia, M.L. 1997, "A project planning and monitoring system for research projects", *International Journal of Project Management*, vol. 15, no. 3, pp. 159.
- Graves, S.B., Ringuest, J.L. & Case, R.H. 2000, "Formulating optimal R&D portfolios", *Research-Technology Management*, vol. 43, no. 3, pp. 47-51.
- Gustafsson, J. & Salo, A. 2005, "Contingent portfolio programming for the management of risky projects", *Operations research*, vol. 53, no. 6, pp. 946-956.
- Hamilton, D. 1999, "Linking strategic information systems concepts to practice: systems integration at the portfolio level", *Journal of Information Technology*, vol. 14, no. 1, pp. 69-82.
- Hawlitzky, N., Munnich, A., Nothhelfer-Kolb, B. & Rappl, M. 2000, "Managing distributed software development - A portfolio based methodology", *Product Focused Software Process Improvement*, vol. 1840, pp. 282-295.
- Hendriks, M.H.A., Voeten, B. & Kroep, L. 1999, "Human resource allocation in a multi-project R&D environment", *International Journal of Project Management*, vol. 17, no. 3, pp. 181.
- Henriksen, A.D. & Traynor, A.J. 1999, "A practical R&D project-selection scoring tool", *IEEE Transactions on Engineering Management*, vol. 46, no. 2, pp. 158-170.
- Herbots, J., Herroelen, W. & Leus, R. 2007, "Dynamic order acceptance and capacity planning on a single bottleneck resource", *Naval Research Logistics*, vol. 54, no. 8, pp. 874-889.
- Herfert, K.F. & Arbige, M.V. 2008, "Aligning an R&D portfolio with corporate strategy", *Research-Technology Management*, vol. 51, no. 5, pp. 39-46.
- Jasperson, J., Carte, T.A., Saunders, C.S., Butler, B.S., Croes, H.J.P. & Zheng, W. 2002, "Review: Power and Information Technology Research: a Metatriangulation Review", *MIS Quarterly*, vol. 26, no. 4, pp. 397-459.
- Jeffery, M. & Leliveld, I. 2004, "Best practices in IT portfolio management", *Mit Sloan Management Review*, vol. 45, no. 3, pp. 41-+.

- Jiang, J.J. & Klein, G. 1999, "Project selection criteria by strategic orientation", *Information & Management*, vol. 36, no. 2, pp. 63-75.
- Jurison, J. 1996, "Toward more effective management of information technology benefits", *Journal of Strategic Information Systems*, vol. 5, no. 4, pp. 263-274.
- Kao, H.P., Wang, B., Dong, J. & Ku, K.C. 2006, "An event-driven approach with makespan/cost tradeoff analysis for project portfolio scheduling", *Computers in Industry*, vol. 57, no. 5, pp. 379-397.
- Kaplan, J.D. 2005, *Strategic IT portfolio management: governing enterprise transformation*.
- Kaulio, M. 2008, "Project leadership in multi-project settings: Findings from a critical incident study", *International Journal of Project Management*, vol. 26, no. 4, pp. 338.
- Kendall, G., Rollins, SC 2003, "Advanced Project Portfolio Management and the PMO: Multiplying Warp Speed", *J. Ross Publishing, Inc. Co-published with International Institute of Learning, Inc.*
- Kester, L., Hultink, E.J. & Lauche, K. 2009, "Portfolio decision-making genres: A case study", *Journal of Engineering and Technology Management*, vol. 26, no. 4, pp. 327-341.
- Kirsch, L.J. 1997, "Portfolios of control modes and IS project management", *Information Systems Research*, vol. 8, no. 3, pp. 215-239.
- Kotani, M. & Iijima, J. 2008, "IT applications portfolio management under business and implementation uncertainty", *Journal of Systems Science and Systems Engineering*, vol. 17, no. 1, pp. 109-124.
- Kulk, G.P. & Verhoef, C. 2008, "Quantifying requirements volatility effects", *Science of Computer Programming*, vol. 72, no. 3, pp. 136-175.
- Kumar, R. 2008, "Information technology portfolio management: literature review, framework, and research issues", *Information resources management journal*, vol. 21, no. 3, pp. 64.
- Kwak, Y.H. & Anbari, F.T. 2009, "Analyzing project management research: Perspectives from top management journals", *International Journal of Project Management*, vol. 27, no. 5, pp. 435-446.
- Lacity, M.C. & Hirschheim, R. 1995, "Benchmarking as a Strategy for Managing Conflicting Stakeholder Perceptions of Information-Systems", *Journal of Strategic Information Systems*, vol. 4, no. 2, pp. 165-185.
- Lam, W. 2005, "An enterprise application integration (EAI) case-study: Seamless mortgage processing at Harmond Bank", *Journal of Computer Information Systems*, vol. 46, no. 1, pp. 35-43.

- Lederer, A.L. & Salmela, H. 1996, "Toward a theory of strategic information systems planning", *Journal of Strategic Information Systems*, vol. 5, no. 3, pp. 237-253.
- Leek, C. 1997, "Information systems frameworks and strategy", *Industrial Management & Data Systems*, vol. 97, no. 3-4, pp. 86-&.
- Liesio, J., Mild, P. & Salo, A. 2008, "Robust portfolio modeling with incomplete cost information and project interdependencies", *European Journal of Operational Research*, vol. 190, no. 3, pp. 679-695.
- Lin, C.H. & Hsieh, P.J. 2004, "A fuzzy decision support system for strategic portfolio management", *Decision Support Systems*, vol. 38, no. 3, pp. 383-398.
- Lint, O. & Pennings, E. 2001, "An option approach to the new product development process: a case study at Philips Electronics", *R & D Management*, vol. 31, no. 2, pp. 163-172.
- Loch, C.H. & Kavadias, S. 2002, "Dynamic portfolio selection of NPD programs using marginal returns", *Management Science*, vol. 48, no. 10, pp. 1227-1241.
- Lycett, M., Rassau, A. & Danson, J. 2004, "Programme management: a critical review", *International Journal of Project Management*, vol. 22, no. 4, pp. 289-299.
- Lyytinen, K. & Mathiassen, L. 1998, "Attention Shaping and Software Risk--A Categorical Analysis of Four Classical Risk Management Approaches", *Information Systems Research*, vol. 9, no. 3, pp. 233-255.
- MacMillan, I.C. & McGrath, R.G. 2002, "Crafting R&D project portfolios", *Research-Technology Management*, vol. 45, no. 5, pp. 48-59.
- Martinsuo, M. & Lehtonen, P. 2007, "Role of single-project management in achieving portfolio management efficiency", *International Journal of Project Management*, vol. 25, no. 1, pp. 56.
- Maylor, H., Brady, T., Cooke-Davies, T. & Hodgson, D. 2006, "From projectification to programmification", *International Journal of Project Management*, vol. 24, no. 8, pp. 663.
- McDonough, E.F. & Spital, F.C. 2003, "Managing project portfolios", *Research-Technology Management*, vol. 46, no. 3, pp. 40-46.
- Mcfarlan, F.W. 1981, "Portfolio Approach to Information-Systems", *Harvard business review*, vol. 59, no. 5, pp. 142-150.
- Medaglia, A.L., Graves, S.B. & Ringuest, J.L. 2007, "A multiobjective evolutionary approach for linearly constrained project selection under uncertainty", *European Journal of Operational Research*, vol. 179, no. 3, pp. 869-894.
- Mikkola, J.H. 2001, "Portfolio management of R&D projects: implications for innovation management", *Technovation*, vol. 21, no. 7, pp. 423-435.

- Mitri, M. 1999, "A DSS for teaching application portfolio management decisions in an information systems class", *Journal of Computer Information Systems*, vol. 39, no. 4, pp. 48-56.
- Morris, P.W.G. 2007, *Wiley Guide to Managing Projects*, John Wiley Sons
- Nieminen, A. & Lehtonen, M. 2008, "Organisational control in programme teams: An empirical study in change programme context", *International Journal of Project Management*, vol. 26, no. 1, pp. 63-72
- Payne, J.H. & Turner, J.R. 1999, "Company-wide project management: The planning and control of programmes of projects of different type", *International Journal of Project Management*, vol. 17, no. 1, pp. 55.
- Payne, J.H., 1995. "Management of multiple simultaneous projects: a state-of-the art-review". *International Journal of Project management* 13 (3), 163-168
- Platje, A. & Seidel, H. 1993, "Breakthrough in multiproject management: How to escape the vicious circle of planning and control", *International Journal of Project Management*, vol. 11, no. 4, pp. 209.
- Platje, A., Seidel, H. & Wadman, S. 1994, "Project and portfolio planning cycle", *International Journal of Project Management*, vol. 12, no. 2, pp. 100.
- Ringuest, J.L., Graves, S.B. & Case, R.H. 2000, "Conditional stochastic dominance in R&D portfolio selection", *IEEE Transactions on Engineering Management*, vol. 47, no. 4, pp. 478-484.
- Rivenbark, W.C., Fitzgerald, K.M. & Schelin, S.H. 2003, "Analyzing information technology investments in state government", *Social Science Computer Review*, vol. 21, no. 4, pp. 497-505.
- Salo, A., Mild, P. & Pentikainen, T. 2006, "Exploring causal relationships in an innovation program with Robust Portfolio Modeling", *Technological Forecasting and Social Change*, vol. 73, no. 8, pp. 1028-1044.
- Scheinberg, M. & Stretton, A. 1994, "Multiproject planning: Tuning portfolio indices", *International Journal of Project Management*, vol. 12, no. 2, pp. 107.
- Schultze, U. & Leidner, D.E. 2002, "Studying Knowledge Management in Information Systems Research: Discourses and Theoretical Assumptions", *MIS Quarterly*, vol. 26, no. 3, pp. 213-242.
- Shehu, Z. & Akintoye, A. 2009, "Construction programme management theory and practice: Contextual and pragmatic approach", *International Journal of Project Management*, vol. 27, no. 7, pp. 703.
- Sia, S.K. & Neo, B.S. 1996, "The impacts of business process re-engineering on organizational controls", *International Journal of Project Management*, vol. 14, no. 6, pp. 341.

- Singh, R., Keil, M. & Kasi, V. 2009, "Identifying and overcoming the challenges of implementing a project management office", *European journal of information systems*, vol. 18, no. 5, pp. 409-427.
- Smeds, R., Haho, P. & Alvesalo, J. 2003, "Bottom-up or top-down? Evolutionary change management in NPD processes", *International Journal of Technology Management*, vol. 26, no. 8, pp. 887-902.
- Spradlin, C.T. & Kutoloski, D.M. 1999, "Action-oriented portfolio management", *Research-Technology Management*, vol. 42, no. 2, pp. 26-32.
- Stamelos, I. & Angelis, L. 2001, "Managing uncertainty in project portfolio cost estimation", *Information and Software Technology*, vol. 43, no. 13, pp. 759-768.
- Stummer, C. & Heidenberger, K. 2003, "Interactive R&D portfolio analysis with project interdependencies and time profiles of multiple objectives", *IEEE Transactions on Engineering Management*, vol. 50, no. 2, pp. 175-183.
- Subramanian, D., Pekny, J.F. & Reklaitis, G.V. 2000, "A simulation-optimization framework for addressing combinatorial and stochastic aspects of an R&D pipeline management problem", *Computers & Chemical Engineering*, vol. 24, no. 2-7, pp. 1005-1011.
- Tseng, C.L., Lin, K.Y. & Sundararajan, S.K. 2005, "Managing cost overrun risk in project funding allocation", *Annals of Operations Research*, vol. 135, no. 1, pp. 127-153.
- Venshosky, D. 1994, "Portfolio Approach to Strategic Management of Ae Firms", *Journal of Management in Engineering*, vol. 10, no. 5, pp. 41-47.
- Verhoef, C. 2002, "Quantitative IT portfolio management", *Science of Computer Programming*, vol. 45, no. 1, pp. 1-96.
- Verhoef, C. 2005, "Quantifying the value of IT-investments", *Science of Computer Programming*, vol. 56, no. 3, pp. 315-342.
- Verhoef, C. 2007, "Quantifying the effects of IT-governance rules", *Science of Computer Programming*, vol. 67, no. 2-3, pp. 247-277.
- Verma, D. & Sinha, K.K. 2002, "Toward a theory of project interdependencies in high tech R&D environments", *Journal of Operations Management*, vol. 20, no. 5, pp. 451-468.
- Vijoen, P.J. & Steyn, H. 2007, "A conceptual model for improved project selection and prioritisation", *South African Journal of Industrial Engineering*, vol. 18, no. 1, pp. 91-106.
- Wagner, S.M. & Johnson, J.L. 2004, "Configuring and managing strategic supplier portfolios", *Industrial Marketing Management*, vol. 33, no. 8, pp. 717-730.

- Wang, J. & Hwang, W.-. 2007, "A fuzzy set approach for R&D portfolio selection using a real options valuation model", *Omega-International Journal of Management Science*, vol. 35, no. 3, pp. 247-257.
- Wateridge, J. 1997, "Training for IS/IT project managers: A way forward", *International Journal of Project Management*, vol. 15, no. 5, pp. 283.
- Webster, J. & Watson, R. 2002, "Analyzing the past to prepare for the future: Writing a literature review", *MIS Quarterly*, vol. 26, no. 2, pp. XIII-XXIII.
- Weill, P. & Aral, S. 2006, "Generating premium returns on your IT investments", *Mit Sloan Management Review*, vol. 47, no. 2, pp. 39-+.
- Weill, P. & Vitale, M. 1999, "Assessing the health of an information systems applications portfolio: An example from process manufacturing", *Mis Quarterly*, vol. 23, no. 4, pp. 601-624.
- Weill, P. & Ross, J.W. 2009, *IT Savvy: What Top Executives Must Know to Go from Pain to Gain*, .
- Whitty, S. & Maylor, H. 2009, "And then came Complex Project Management (revised)", *International Journal of Project Management*, vol. 27, no. 3, pp. 304.
- Winter, M. & Szczepanek, T. 2008, "Projects and programmes as value creation processes: A new perspective and some practical implications", *International Journal of Project Management*, vol. 26, no. 1, pp. 95.
- Woudhuysen, J. 1994, "Tailoring it to the Needs of Customers", *Long range planning*, vol. 27, no. 3, pp. 33-42.
- Wu, L. & Ong, C. 2008, "Management of information technology investment: A framework based on a Real Options and Mean-Variance theory perspective", *Technovation*, vol. 28, no. 3, pp. 122-134.

Appendix A

Classification of the IT PM literature	
<p>Dialogical discourse</p> <p>CHOU DHURY, V. and SABHERWAL (2003).</p> <p>KIRSCH (1997)</p>	<p>Critical Discourse</p> <p>LACITY and HIRSCHHEIM (1995)</p> <p>PLATJE and SEIDEL (1993)</p> <p>PLATJE et. al. (1994)</p>
<p>Interpretive Discourse</p> <p>COOPER and EDGETT (2003)</p> <p>BLICHFELDT and ESKEROD (2008)</p> <p>ESKEROD (1996)</p> <p>LAM (2005)</p> <p>MITRI (1999)</p>	<p>Normative Discourse</p> <p>AGARWAL et. al (1994)</p> <p>AGRESTI and HARRIS (2009)</p> <p>ANDERSEN and JESSEN (2003)</p> <p>ANGELOU and ECONOMIDES (2008)</p> <p>ARCHER and GHASEMZADEH (1999).</p> <p>BAI and PIGOTT (2004)</p> <p>BARCZAK and KAHN (2009).</p> <p>BARDHAN, BAGCHI and SOUGSTAD (2004).</p> <p>BITMAN and SHARIF (2008)</p> <p>BREDILLET (2008)</p> <p>CANEZ and GARFIAS (2006).</p> <p>CARON and RIGAMONTI (2007)</p> <p>CHOU and TZENG (2006)</p> <p>CLINE and GUYNES (2001)</p> <p>COMAN and RONEN (1995).</p> <p>COOPER K.G. et. al. (2002)</p> <p>COOPER and KLEINSCHMIDT (2004)</p> <p>COOPER et al. (2002).</p> <p>COOPER et. al (2000)</p> <p>COOPER (2006)</p>

	<p>COSTA et. al. (2007)</p> <p>CULLEN et. al. (2005)</p> <p>DE REYCK et. al (2005)</p> <p>DEMAIO et. al. (1994)</p> <p>DICKINSON et. al. (2001)</p> <p>DOERNER et. al. (2006)</p> <p>EDEN et. al.(2000).</p> <p>ELONEN and ARTTO (2003)</p> <p>EVELEENS and VERHOEF (2009)</p> <p>FERNANDES and VALDIVIEZO (1997)</p> <p>FLORICEL and IBANESCU (2008)</p> <p>GERALDI (2008)</p> <p>GHASEMZADEH et. al. (1999)</p> <p>GHASEMZADEH and ARCHER (2000)</p> <p>GIROTRA et. al (2007).</p> <p>GLICKMAN (2008)</p> <p>GOKHALE and BHATIA (1997)</p> <p>GRAVES et. al.(2000)</p> <p>GUSTAFSSON and SALO (2005)</p> <p>HAMILTON (1999)</p> <p>HAWLITZKY et. al. (2000)</p> <p>HENDRIKS et. al. (1999)</p> <p>HENRIKSEN and TRAYNOR (1999)</p> <p>HERBOTS et. al. (2007)</p> <p>HERFERT and ARBIGE (2008)</p> <p>JEFFERY and LELIVELD (2004)</p> <p>JIANG, and KLEIN (1999)</p> <p>JURISON (1996)</p>
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	<p>KAO et. al (2006)</p> <p>KAULIO (2008)</p> <p>KESTER et. al. (2009)</p> <p>KOTANI and IJIMA (2008)</p> <p>KULK and VERHOEF (2008)</p> <p>KWAK and ANBARI (2009)</p> <p>LEDERER and SALMELALEEK (1997)</p> <p>LEEK (1997)</p> <p>LIESIO et. al. (2008)</p> <p>LIN and HSIEH (2004)</p> <p>LINT and PENNINGS (2001)</p> <p>LYCETT et al. (2004)</p> <p>LOCH and KAVADIAS (2002)</p> <p>MACMILLAN and MCGRATH (2002)</p> <p>MARTINSUO and LEHTONEN (2007)</p> <p>MAYLOR et. al. (2006)</p> <p>MCDONOUGH and SPITAL (2003)</p> <p>MCFARLAN (1981)</p> <p>MEDAGLIA et. al. (2007)</p> <p>MIKKOLA (2001)</p> <p>NIEMINEN and LEHTONEN (2008)</p> <p>PAYNE and TURNER (1999)</p> <p>RINGUEST et. al.(2000)</p> <p>RIVENBARK (2003)</p> <p>SALO (2006)</p> <p>SCHEINBERG and STRETTON (1994)</p> <p>SHEHU and AKINTOYE (2009)</p> <p>SIA and NEO (1996)</p>
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	<p>SMEDS et. al. (2003)</p> <p>SPRADLIN and KUTOLOSKI (1999)</p> <p>STAMELOS and ANGELIS (2001)</p> <p>STUMMER and HEIDENBERGER (2003)</p> <p>SUBRAMANIAN et. al. (2000)</p> <p>TSENG (2005)</p> <p>VENSHOSKY (1994)</p> <p>VERHOEF (2007)</p> <p>VERHOEF (2005)</p> <p>VERHOEF (2002)</p> <p>VERMA and SINHA (2002)</p> <p>VIJOEN and STEYN (2007)</p> <p>WAGNER and JOHNSON (2004)</p> <p>WANG and HWANG (2007)</p> <p>WATERIDGE (1997)</p> <p>WEILL and ARAL(2006)</p> <p>WEILL and VITALE (1999)</p> <p>WHITY and MAYLOR (2009)</p> <p>WINTER and SZCZEPANEK (2008)</p> <p>WLOUDHUYSEN (1994)</p> <p>WU and ONG (2008)</p>
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Appendix B

IT PM literature included in the sample and the journals are listed in alphabetic order and the article are listed in chronological order. The data in the column “research field” are determined on the background of the list from Association of Information Systems (May 2011).

Journal	Research field	Author(s)	Title
<i>Annals of Operations Research</i>	Outside the field of IS	Tseng et. al. (2005),	Managing cost overrun risk in project funding allocation
<i>Computers & Chemical Engineerig</i>	Outside the field of IS	Subramanian et. al. (2000)	A simulation-optimization framework for addressing combinatorial and stochastic aspects of an R&D pipeline management problem
<i>Computers in Industry</i>	Outside the field of IS	Kao et. al. (2006)	An event-driven approach with makespan/cost tradeoff analysis for project portfolio scheduling
<i>Decision Support Systems</i>	Inside the field of IS	Ghasemzadeh and Archer (2000)	Project portfolio selection through decision support",
		Lin and Hsieh (2004)	A fuzzy decision support system for strategic portfolio management
<i>European Journal of Operational Research</i>	Inside the field of IS	Demaio et. al. (1994)	A Multi-Project Management Framework for New Product Development
		Chou et. al. (2006)	Evaluating IT/IS investments: A fuzzy multi-criteria decision model approach
		Doerner et. al. (2006)	Pareto ant colony optimization with ILP preprocessing in multiobjective project portfolio selection
		Medaglia et. al.	A multiobjective evolutionary approach for linearly

		(2007)	constrained project selection under uncertainty
		Glickman (2008)	Program portfolio selection for reducing prioritized security risks
		Liesio et. al. (2008)	Robust portfolio modeling with incomplete cost information and project interdependencies
<i>Harvard business review</i>	Inside the field of IS	McFarlan (1981)	Portfolio Approach to Information-Systems
<i>IEEE Transactions on Engineering Management</i>	Inside the field of IS	Henriksen and Traynor (1999)	A practical R&D project-selection scoring tool
		Ringuest (2000)	Conditional stochastic dominance in R&D portfolio selection
		Dickinson et. al. (2001)	Technology portfolio management: Optimizing interdependent projects over multiple time periods
		Stummer and Heidenberger (2003)	Interactive R&D portfolio analysis with project interdependencies and time profiles of multiple objectives
		Angelou and Economides (2008)	A decision analysis framework for prioritizing a portfolio of ICT infrastructure projects
		Bitman and Sharif (2008)	A conceptual framework for ranking R&D projects
		Agresti et. al. (2009)	Practical Profiles for Managing Systems Engineering R&D
<i>Industrial Management & Data Systems</i>	Outside the field of IS	Leek (1997)	Information systems frameworks and strategy
<i>Industrial Marketing</i>	Inside the field of IS	Wagner and	Configuring and managing

<i>Management</i>		Johnson (2004)	strategic supplier portfolios
<i>Information & Management</i>	Outside the field of IS	Agarwal et al (1994)	Mis Planning - a Methodology for Systems Prioritization
		Jiang and Klein (1999)	Project selection criteria by strategic orientation
<i>Information and Software Technology</i>	Inside the field of IS	Stamelos and Angelis (2001)	Managing uncertainty in project portfolio cost estimation
<i>Information Systems Research</i>	Inside the field of IS	Kirsch (1997)	Portfolios of control modes and IS project management
		Choudhury and Sabherwal (2003)	Portfolios of control in outsourced software development projects
<i>International Journal of Production Research</i>	Outside the field of IS	Coman and Ronen (1995)	Information Technology in Operations Management - a Theory-Of-Constraints Approach
<i>International Journal of Project Management</i>	Outside the field of IS	Platje and Seidel. (1993)	Breakthrough in multiproject management: How to escape the vicious circle of planning and control
		Platje and Seidel. (1994)	Project and portfolio planning cycle
		Scheinberg and Stretton (1994)	Multiproject planning: Tuning portfolio indices
		Eskerod (1996)	Meaning and action in a multi-project environment: Understanding a multi-project environment by means of metaphors and basic assumptions
		Sia and Neo (1996)	The impacts of business process re-engineering on organizational

			controls
		Gokhale and Bhatia (1997)	A project planning and monitoring system for research projects
		Wateridge (1997)	Training for IS/IT project managers: A way forward
		Archer and Ghasemzadeh (1999)	An integrated framework for project portfolio selection"
		Hendriks et. al. (1999)	Human resource allocation in a multi-project R&D environment
		Payne and Turner (1999)	Company-wide project management: The planning and control of programmes of projects of different type
		Cooper K.G. et. al. (2002)	Learning to learn, from past to future
		Andersen and Jessen (2003)	Project maturity in organizations
		Elonen and Artto (2003)	Problems in managing internal development projects in multi-project environments
		Lycett et. al. (2004)	Programme management: a critical review
		De Reyck et. al. (2005)	The impact of project portfolio management on information technology projects
		Maylor (2006)	From projectification to programmification
		Caron and Rigamonti (2007)	Engineering and contracting projects: A value at risk based approach to portfolio balancing
		Martinsuo and Lehtonen, (2007)	Role of single-project management in achieving portfolio management efficiency

		Geraldi (2008)	The balance between order and chaos in multi-project firms: A conceptual model
		Blichfeldt and Eskerod (2008)	Project portfolio management - There's more to it than what management enacts
		Bredillet (2008)	Learning and acting in project situations through a meta-method (MAP) a case study: Contextual and situational approach for project management governance in management education
		Kaulio (2008)	Project leadership in multi-project settings: Findings from a critical incident study
		Nieminen and Lehtonen (2008)	Organisational control in programme teams: An empirical study in change programme context
		Winter and Szczepanek (2008)	Projects and programmes as value creation processes: A new perspective and some practical implications
		Kwak and Anbari (2009)	Analyzing project management research: Perspectives from top management journals
		Shehu and Akintoye (2009)	Construction programme management theory and practice: Contextual and pragmatic approach
		Whitty and Maylor (2009)	And then came Complex Project Management
<i>International Journal of Technology Management</i>	Inside the field of IS	Fernandes and Valdiviezo (1997)	Total cost management of interdependent projects
		Smeds et. al. (2003)	Bottom-up or top-down? Evolutionary change

			management in NPD processes
<i>Journal of Computer Information Systems</i>	Inside the field of IS	Mitri (1999)	A DSS for teaching application portfolio management decisions in an information systems class
		Cline and Guynes (2001)	A study of the impact of information technology investment on firm performance
		Lam (2005)	An enterprise application integration (EAI) case-study: Seamless mortgage processing at Harmond Bank
<i>Journal of Engineering and Technology Management</i>	Inside the field of IS	Kester et. al. (2009)	Portfolio decision-making genres: A case study
<i>Journal of Information Technology</i>	Inside the field of IS	Hamilton (1999)	Linking strategic information systems concepts to practice: systems integration at the portfolio level
<i>Journal of Management in Engineering</i>	Outside the field of IS	Venshosky (1994)	Portfolio Approach to Strategic Management of Ae Firms
<i>Journal of Management Information Systems</i>	Inside the field of IS	Bardhan et. al. (2004)	Prioritizing a portfolio of information technology investment projects
<i>Journal of Operations Management</i>	Outside the field of IS	Verma and Sinha (2002)	Toward a theory of project interdependencies in high tech R&D environments
<i>Journal of Product Innovation Management</i>	Outside the field of IS	Barczak et. al (2009)	PERSPECTIVE: Trends and Drivers of Success in NPD Practices: Results of the 2003 PDMA Best Practices Study"
<i>Journal of Professional Issues in</i>	Outside the field of IS	Bai and Pigott (2004)	Assessing outcomes using program assessment portfolio approach

<i>Engineering Education and Practice</i>			
<i>Journal of Strategic Information Systems</i>	Inside the field of IS	Lacity and Hirschheim (1995)	Benchmarking as a Strategy for Managing Conflicting Stakeholder Perceptions of Information-Systems
		Jurison (1996)	Toward more effective management of information technology benefits
		Lederer and Salmela (1996)	Toward a theory of strategic information systems planning
		Cullen et. al. (2005)	IT outsourcing configuration: Research into defining and designing outsourcing arrangements
<i>Journal of Systems and Software</i>	Inside the field of IS	Costa et. al. (2007)	
<i>Journal of Systems Science and Systems Engineering</i>	Outside the field of IS	Kotani and Iijima (2008)	IT applications portfolio management under business and implementation uncertainty
<i>Journal of the Operational Research Society</i>	Outside the field of IS	Eden et. al. (2000)	The role of feedback dynamics in disruption and delay on the nature of disruption and delay (D&D) in major projects
		Ghasemzadeh et. al. (1999)	A zero-one model for project portfolio selection and scheduling
<i>Long range planning</i>	Outside the field of IS	Woudhuysen (1994)	Tailoring it to the Needs of Customers
<i>Management Science</i>	Inside the field of IS	Loch and Kavadias (2002)	Dynamic portfolio selection of NPD programs using marginal returns

		Girotra et. al. (2007)	Valuing R&D projects in a portfolio: Evidence from the pharmaceutical industry
<i>Mis Quarterly</i>	Inside the field of IS	Weill and Vitale. (1999)	Assessing the health of an information systems applications portfolio: An example from process manufacturing
<i>MIT Sloan Management Review</i>	Inside the field of IS	Jeffery and Leliveld (2004)	Best practices in IT portfolio management
		Weill and Aral (2006)	Generating premium returns on your IT investments
<i>Naval Research Logistics</i>	Outside the field of IS	Herbots et. al. (2007)	Dynamic order acceptance and capacity planning on a single bottleneck resource
<i>Omega-International Journal of Management Science</i>	Outside the field of IS	Wang and Hwang (2007)	A fuzzy set approach for R&D portfolio selection using a real options valuation model
<i>Operations research</i>	Inside the field of IS	Gustafsson (2005)	Contingent portfolio programming for the management of risky projects
<i>Product Focused Software Process Improvement</i>	Outside the field of IS	Hawlitzy et. al. (2000)	Managing distributed software development - A portfolio based methodology
<i>R & D Management</i>	Outside the field of IS	Lint and Pennings (2001)	An option approach to the new product development process: a case study at Philips Electronics
		Florice and Ibanescu (2008)	Using R&D portfolio management to deal with dynamic risk
<i>Research-Technology Management</i>	Outside the field of IS	Spradlin and Kutoloski (1999)	Action-oriented portfolio management
		Cooper et. al.	New problems, new solutions:

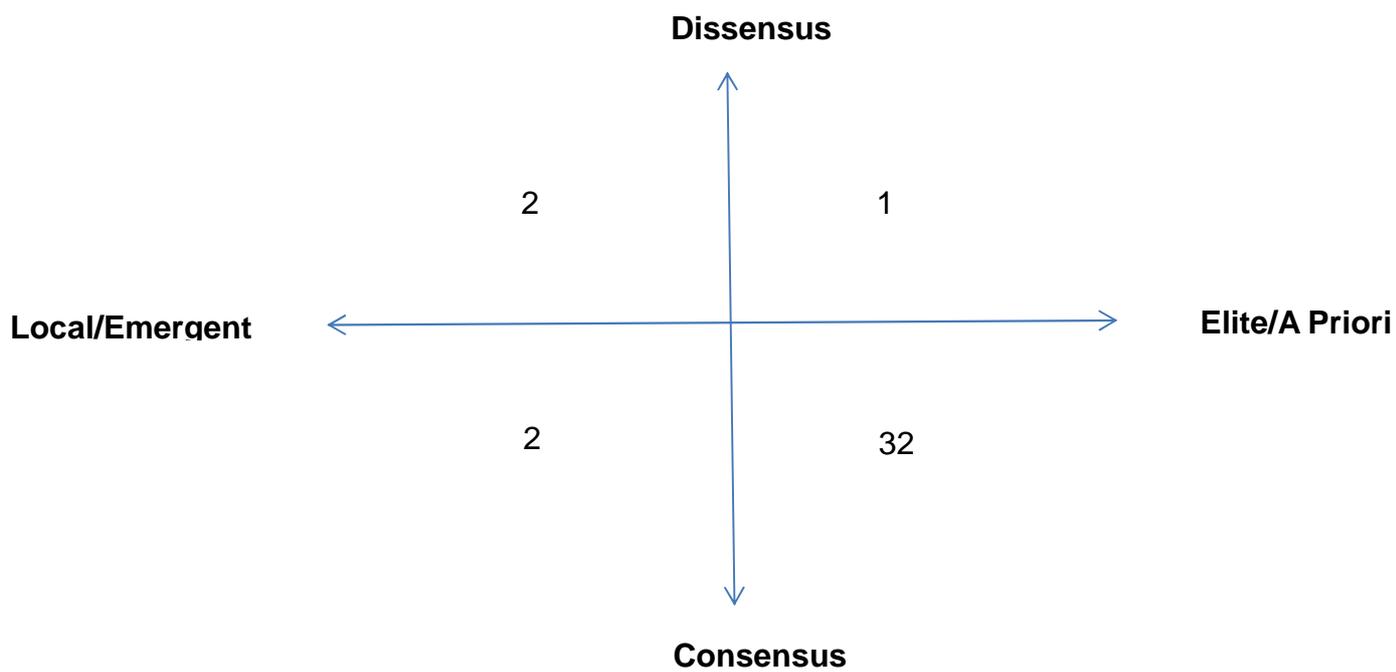
		(2000)	Making portfolio management more effective
		Graves et. al. (2000)	Formulating optimal R&D portfolios
		Cooper et. al (2002)	"Optimizing the stage-gate process: What best-practice companies do - II",
		MacMillan and McGrath (2002)	Crafting R&D project portfolios
		Cooper and Edgett (2003)	Overcoming the crunch in resources for new product development
		McDonough and Spital (2003)	Managing project portfolios
		Cooper et. al. (2004)	Benchmarking best NPD practices-II
		Canez and Garfias (2006)	Portfolio management at the Mexican Petroleum Institute
		Cooper (2006)	xManaging technology development projects
		Herfert and Arbige (2008)	Aligning an R&D portfolio with corporate strategy
<i>Science of Computer Programming</i>	Outside the field of IS	Verhoef (2002)	Quantitative IT portfolio management
		Verhoef (2005)	Quantifying the value of IT-investments
		Verhoef, (2007)	Quantifying the effects of IT-governance rules
		Kulk and Verhoef (2008)	Quantifying requirements volatility effects
		Eveleens and Verhoef (2009)	Quantifying IT forecast quality

<i>Social Science Computer Review</i>	Outside the field of IS	Rivenbark et. al. (2003)	Analyzing information technology investments in state government
<i>South African Journal of Industrial Engineering</i>	Outside the field of IS	Vijoen and Steyn (2007)	A conceptual model for improved project selection and prioritization
<i>Technological Forecasting and Social Change</i>	Outside the field of IS	Salo et. al. (2006)	Exploring causal relationships in an innovation program with Robust Portfolio Modeling
<i>Technovation</i>	Outside the field of IS	Mikkola (2001)	Portfolio management of R&D projects: implications for innovation management
		Wu and Ong (2008),	Management of information technology investment: A framework based on a Real Options and Mean-Variance theory perspective

Figure 8: The stock of 107 Articles ordered by journal

Appendix C

The distribution of the 37 articles that originate from the field of IS (According to the list from Association of Information Systems (AIS) anno June 2011).



From Deetz (1996)

Figure 9: Distribution of the 37 articles from the field of IS in framework by Deetz (1996)

Priming a Pilot Implementation: Experiences From an Effects Specifications Workshop

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Abstract. *We report on the initial findings of an exploratory action research study about effects specifications using the systems development method Effects-driven IT development. It is part of a larger IS pilot implementation project conducted in the Danish healthcare sector. Through interviews and a workshop we have identified and specified effects that comprise the basis for an evaluation of the project between several organisational agents with diverse professional backgrounds. Gathering organisational participants at a workshop with a common goal of discussing and prioritizing a finished list of effects has proved to be a valuable approach to create mutual learning process amongst the participants and the facilitators of the workshop. The challenges we experienced during the effects specification process were to balance a dichotomous focus between on one hand the visions of the participants and on the other hand the limitations of the IT artefact functionality to be evaluated.*

Key words: effects-driven IT development, effects specifications, effects-driven workshop, pilot implementation, action research

1 Introduction

Introducing Information Technology (IT) in an organisation often causes bigger organisational changes of for example work practices, procedures or resources, also referred to as a *technochange* [1] or a *socio-technical change* [2]. A (socio)technochange is about changes of organisational performance through integration of organisation and IT. However, neither traditional IT management nor organisational change management are equipped to handle technochange very well. In traditional IT projects there is often a one-sided focus on developing the system within budget and deadline and organisational implementation is not considered a part of the project [1]. Organisational change management on the other hand tends to have a focus on work practices being affected by the IT system, for example by motivation or upgrading skills rather than a task of making design and organisation fit together [1]. This gap between development

and implementation has at least two disadvantages. First of all the effect of IT on work practice does not fully emerge until it is in operation. New work processes and organisational changes may occur once the system is being used, which were not previously planned for [3]. This could lead to a misfit between IT-system and organisation. Secondly, the risk of misfit could cause the users to make workarounds to make their work practice fit the system or in worst case abandon the system because it does not provide the necessary support. Hence there is a risk that the organisation will not harvest the benefits originally planned for [1].

One way of bridging the gap between technical development and organisational change management in work systems, and seizing emergent changes, is to use *effects-driven IT development* (EDIT) as introduced by Hertzum and Simonsen [4][5]. Inspired by “Benefits management” [6] and “Technochange” [1], EDIT is based on the notion that IT can be used to drive organisational changes and it aims at systematically capturing the benefits achieved through the changes invoked by the new IT system. While the benefits in benefits management are normally refined into functionality evaluated at the end of the project, EDIT specifies benefits in terms of effects, and does this formatively throughout the project.

An effect is understood as usage effects, a change caused by the use of the system [5]. An example of an effect could be physicians saving time registering patient information into an electronic patient record to managerial satisfaction of the performance of new work practices. To assess whether the benefits are achieved EDIT suggests a participatory and iterative approach in three phases, where 1) effects are specified; 2) specified effects are used to evaluate whether the system supports the changes; and 3) the assessment and evaluation of the effects provides feedback for further development of the IT system. This way the effects become an instrument for managing the gap between development and implementation.

Since effects can serve multiple purposes for multiple users, the meaning that users assign to effects is context dependent. To gain knowledge of the desired effects of different user groups involved in an effects specification Simonsen and Hertzum have suggested a Participatory Design process [7] and they argue for the use of an effect hierarchy containing five levels of effects to guide the process [5]:

1. *Environment*: The highest abstraction level, including legislation and political demands.
2. *Business strategy*: Stating the organisation-wide strategy for good performance.
3. *Work tasks*: The organisation of work that fulfils the business strategy.
4. *Work processes*: The concrete processes of how work tasks are fulfilled using a variety of tools, among other IT systems.
5. *IT systems*: The tools that enable the fulfilment of work processes.

The effect hierarchy is used to structure and understand how effects intermingle and relate to each other at different level and across users. A political demand on level one could for example be: Overall better quality and a broader coverage of quality of prehospital patient care, while a level three effect could be: “Ambulance crew spends less time at the emergency department.” A level five effect could be: “Automatic integration between medical recording equipment and electronic patient record”.

During the effects specification it is central that the users using the system identify and specify effects on the higher abstraction levels of the hierarchy and connect them with effects on the lower and operational levels. The hierarchy, however, can be a difficult and abstract tool for explaining an effect, and so the desired effects must be specified in a measurable and meaningful way that describes the anticipated outcome of the evaluation [8].

For an easier way for users to understand and focus on desired effects Granlien [8] and Barlach & Simonsen [9] have developed and tested different tools, which include effect cards and an effect map. While Barlach & Simonsen specified effects with a relatively homogeneous group of users, ending up with a prototype design for attaining the desired effects, Granlien worked with a heterogeneous group of participants from management to end-users within the same department and used this effect specification as an evaluation tool.

In this paper we will further explore the effects specification process in a pilot implementation project conducted in the Danish Health care that is concerned with use of an electronic ambulance record (EAR) in prehospital care. What makes this project differ from previous research is that effects are specified through a heterogeneous user group on different management levels and across profession as well as place of employment. Our research question is: *“What are the challenges and opportunities of facilitating an effects specification process in a setting that involves multiple participants from diverse professions?”*

The paper is structured so that we firstly describe our methodical reflections, explaining how we have conducted the research as an action research project. Next we will present our results regarding our research question, analysing challenges and learning points from the effects specification process. From here we will discuss and reflect on our approach and the central questions raised afterwards.

2 Method

Effects-driven IT development is a fairly new approach that has not been widely incorporated into the field of practitioners. Hence in order to gain knowledge about the effects specification processes we have adopted an action research (AR) approach, which calls for interventions and active participation in the field of research. To consciously work with and to differentiate between research contribution and practical problem solving we use AR as presented by McKay and Marshall who describe AR as two parallel cycles; the research and the problem

solving cycle [10]. Thus the purpose of AR is double-sided: While providing empirical data about effects specification processes contributing to our research it also creates room for mutual learning processes between researchers and practitioners during problem solving [11][12]. The problem we have engaged in solving for the client is the evaluation of the EAR project. Using EDIT as our problem solving method for intervention, the problem solving cycle and research cycle coincides with the research contribution to existing literature on EDIT by exploring the effects specification process in a new setting. Our intervention in this process is through a participatory design inspired effects specification workshop where our main data are constructed. In addition we also conducted interviews prior to the workshop to familiarize ourselves with the prehospital practice.

2.1 Problem solving area

Our field of intervention is the ongoing EAR pilot project. The project is conducted by two regions in Denmark, where EAR will be installed in 17 paramedical ambulances to provide better documentation of the prehospital care and support collaboration between ambulance crew and clinical staff at the emergency department. The EAR in short is a mobile touch screen mounted in the ambulance envisioned to support the ambulance crew in documenting and sharing information about the patients when treated. The EAR is going to replace the existing practice using pen and paper-based records and the evaluation of the EAR should reveal some of the effects of introducing this new IT system. The ambulance crew will ensure input about patient condition to the system while the emergency department personnel will use the system as output for managing resources and preparations. Our role in the project is primarily to manage the effects specification and evaluate these effects during the pilot project.

As our participatory design approach is rooted in the Scandinavian critical approach [13], the primary agents we focus on are those whose work practices are influenced by the EAR:

1. Two different ambulance contractors of the region who put their ambulances at disposal
2. The ambulance control centre of the region, which manages the ambulance runs
3. The emergency departments in the region
4. The contractor of the electronic ambulance record who put their system at disposal

By “agents” we refer to those individuals who will be affected by the EAR (e.g. management, ambulance crew etc.). We further use the term “users”, and “participants” by denoting “users” as those who will be interacting with the IT artefact, and “participants” as those who will participate in our effects specification process.

For the remainder of this section we will give a more detailed description of the various activities performed while gathering empirical data. The activities fall

into three stages: preliminary examination, preparing for the workshop, and the workshop.

2.2 Stage 1: Preliminary examination

To get acquainted with prehospital care, we conducted semi-structured interviews prior to the effect workshop with the participants. This included 12 interviews with two emergency medical dispatchers from the ambulance control centre, two superiors and three paramedics from the two ambulance contractors, and four clinicians from two emergency departments (two head physicians and two nurses). Our assumption was that end-users such as ambulance crew and clinical personnel would represent effects on level four and five, while their superiors would represent effects on level two and three. For this reason we interviewed a lawyer from the region representing the political effects. All interviews were held over the course of 16 days and they were conducted at the workplace of the interviewees. The interviews were audio-recorded and thorough notes were taken during and after each interview. The interviews lasted between 40 minutes to two hours, depending on the time available and the enthusiasm of the participants.

Interviews were chosen because we wanted to learn about the participants' professional backgrounds and to introduce the participants to the concept of effects. Interviews would also give us the opportunity to introduce our own roles as researchers and evaluators of the IT artefact. This way they would know that the workshop would be in accordance with the interviews and represent a forum for specifying effects and not functionality. Our goal was to end up with a "pool" of effects that during the workshop could be specified and prioritized.

For the interviews we prepared an semi-structured interview guide that would encourage the participant to openly discuss their use of current paper based records and how they expected or wanted the EAR to have an impact on their future work practice. A "rich picture" of the process of an emergency call and where the EAR subsequently would be included in the process was used to spark reflections on what effects to be evaluated, why and who to involve and also to provide a shared frame of reference.

During the interviews we would make use of hermeneutic elements by reformulating wishes into effects, for example by asking "So when you say you want to be satisfied with your work, why is this important, what problem is this rooted in?" This technique allowed us to follow up on and interpret statements on the fly to make sure that we created a mutual understanding between us.

2.3 Stage 2: Preparing for the workshop

From the interviews we extracted a list of effects to present at the workshop. The interviewees explicitly mentioned most effects while other effects emerged through the hermeneutic process in the interviews or afterwards in our interpretation of the interview. The list amounted to a total of 113 effects. To reduce

the list to a more workable size, we iterated through the list three times. First we grouped effects according to subject. A simple open coding process processed each effect into a group: reading the list of effects once and continuously writing down categories [14].

In the second iteration we discussed the categories and each effect would be placed into a group while doublets would be deleted. In the last iteration effects were clustered according to either agents or work types present in the effects. Due to overlapping effects this was not an easy task. For example the effect: “Patient gets a better experience of the prehospital treatment” would primarily be clustered in the category “Patient treatment” but since the effect emanated from the problem that “The same information about the patient trajectory is repeated several times during prehospital care”, we chose to cluster it in the category “communication”.

Using this method, we eliminated 44 effects and ended up with 69 effects divided into seven groups:

1. Communication (22 effects)
2. Education (3 effects)
3. Patient treatment (12 effects)
4. Documentation (13 effects)
5. Time (9 effects)
6. Working conditions (7 effects)
7. Miscellaneous (3 effects)

Finally we listed the effects describing for each a) the effect, b) the problem(s) the effect was grounded in, and c) the agent(s) that the effect would affect. This meant that different problems by different agents could sometimes point to the same desired effect, creating a common context to reason the effect from.

2.4 Stage 3: The Workshop

The workshop lasted for six hours and a total of eight of the twelve interviewees were able to participate; two superiors and three paramedics from the two ambulance contractors, two head clinicians, and one emergency medical dispatcher. The workshop started out with a presentation of the system, performed by a salesperson from the IT vendor. The presentation was supposed to satisfy the users’ thirst for information, since no one until now had informed the participants of the functionality of the IT artefact and time frame. In the introduction we included a short presentation of the political effects, since they were not mentioned in the list of effects. This was done in an attempt to consolidate the high level of effects with the low levels of the effects hierarchy between the users, which Hertzum and Simonsen (2011) recommends [5].

To increase mutual learning between the participants, the central part of the workshop consisted of group discussions, where the participants would have to discuss what effects they would prioritize for the evaluation. Each participant would be able to present her/his own reasons for the importance of the effect and learn from other participants’ points of view. Due to concerns regarding power

struggles between the participants, we split them evenly into two heterogeneous groups, so each group contained at least one physician, one paramedic, one superior from the contractors and one emergency medical dispatcher. However, only one emergency medical dispatcher showed up, thus one group contained two paramedics instead.

The list of effects was split into two parts due to concerns that the groups would not be able to discuss all effects within the given timeframe. One group would discuss the categories: communication, education, patient treatment and the other group documentation, time, working conditions and miscellaneous.

One of the goals of the workshop was to end up with a list of 20 manageable effects, and so we suggested them to vote for ten effects per group. Two of the three researchers would facilitate each group while the third would move between groups, taking notes and watching the time. Before the workshop we had created a facilitation guide for how to discuss each effect. Much like a semi-structured interview guide, each effect would be discussed according to SMART goals inspired by Granlien [8] and Barlach [9]; *what* the effect entailed (S), *who* it involved (S), *how* to evaluate the effect (M), the *importance* of the effect (A), whether the effect was *realistic* in the given period (RT), and *what barriers* (R) would exist that may prohibit the realization of the effect. The participants were meant to fill out a card per effect with the abovementioned questions answered, and the facilitators of the workshop used the cards as means to exhaust the description of each effect.

The 20 effects that were chosen represented six groups with:

1. Communication: 6 effects
2. Education: 2 effects
3. Patient treatment: 2 effects
4. Documentation: 5 effects
5. Time: 4 effects
6. Working conditions: 1 effect

At the end of the workshop we agreed to return a finished list of effects to the participants as well as minutes of the meeting detailing activities and decisions made.

3 Results

In the following section we present the challenges of specifying and prioritizing effects and we discuss some of the most important lessons learned from the process.

3.1 Interviews influence the type and amount of effects

We experienced that participant background and context played an important part in the outcome of the interviews. The participants' existing knowledge of

current technology enabled them to specify effects at level five (functionality) and they had many suggestions for the physical design of the IT artefact. In these situations we reshaped the specific effects by asking questions such as: “Why is this relevant” or “What do you want to achieve in your work by doing this?” but often it was very difficult to make the participants relate to this.

However, for the participants who would be using the system, we found it challenging to keep a rigid structure of the interviews since many of the participants had a strong desire for the new technology, and were very motivated for the project. As one participant declared: “Im being affected by the EAR in many ways and I welcome this very positively”, and another paramedic uttered: “We have been waiting for this technology for almost five years”. Their impatience with getting their desires off their chest also made them eager to go to the next wish instead of reflecting on the importance of the effect. Thus they had a lot of input to possible effects and sometimes it was difficult to facilitate the specification because they almost flooded us with information. As a response we changed the interview strategy. We would give the participants a chance to get everything off their chest at first, encouraging them to talk unstructured about what they wanted with the new IT artefact. Meanwhile we would take notes and once the participant was done we would elaborate on each of their wishes one by one and rephrase them to effects through mutual interpretation. This enabled us to make structured notes and ask clarifying questions without losing track.

Interviews proved efficient as a means to gather the diverse group of visions of the EAR technology. This was due to: (1) the structure and goal of the interviews was uncritically to gather effects and introduce effects as the idea of evaluation to the participants; (2) the participants were highly motivated to provide information; (3) the uncritical list of effects would be specified further at the workshop.

3.2 The setup of the technology influences choice of effects

We experienced that many effects were not prioritized during the workshop as a result of limitations of functionality of the IT artefact. In the interview we had avoided talking about the functionality of the EAR. This was done deliberately from our side in order to not act as barriers during the interviews. However, as all participants wished for knowledge about the functionality of the technology, we invited the vendor to answer pressing questions that the participants might have. This resulted in a long discussion going on for more than one and a half hour until we had to stop the participants. One of the ambulance crew declared that it was crucial information to him what the system could and could not do, because this made it much easier to choose which effects were important to him.

By not revealing functionality a lot of time may have been wasted on specifying irrelevant effects that had no merit. However, even though some effects were deemed irrelevant to the evaluation at the time of the workshop, they were still prioritized very highly amongst all the participants. Two of these effects were level five effects: 1) “integration with electronic medical equipment and automatic recording into the EAR”, and 2) “integration with the electronic

whiteboards on the ED". While it was not a planned function of the IT artefact the prioritization round showed both management and the contractor that integration between equipment would grant the participants value in their work, and money was contributed so that this functionality could be implemented iteratively during the period.

We learned that the functionality of the planned pilot implementation was an obstacle for the visions that the participants had, and learned that informing all participants about planned functionality of the IT artefact plays an important role in framing the prioritization of effects. However, it is difficult to point out when in the process this information should be communicated and how to do this to manage expectations properly.

3.3 Political effects influence choice of effects

We experienced that the political effects on level one would affect the participants' choice of effects. The influence, however, did not result in lower level effects that would support the political ones. One of the ambulance contractor superiors mentioned that due to the limitations of the technology he was more inclined to prioritize effects supporting the political agenda instead of reformulating lower level effects based on the higher level effects. Incidentally, the other members of his group found this aggravating. We believe this choice to be a trade-off between financial factors and factors based on the perceived value of work practice. If focus were on the political effects and how to achieve these, the ambulance contractor would keep the contract and this would prove an important motivational factor. By splitting up specifications of respectively level one effects and the other levels we experienced a conflict between the political effects and participants' visionary effects because the lower level effects must be custom fitted retrospectively to the political ones. This ran the risk of not facilitating learning processes between all participants. This could end up disastrous for the integration of the technology with the ambulance crews work because the technology would not grant any value to the primary users.

3.4 Effects to bridge tolerance and understanding between participants?

We experienced very positive results by putting together a diverse group of participants. The workshop not only worked as a tool to prioritize effects but just as much an activity for networking within the user organisations. Many of the participants had never met before but now realized who each other was. During the group task we saw several examples of how other users uttered preconceived attitudes towards the ambulance crew and their work, only to silence themselves afterwards when the ambulance crew pointed out the importance of the effect in their own work. In one instance a participant contested that the ambulance crew should use touch screen-based keyboards to work with the EAR, but due to

protests from several of the ambulance crew, the particular participant changed his mind. It was decided that typing in an ambulance going 80 mph using a pen on a vertical touchscreen was not considered “easy”.

We interpret this to convey that the list of effects worked as a bridge between different understandings that helped facilitate mutual learning between the participants. We also saw mutual learning actively used by participants in the example from earlier regarding integration between medical equipment. Here vendor, management and ambulance paramedics created a common understanding of the importance of the functionality in the work practice.

4 Discussion

In this exploratory action research project we have investigated the research question: “What are the challenges and opportunities of facilitating an effects specification process in a setting that involves multiple participants from diverse professions?”

Our goal was to let participants who would be influenced by the IT artefact generate, specify and prioritize effects while at the same time learn about the diverse backgrounds and reasons for choosing the effects. The goals were only partially met and while having a list of 20 effects, many of them overlapped and needed further interpretation from our side in order to operationalize. This can be explained by our choice of using interviews to generate the first batch of effects. This resulted in a dichotomous focus between on one hand dreams and visions of the participants’ work practice with new technology and on the other hand a focus on a finished product that needed to be evaluated that actually limited many of the visions.

The dichotomy problem we experienced may be due to several factors. For one, our choice of performing interviews before the workshop may have unnecessarily clouded the effects specification process, since the goal of the interviews was both to learn about participant backgrounds and their visions of future work. Secondly the open structured form of the interviews and lack of knowledge of the IT artefact from our side may have reinforced the idea that everything was possible. Thirdly the motivation of the ambulance crew was very high and had been for years, driving many design proposals forward. So while high motivation could easily drive the user centred design process, the evaluation of the EAR resulted in disappointment when the limited functionality was revealed. And this would result in an inability to think beyond the pilot implementation.

Showing the political effects accents further discussion, as both Hertzum and Simonsen (2011) suggest that level one effects should be coupled and related to the lower levels [5]. Even though the political effects on level one were presented at the workshop, we failed to couple these effects to the proposed effects of the interviews. This indicates that influence on effects moves easier from level one to five than the other way. Thus separating the political effects from the lower level effects do not seem to be very lucrative.

This was definitely a weakness of the study and further studies should much more narrowly focus on coupling a very small set of effects on the different levels of the effect hierarchy.

Granlien (2009) engaged in a specification process on an existing work system with no intentions of changing the IT artefact but instead performing interventions of work practice [8]. This meant that a very specific focus on the current work practice and how to improve this could be taken. Compared to our setting, we counted three different work settings (ambulance, ED personnel and ambulance control center). Barlach & Simonsen (2008) used effects specification workshops for design of prototypes that transitioned the ephemeral visions into tangible products for the users to test themselves [9]. In this case the focus was on effects to steer the design process from initial analysis to a recommended product much like a feasibility study [15]. Where Granlien and Barlach & Simonsen's goals was to test the conceptual objects of "effects templates" as an alternative to use cases, we have built on these templates and explored them in an organisational setting with a diverse number of organisational agents influenced by new technology.

Both Granlien and Barlach & Simonsen managed to couple high level effects with lower level effects. In Granliens case management was participating in the workshop and in Barlach & Simonsen's case managerial goals were incorporated during workshops. While Barlach & Simonsen and Granlien used management effects on the organisational business level (level two), we procured abstract political effects on level one. This may have resulted in the experienced difficulty of coupling participants' effects with the political ones.

Comparing our effects specification process with the two mentioned above shows that effects specification processes are very difficult to generalize, and facilitators should reflect thoroughly upon the actual context regarding number of participants, type of technology as well as looking at the future political goals of the project in general.

It is likely that in a complex setting such as ours, only one shot is given for getting organisational agents together and this requires a strict focus on what to actually achieve.

The physical setting of the workshop where we gathered the diverse participants of the organisational agents provided for an interesting context for mutual learning. By using participatory techniques in a pilot implementation setting, many assumptions of others' work practices were challenged and effects were excluded on this basis. However, it is still difficult for us to say what specific learning emerged on the workshop as well as how to take advantage of it practically and theoretically. Further studies should investigate this phenomenon even further in order to take advantage of the concept of mutual learning.

5 Conclusion and further research

In this paper we have suggested one way to conduct an effects specification process in a pilot implementation project that spans three different organisations. We have applied interviews prior to the workshop where the participants could speak out freely about their desired effects of the IT artefact. This resulted in a significant amount of effects and these were debated and prioritized during the workshop and reduced to 20 effects that should be used in the evaluation of the pilot implementation.

The effects specification process points to the following challenges and opportunities: 1) Interviews worked well for gaining background information about the participants and procuring effects but also affected the purpose and we experienced a dichotomy between envisioning a new work practice based on existing practice and evaluation of a finished product with finite functionality; 2) we experienced that it was very important to explain the political agenda as an initial setting prior to the effects specification; 3) we experienced that explaining the setting of the pilot implementation with regards to functionality as well as clarifying the learning aspect was equally important; 4) gathering a diverse amount of agents with different professional backgrounds created a lucrative basis for mutual learning and helped prioritize effects.

Overall our study contributes to the current literature of effects-driven IT development by anticipating three elements of the effects specification process that must be aligned:

- Visions of future work practices.
- Political and managerial strategy.
- The technical functionality of the IT artefact.

Further research should focus on the value of interviews in complex organisational settings to procure effects that are both focussed and specific enough to operationalize. Further studies should also embrace the dichotomy between visions and limiting evaluations and use this explicitly in the process.

References

1. Markus, M.: Technochange management: Using it to drive organizational change. *Journal of Information Technology* **19**(1) (2004) 4–20
2. Berg, M.: Implementing information systems in health care organizations: myths and challenges. *International Journal of Medical Informatics* (Jan 2001)
3. Orlikowski, W., Hofman, J.: *An Improvisational Model for Change Management: The Case of Groupware Technologies*. The MIT Press (Jan 1997)
4. Simonsen, J., Hertzum, M.: Participative design and the challenges of large-scale systems: extending the iterative pd approach. In: *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008*. PDC '08, Indianapolis, IN, USA, Indiana University (2008) 1–10

5. Hertzum, M., Simonsen, J.: Effects-driven it development: Specifying, realizing, and assessing usage effects. *Scandinavian Journal of Information Systems* (Feb 2011) 1–18
6. Ward, J., Daniel, E.: *Benefits management: Delivering value from IS & IT investments*. John Wiley & Sons ltd. (2006)
7. Hertzum, M., Simonsen, J.: Effects-driven it development: an instrument for supporting sustained participatory design. *Proceedings of the 11th Biennial Participatory Design Conference* (Jan 2010) 61–70
8. Granlien, M.: Facilitating participation in formative evaluation supported by effect map. *Selected Papers of the 32nd information systems research seminar in Scandinavia* (2009) 73–88
9. Barlach, A., Simonsen, J.: Effect specifications as an alternative to use cases. *Proceedings of the 31st Information Systems Research Seminar in Scandinavia* (Jan 2008)
10. McKay, J., Marshall, P.: The dual imperatives of action research. *Information Technology & People* **14**(1) (2001) 46–59
11. Baskerville, R.: Investigating information systems with action research. *Communications of the AIS* **2**(3es) (1999) 4
12. Kohli, R., Hoadley, E.: Healthcare. *Information Systems Action Research* (2007) 241–253
13. Mathiassen, L., Nielsen, P.: Engaged scholarship in is research. *Scandinavian Journal of Information Systems* **20**(2) (2008) 1
14. Strauss, A., Corbin, J.: *Basics of qualitative research: Grounded theory procedures and techniques*. Sage Publications, Inc. (Jan 1990)
15. Bødker, K., Kensing, F., Simonsen, J.: *Participatory IT design: designing for business and workplace realities*. The MIT Press (Jan 2004)

Branding and Channel Issues in E-commerce from an Information System's Perspective

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Abstract. E-commerce has matured and become mainstream. The fashion industry is now competing strongly in the digital markets. Beside traditional web-shops, new sales and branding channels are emerging e.g. M-commerce (mobile); social commerce; marketplaces; gaming etc. E-commerce and multi-channel retailing (MCR) now have a less technology-centric perspective while focusing more on sales and branding, although technology is the carrier and imposes limits. Corporate information systems are extended to the consumer's computers, smartphones and digital entertainment platforms. The information systems (IS) research tradition is somewhat challenged but can provide an elaborate framework for the understanding of the business and technology changes as well as provide an ideal support for research and businesses in choosing among the different MCR options. This paper proposes a model to understand and position fashion companies' existing and future sales and branding channels from an IS perspective. Future research suggestions include long-term challenges and benefits of distinct electronic channels.

Keywords: multi-channel retailing, e-commerce, information systems, branding, fashion

1 Introduction

E-commerce has in many industries and for many companies become commonplace, although by mainstream corporations first generally accepted during the last two-three years. Especially in the fashion industry, e-commerce [1][2] is experiencing a strong growth [3] –in general a 17% annual growth is experienced in the period from 2000 – 2009 [4]. E-commerce operations are now expected to be in place by customers, distributors and partners, and the absence of well-working and well-designed e-commerce operations will negatively affect the business. A transition is about to take place from multiple channels to multi-channel retailing (MCR) which ideally merge company insights with customer behaviour and preferences [5][6][7].

As most research contributions originates from “the first dot com bubble” from 1995 – 2005, it is now interesting to redefine the insight into companies dealing with

e-commerce as a mature technology with mature business processes. Scupola [8] looks at e-commerce from a company/leadership adoption perspective, where “why” seems to have been replaced with “how”. Several maturity models have been proposed [9][10] although promising, they seem idealistic with several targets lying 5 – 10 years ahead for even the most dedicated companies. At the same time new channels are emerging such as social commerce [12], refined infomediaries [11], marketplaces, affiliate and cooperative retailing [4].

The main research question of this study is: *Which factors should a fashion brand consider in order to succeed when building an e-commerce multichannel portfolio?* Contrary to extensive business transformation suggested by e.g. Ashworth et al. [10] we see companies letting their business remain on the lower levels of Ashworth’s maturity model, but at the same time adopt new technologies (channels), such as social commerce and mobile commerce. Along with this, companies are struggling to achieve adherence and synergy among channels. We argue that an IS view will enhance this understanding and shed light on the consequences better than the classical view with more singular views on either business or technology can do.

2 Methodological considerations on multi-channel retailing

This study is qualitative, cross-disciplinary and inspired by interpretivism [14][15]. Critical is the positioning of multi-channel retailing (MCR) [9] within an IS research methodology [16]. The basic platform of MCR is viewed as a technological system typically representing a supply chain. Information conveyed by the IS platform includes disciplines such as sales, customer relationship management, branding and an array of socio-technical issues which each has research traditions of its own [17]. This relates to Taylor [18] identifying IS research as issues of balancing focus and diversity by applying a polycentric view.

This paper stretch from business strategy into IS strategy [19] and with Taylor [18] remains largely within ‘Internet Applications Thematic Miscellany’. A critical issue within MCR is that various channels relate to different foci: social commerce is related to collaborativeness and inter-human relations [13], M-commerce is highly technical, affiliations relate to inter-business systems, all challenging a clear cut methodological stance. Bryant [20] states that communication is always prevalent in IS research and that communication convey social constructs, i.e. aiming at maintaining the view on the techno-social construct around MCR; the context of the system, more than the system itself, is critical Avgerou [21]. Smithson & Hirscheim [22] have in their seminal contribution(s) underlined IS as a research discipline of comprehension through evaluation of technological and business factors.

Baskerville & Myers [23] have described the “danger” of IS research working in waves of fashion (not clothes, but habits) with rising and declining interest for certain topics. In this study we “suffer” from the majority of IS e-commerce contributions being from a past wave. We therefore join Baskerville & Myers by conducting this study in close collaboration with IS practitioners and as Benbasat & Zmud [24], we emphasize relevance in practice. The idea of engaged scholarship from Van de Ven [52] and Mathiassen & Nielsen [25] focuses the research agenda on finding reason

and provide practitioners, as well as research communities, with insight from the matured use of e-commerce.

This study is based on data collection from a number of fashion companies with e-commerce, MCR strategy or perspective [17]. The two largest fashion companies in Denmark are used as exemplary cases [15]. Data collection is by unstructured and open-ended interviews with managers and IT suppliers and business partners. Data collection identified strategic, tactical and operational approaches to MCR in each company. Company access include past employment, as advisers, or in regular researcher roles. The considerations have been presented at industrial seminars with about 110 participants in December 2010 and January 2011 and feedback has been collected from these events.

This paper is a part of a series of papers from an industrial PhD project, and a general research in technology-based innovation focusing on the fashion industry.

The method can be visualized as revolving between two main pillars of *technical infrastructure* (enablers) and a set of *commercial objectives* (promoters) with two beams of *channel design* and the *social construct*.

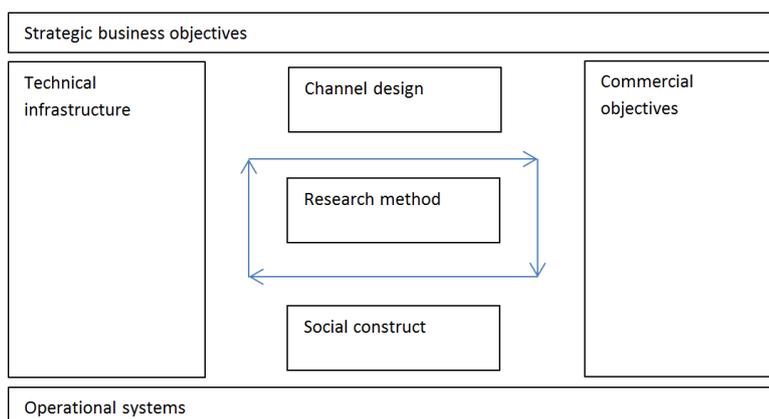


Fig. 1. Research model.

The social construct include branding and consumer-oriented flow of information; also actors along the supply chain could be observed here. Channel design includes decision making on channel life-cycles, channel positioning, cross-channel issues and eventually the functional design of the channel. The boundaries of the method are made by the business strategy and the existing operational system. The IS method and its cross-disciplinary nature include elements of retail and branding research [26][16].

3 Theoretical understanding of multi-channel retailing factors

E-commerce and MCR conjoin the technological platforms of commercial organisations and the commercial activity of branding [27], marketing [28] and sales itself. This dichotomy itself is reflected in companies with potentially unclear responsibilities and difficulties in the promotion, development and operation of the individual organisational and the business process components required to reach full benefits of the market potentials.

3.1 The value of information systems

The carrying fundamental of any business activity including IS and e-commerce is the ability to create value. Amit & Zott [29] suggest a framework for evaluation of value in e-commerce comprising *business model structure* and *business model content*. From an innovation economics view, they observe value sources from efficiency, complementarity, lock-in and novelty. In a commentary to Amit & Zott, Johansson & Mollstedt [30] argue to replace ‘complementarity’ with ‘nature of the core product’. Karabeg [51] expand Amit & Zott’s concept of value creation in e-business with issues of aesthetics and visual/function attractiveness. Also Noboa [31] argue in the line of Amit & Zott on value creation and required frameworks for assessing and developing value.

IS are where IT meet the organisation. Alter [32] presents a number of suggestions for definition of IS and IS research and most importantly the proposal for a generalised IS observation of IS as ‘work systems’. By this definition an organisational, a personal or a business context should always be present, perceived or identifiable. E-commerce differs somewhat, as the business purpose is obvious, and some IS components reside in the internal organisation. The consumer perspective is less clear however Chang *et al.* [33] provide a detailed literature study in consumer – channel interrelatedness.

IS research communities has largely adopted e-commerce as a research discipline on electronic retailing [34][35][36][11][37][38][39]. Chu & Smithson [34] point at the dominating risk of conflicts within the commercial and organisational fabric. Parboteeah *et al.* [36] observe consumer excitement and satisfaction as parallelisms to user satisfaction. Son & Riggins [11] unfolds infomediaries as generators of consumer traffic in line with e.g. search engines [40][4].

3.2 E-commerce and multi-channel retailing

E-commerce is the classical discipline of exposing physical products at display on an electronic platform, attracting customers, enabling selling, and executing fulfilment. E-commerce is described as the combination of sales, administration, IT and logistics [41]. Heinemann & Schwartzl [4] state ‘new online retailing’ as evolutionary to retailing, and the general potential of the internet as a matured sales channel being complementary to other sales channels. Aldin & Stahre [42] emphasize e-commerce as the coupling of digitally-enabled marketing with digital supply chain systems.

Gensler *et al.* [43] address multi-channel in a broader sense including bricks-and-mortar, tv-shops, trade shows and homeshopping, and call for implementation of channel evaluation systems with respect to different customer profiles especially noting loyal versus switching customers. Evaluation of loyalty is also presented by Verhoef *et al* [7].

Retailing channels are to be distinguished between physical (offline) and digital (online) channels [10]. Even Wightman [39] projects how IS and retail should merge views. Kwon & Shannon [44] describe offline shopper belief as consisting of self-relevance, service, merchandise and store environments, whereas the online shopper is directed by aesthetic appeal, navigation convenience, transaction convenience and online content. Furthermore they describe cross-channel shopping as impacted dominance of offline shopping experience above online shopping experience. In the current context online channels are to be viewed as a multiplicity of digital communication and commerce options.

Gensler *et al.* [43] raise the importance of continuous evaluation of channel performance although cross-channel performance plays a limited role. Wallace *et al.* [45] optimistically state that customer satisfaction and the availability of multiple channels are interconnected, as customers expect a variety of retailing options. Webb & Lambe [46] warn of risks of internal and external conflicts and rivalry among channels and emphasizes the brand-owner responsibilities. Aldin & Stahre [42] discuss the issue of cannibalising the existing retail channels.

Channels are evolving from traditional mono-brand web-shops into social commerce, mobile commerce, gaming, product placement, affiliations, marketplaces etc.

3.3 Brand

The brand is one of the most critical assets of any company in terms of identification, attracting new customers, and developing existing customer relationships [27]. E-commerce extends a brand from a physical realm to a digital realm. Traditionally, branding has had a strong role in internet strategies. E-commerce systems still represents a balance between branding and sales with search engines making products commonly search-able [40]. A company needs to protect and care for the brand with equal importance in the digital sales channels as in the physical sales channels. The MCR marketing environment presents a number of brand management challenges [47]. Marketers must manage channels and communication options to strengthen direct sales and brand equity (value) impact, including indirect brand equity effects connected to a particular channel or communication option. From a strategic perspective, marketers must develop and operate channels and communication options to ensure synergy of sales and brand equity impacts. The brand is one of the firm's most valuable intangible assets [26] and generally branding is regarded a top management priority. In retailing, branding can be especially important in influencing customer perceptions and driving store choice and loyalty. Treiblmaier & Strebinger [37] discuss the requirements of aligning business strategy with both technology and branding, albeit with an underlining of appropriate matches of the right IT infrastructure and project governance for the right branding approach. E.g. strong

branding imposes other requirements on IT than a strong focus on high performance e-commerce. With IS, it seems there are some evidence that branding i.e. replace traditional front-end requirements of IS.

3.4 The IS perspective

As stated above, IS provides the methodological foundation for this study. Contributions like [34][35][36][11][37][38][39] each account for IS as scientific understanding for e-commerce and its position with organisational environments.

Subsequently we view the presented cases with a theoretical foundation driven by an IS perspective augmented by channel and branding considerations [48]. Alter's [32] multi-factor *work systems model* (WSM) approach gives meaning in terms of research criteria such as '*Recognition that IS should be analysed and designed as sociotechnical systems*' and '*Elevating the centrality of service and service metaphors in the IS field*'. As Alter discusses the widespread (lack of) user satisfaction, e-commerce is more self-evaluating: As put by Karabeg [51], customers are only attracted to e-commerce if the visual and functional appeal is superior to the perceived product value. Alter's [32] model WSM model reflect Information Systems research as a triangle of strategies, infrastructure and environment (see figure 4). E-commerce adds intra-, inter- and extra-organisational issues that fits appropriately into the IS analytical lens.

MCR tend to resemble classical work systems regarding corporate objectives, design processes, decision processes and organisation, just the 'users' are replaced by 'consumers'. 'Usefulness' [32] is replaced by commercial success. Williams [49] suggests an evolutionary view on the organisational development of the e-commerce unit within companies. Zeng *et al.* [50] discuss organisational transformation closely related to development in the technological foundation of e-commerce.

4 Case studies

4.1 Bestseller A/S

Bestseller A/S is a 2bn€ fashion wholesaler and retailer based in Denmark with 2.000+ concept stores in EMEA and Canada and 10.000 multi-brand retail customers including large European department stores such as Peek & Cloppenburg, Stockman and Gallerie Lafayette. Bestseller was founded in 1975, is privately owned by the CEO, and has 10 main brands. For most brands four – eight collections are presented annually comprising around 12000 new products. The number of recurring or stocked products is relatively low as it account for around 8 % of the turn-over. Some store segments receive new products as often as weekly to bi-monthly. The average product life time in stores should be less than 3 months.

From 2001 – 2007 Bestseller remained reluctant on up e-commerce, but made large scale experiments with texting/SMS-marketing, online customer clubs, online

games, online storytelling, and various local initiatives from brands, countries and store owners on customer loyalty systems, online promotions, etc. Bestseller started B2C e-commerce in January 2008 with its leading kids brand 'Name It' on the remnant of a defunct kids store. E-commerce now includes five main brands. Each brand was first "rolled out" in a detailed country-by-country manner with careful adaption to language, sales traditions and native customer support. Today the shop is serving the markets of Denmark, Sweden, Finland, Norway, Netherlands, Germany and a general English-version named "Others".

E-commerce was initially started as a separate organisational entity dislocated from the headquarters. This - along with a rapid development in the new area - created tensions with existing marketing and sales activities. These tensions led to a termination of the dislocated organisational entity and an outsourcing of the activity to a specialised e-commerce operator. one year after, product management, customer support, and several other activities were back-sourced into Bestsellers headquarter. The e-commerce operation is now developing steadily. During the early phase MCR was heavily pursued in getting stores to actively use e-commerce as referrers, linking between online and local, physical stores and create coherency in products and services across channels. Much of this was too complex at the time, and MCR has been downplayed to the benefit of a stricter revenue focus.

4.2 IC Companys A/S

IC Companys is a Northern European wholesaler and retailer of fashion products managing a number of brands targeted to markets like winter sports, luxury apparel, and mid-market. IC Companys has a number of "home grown" brands, but has successfully bought and developed a series of new brands. IC Companys has around 350 concept stores, a smaller number of strong chains, and approximately 3000 traditional multi-brand retail customers. IC Companys has since 2007 entered a high prioritized e-commerce strategy. The concept stores are generally recognized by using point-of-sales and other IT systems operated by IC Companys's central office. The multi-brand chains are closely linked to IC Companys using a number of EDI and business integration technologies.

IC Companys originally viewed itself as a wholesaler of fashion products leaving all retail operations to the retailer. However, over the years the concepts stores as a sales and branding channel have grown in importance. The same applies to the chains consisting of both department stores and e.g. sporting goods chains. This change in strategic importance regarding retail stores, together with the new e-commerce activity, has forced IC Companys to revise its business strategy. Looking at consumers across both online and offline retail channels could increase IC Companys overall service offering to the consumers. Consumer purchase preference, history intelligence, supply chain insight and seasonal offerings are adapted closely to the consumers' idea about the brands. A multi-channel retailing strategy is defined by a combined view on consumers across channels. The strategy furthermore enables a close monitoring of marketing campaigns. IC Companys is in its operational division constantly looking to architect information systems for a guiding role in

transformation of the operational systems towards accomplishing the targets of the new business strategy.

With a different technological approach, IC Companys is looking to develop its supply chain technologies. Currently, the store warehouses and the e-commerce warehouse are separate. At the same time, many concept stores and chain customers have a substantial stock of the season's products. IC Companys is looking to integrate retailing, IT and logistics into a single warehouse supplying all categories of customers - both B2B and e-commerce - to optimize supply chain efficiency and forward products to those channels giving the best earning. Rapid sales insights at the store level should enable intelligent replenishment of goods from a common warehouse. This also relates to another innovation approach, where the store-owners ask IC Companys for active participation in risk-sharing when buying a new season's products without knowing the sales opportunities. Consumer insight, e-commerce and intelligent, fast warehouse operations will all contribute to accomplishment of this innovation request.

IC Companys' MCR approach is as such one of the most aggressive found in Scandinavia with a direct aim of linking e-commerce and several physical channels to a common supply-chain. Basic to this is a radical change in information systems design. Where the value chain used to be: design – purchase – sell – ship it will now be: design – purchase – sell – MCR where the operating system will serve any channel, and independent customers will “just” be another channel with less information insight than the own-owned channels.

4.3 Cases summary

The cases are from the two largest fashion companies in Denmark. Over the last 3 years their e-commerce have gone from 0 to about 1% of the retail turn-over.

The companies interpret MCR somewhat differently. ICC's MCR strategy is ambitious in following the unique consumer through concept stores, multi-brand stores and online, by offering personalised shopping advice and taking an active customer relationship approach. Bestsellers MCR strategy focuses more on the general branding, the effect of presence in both digital and physical markets, and a future possibility to expose the individual store. Both companies are linking from brand-sites to the online shop for the brand, thus slightly reducing the direct impact of branding and shopping. Mobile commerce is not yet in question. Bestseller is using social commerce to a limited degree, but has a stable tradition for various online communities and has used several types of infomediaries. Bestseller is taking advantage of marketplaces like the UK online retailer ASOS, but with individual legal entities having the selling responsibilities.

There is no direct engagement from stores to e-commerce at the moment for any of the companies. I.e. no hand out of goods purchased online in stores, no profit sharing and no cross referral. This puts both companies in the very early stages of the maturity models [9] [10].

New channels are generally more business driven than technology driven, which is both yielding success based on known technologies, but also reducing failures with

immature technologies. New channel responsibilities are typically anchored within the marketing and sales departments in mixed marketing strategies [28].

5 Discussion

In both cases the business objectives are a mix of branding, sales and cross-channel impact. The focus of e-commerce balances between marketing and revenue. A model approach for channel choice and design is required [33]. The model must reflect branding objectives related to the channels, and the channel's role in the retailing scenery must be identifiable [51] [9]. An IS perspective can attribute with the linking between technological and organisational drivers.

5.1 Branding and channel model

Cross-channel expectations and impacts between physical and digital channels are one of the strongest drivers in MCR [49]. It is shown that physical channels impact digital channels more than the reverse in terms of actual buying propensity [44]. Cross-channel impact between digital channels deserves interest, as there is a risk that these only exist to support each other and therefore attention must be paid to continuous evaluation [38]. Marketing views might argue that marketing remain a purpose of its own, merely benefiting from the digital options as enabler technologies. Respecting this together with the learnings from the cases, the marketing effort must be accounted for independently of the sales channels. The multitude of channel facing the companies has led to the following figure:



Fig. 2. Channel grouping.

The companies are thus shifting from 'traditional e-commerce' in the form of webshops into more complex technological and organisational networks of digital branding and sales platforms. Figure 2 visualizes the empirical considerations found.

Brand and technology management must address this. Few scientific contributions exist on value of aggregated and complex technology and branding architectures, but as Treiblmaier & Strebinger [37] we argue that companies need to converge brand and technology management in the making of MCR strategic and tactical prioritisations.

Using classical IS arguments to observe both technology and business, figure 2 is mapped into the subsequently proposed model – figure 3 - oriented at identifying the role of a channel in a mature e-commerce environment. The model also proposes to introduce a pragmatic commercial view on the channel architecture in terms of control of branding and consumer experience.

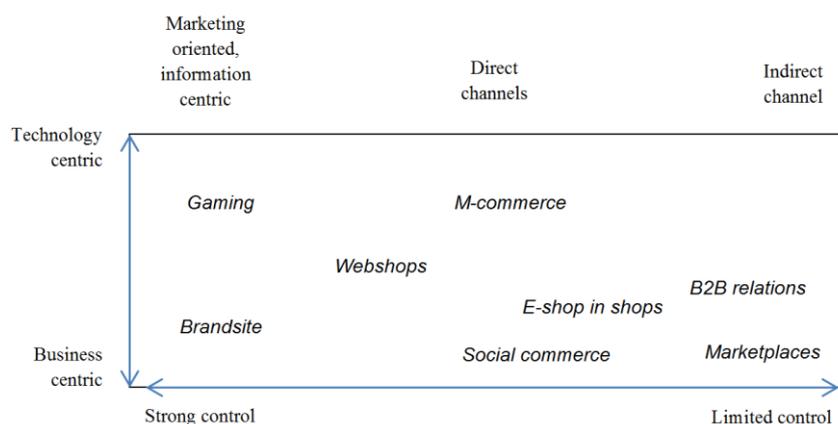


Fig. 3. Modelling of channel positioning.

The control issue links closely with internal vs external relationships and dependencies of the IS construct. Furthermore control is setting the management boundaries: Marketplaces like Amazon.com are only indirectly to control – but plenty reason to maintain control with direct and information channels.

From the cases above, Bestseller has been strong in the left and right hand side of the model, but weak in the centre. Contrary to this IC Companys have had a clearer priority in the centre.

With the strong tradition for selling to both concept stores and multi-brand (independent) retailers, both cases are quite careful in assessing the impact of digital sales channels on physical sales channels i.e sales cannibalisation [4][9][19]. New channels must be developed to support the total sales activities underlining the view of MCR and not just multiple channels.

The empirical observations seem to partly support the view expressed in the proposed maturity models of [9][10]. However the maturity models do not take into account the rapidly expanding number of competing digital channels. Henceforth companies have to pay attention to developing their ability to switch to new and interesting channels, making it difficult to reach the highest level of maturity. Instead, maturity lies in the ability to switch between channels and adapt new channels e.g. using service oriented architectures.

Despite the aforementioned frameworks for identifying business value, the cases show that there is a long way to go. In the first phase of Bestsellers implementation, branding from a marketing view alone justified business value, as the rapidly growing e-commerce accounts for only a fraction of physical retailing. The strategic choice and decision making is fundamental [27] [45] [24] and hence the plethora of new channel options depletes the narrow business value of the individual channel.

The importance of branding indicates that IS studies on e-commerce beneficially could include branding in the scientific lens [26].

5.2 The IS perspective

Where branding and sales should reflect emotions and sentiments [51], IS provide frameworks for balanced evaluation [22] including the breadth of IT, organisation and business factors.

Alter [32] only partially includes e-commerce as IS in a ‘traditional’ sense. Given the above stated uncertainty of control and internal/external the model view could benefit from including a control issue. The control issue will highlight business impact and influence on each channel.

We tend to view several MCR designs as a disruption of systems but as a continuation of information between the buyer and the seller; several technologies and infrastructures might be prevalent as the customer might shop seamlessly between direct and indirect channels.

Furthermore satisfaction is ‘revenue’ on the short term and risk of depleting brand equity on the long term. The above mentioned value proposition is critical to this understanding. The IS perspective is useful but can be augmented with infomediaries, affiliations, social commerce, gaming channels, etc. thus adding new tiers of technology which cannot be controlled by the brand owner.

Using Alters WSM model [32] we propose a parallel model for MCR. The model highlights the MCR and consumers as externalized in relation to corporate information system potentially having their own infrastructure, environment and strategies, but attracted to the company through appropriate branding and channel architectures:

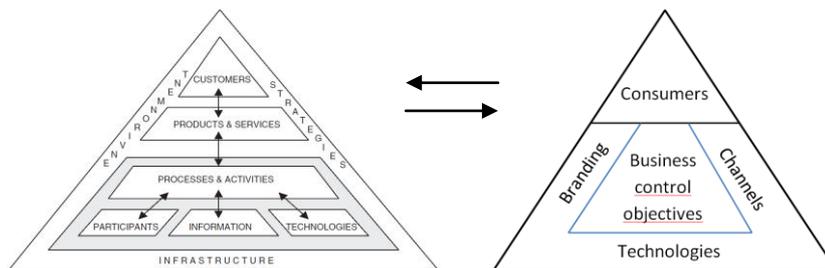


Fig. 4. IS model – branding and channel augmentation to Alter’s model

Branding, channel, and technology impose requirements of alignment with both the internal IS, but also branding across channels and cross-channel issues [37]. The

model suggests – as in IC Companies’ case – that channels are founded on one central connecting point in the hosting organisation. It should ideally be easy to add, reorganise and remove channels. Bestseller is similarly providing data out of a common datahub. The model also suggests that channels tend to be technologically external in terms of corporate production systems. IS research in MCR is thus indicatively more complex and multi-paradigmatic than classic organisation-internal IS.

Considering the methodological standpoint of this study, the IS approach has proven useful, as the business impact of applying technology is determined by the dual context of organisation and technology. The case studies show a different path than expected. The ‘Internet Applications Thematic Miscellany’ seems to evolve into a complete semi-externalised business models. The research model proves useful when going/evolving from traditional work systems to e-commerce.

5.3 Findings summary

E-commerce in fashion retailing is maturing and moving from single, independent channels to both physical and digital multi-channel retailing. This raises the question of which factors a fashion brand should consider in order to succeed when building an e-commerce multichannel portfolio?

This study so far views the fundamental factors as consumers, branding, channels and technology. In figure 3 a model is proposed for management and awareness within e-commerce using technology versus business drivers as one dimension and internal versus external control as the other dimension. To further summarize the findings:

- Existing IS models need to be extended towards branded consumer solutions [26][27][48][50]
- Re-interpret corporate IS from a consumer value perspective including attractiveness and brand value [2][36]
- Clarify the purpose, position, role, interrelation, and success criterias of each channel [4][42][38]
- Develop channel control and management according to figure 3
- Organise internal structures for securing positive interrelations between technology and business [8][10][34][49]
- Understand the technological foundations and infrastructure requirements associated with each channel and the combined offering [37]
- Secure alignment between channels on e.g. price, product categorisation, product presentation, and storytelling [1][9]
- Enable appropriate evaluation mechanisms [7][29][43]

5.4 Contours of future research

As this paper is the first in a recently started research project, a series of analytical studies are planned.

Data collection on e-commerce and MCR strategies is underway for about 12 companies in the fashion and life-style sector. The similarities and differences among these companies are highly interesting when aiming to reach a more detailed understanding of how e-commerce and MCR is influenced by retail presence, product pricing segment, and product life-cycle characteristics. As a business impact study it is highly interesting to identify promoters and barriers and eventually economical results.

Multi-channel retailing has been discussed for several years, however many companies still operate in the multiple channel arena. IC Companies and a number of other fashion brands have expressed clear intentions on pursuing “real” MCR. Even though cross-channel customer insight and customer support/experience seem attractive, little has been recorded on the long-term benefits including channel alignment, extent of channel collaboration, issues on mixed ownership of channels, and the operational issues associated with creating and maintaining customer expectations.

Traditionally IS has not included issues like branding and direct customer/consumer interaction, but when systems are stretched out of the company and made ubiquitous and pervasive in relation to the life of consumer, new requirements and research dimension comes forward.

6 Conclusion

E-commerce has over the last 5 years matured in fashion retailing and been largely accepted by brand owners. Organisational and commercial barriers against e-commerce have been reduced, but new barriers for positive exploitation of the possibilities lies within prioritisation, maintaining uniform and consistent branding, avoiding cross-channel conflicts, selecting between hype and sustainable channels, and the overall strategic alignment between marketing / branding, and channels / technology.

The IS approach offers an improved understanding of the technology – organisation duality as the fundamental driver of business development. Several authors emphasize that MCR is closely connected to organisational transformation; our study however indicates that companies take a more evolutionary path rather than focusing on a radical business transformation. This makes MCR a probably source of organisational conflict. Observation of our proposed models will hopefully contribute to a clearer picture for companies in organising, positioning and aligning MCR.

This study points to a dual conclusion on multi-channel e-commerce and retailing in the design of the business transformation [50] and the management of this process. Multi-channel retailing needs to be driven by a business strategy. Marketing-oriented, shorter-lived channels must be segregated from the long-term channels. Conclusively, the IS stance has yielded a better understanding of the commercial phenomena of e-commerce, channel development, and branding in the context of technology and business.

References

1. Salmeron, J.L., Hurtado, J.M.: Modelling the reasons to establish B2C in the fashion industry. *Technovation*, 26, 865-872 (2006)
2. Dholakia, U.M. et.al.: Consumer Behavior in a Multichannel, Multimedia Retailing Environment. *Journal of Interactive Marketing*, 24, 86–95 (2010)
3. PostNorden: Rapporteur. *Distanshandeln I Norden 2009*, 2010. Accessed at <http://www.posten.norden.com/da/Om-os/Presse/Publikationer/Rapporteur/> (2011)
4. Heinemann, G., Schwartzl, C.: *New Online Retailing. Innovation and Transformation*. Wiesbaden: Gabler Fachverlage (2010)
5. Schröder, H., Zaharia, S.: Linking multi-channel customer behavior with shopping motives. *Journal of Retailing and Consumer Services*, 15, 452–468 (2008)
6. Shankar, V., Yadav, M.S.: Emerging Perspectives on Marketing in a Multichannel and Multimedia Retailing Environment. *Journal of Interactive Marketing* 24, 55–57 (2010)
7. Verhoef, P.C. et al.: CRM in Data-Rich Multichannel Retailing Environments. *Journal of Interactive Marketing* 24, 121–137 (2010)
8. Scupola, A.: E-Commerce Adoption and Organizational Transformation. *Proceedings of IRIS 2006*. 1-17 (2006)
9. Bagge, D.: Multichannel retailing: The route to customer focus. *IBM Global Business Services*. (2007)
10. Ashworth, C.J., Schmidt, R.Ä., Pioch, E.A., Hallsworth, A.: An approach to sustainable ‘fashion’ e-retail: A five-stage evolutionary strategy for ‘Clicks-and-Mortar’ and ‘Pure-Play’ enterprises. *Journal of Retailing and Consumer Services* 13, 289–299 (2006)
11. Son, J.-Y., Kim, S.S., Riggins, F.J.: Consumer Adoption of Net-Enabled Infomediaries: Theoretical Explanations and an Empirical Test. *Journal of the AIS*, 7(7), 473-508 (2006)
12. Stephen, A.T., Toubia, O.: Explaining the power-law degree distribution in a social commerce network. *Social Networks* 31, 262–270 (2009a)
13. Stephen, A.T., Toubia, O.: Deriving Value from Social Commerce Networks. *Journal of Marketing Research*, 47, 215-228 (2009b)
14. Walsham, G.: Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4,74-81 (1998)
15. Lee, A.S.: A Scientific Methodology for MIS Case Studies. *MIS Quarterly*, 13(1), 33-50 (1989)
16. Duan, C.-H., Kung, H.-J., Tung, H.-L., Tseng, H.-C.: The Intellectual Structure of Modern E-Business Research. *Research Journal of International Studies* 13 (2010)
17. Klein, H. K., Myers, M.D.: A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems, *MIS Quarterly*, 23(1), 67-93 (1999)
18. Taylor, H., Dillon, S., Van Wingen, M.: Focus and Diversity in Information Systems Research: Meeting the Dual Demands of a Healthy Applied Discipline. *MIS Quarterly*, 34(4), 647-667 (2010)
19. Zhang, J., Farris, P., Kushwaha, T., Irvin, J., Steenburgh, T.J., Weitz, B.: *Crafting Integrated Multichannel Retailing Strategies*. Working paper 09-12, Harvard Business School (2009)
20. Bryant, A.: The future of information systems – Thinking Informatically. *European Journal of Information Systems*. 17, 695-698 (2008)
21. Avgerou, C.: The significance of context in information systems and organizational change. *Information Systems Journal*, 11(1), 43-63 (2001)
22. Smithson, S., Hirschheim, R.: Analysing information systems evaluation. *European Journal of Information Systems*, 7, 158–174 (1998)
23. Baskerville, R.L., Myers, M.D.: Fashion Waves in Information Systems Research and Practice. *MIS Quarterly*, 33(4), 647-662. (2009)

24. Benbasat, I., Zmud, R.W.: Empirical Research In Information Systems. *MIS Quarterly*. 23(1), 3-16/March (1999)
25. Mathiassen, L., Nielsen, P.A.: Engaged Scholarship in IS Research – The Scandinavian Case. *Scandinavian Journal of Information Systems*. 20(2), 3-20 (2008)
26. Ailawadi, K.L., Keller, K.L.: Understanding retail branding: conceptual insights and research priorities. *Journal of Retailing* 80, 331–342 (2004)
27. Kapferer, J.-N.: *Strategic Brand Management. Creating and Sustaining Brand Equity Long Term*. 8th Edition. London: Kogan Page (2008)
28. Keller, K.L.: Mastering the Marketing Communications Mix: Micro and Macro Perspectives on Integrated Marketing Communication Programs. *Journal of Marketing Management*, 2001,17, 819-847 (2001)
29. Amit, R., Zott, C.: Value Creation in E-Business. *Strategic Management Journal* 22, 493–520 (2001)
30. Johansson, N., Mollstedt, U.: Revisiting Amit and Zott’s model of value creation sources: The Symbelt Customer Center case. *Journal of Theoretical and Applied Electronic Commerce Research*. 1(3), 16-27 (2006)
31. Noboa, F.: E-Business: A Framework For Examining Creation And Appropriation Of Value. *Journal of E-Business*, 4(1), 1-11 (2004)
32. Alter, S.: Defining information systems as work systems: implications for the IS field. *European Journal of Information Systems* 17, 448–469 (2008)
33. Chang, K.T., Cheung, W., Lai, V.S.: Literature derived reference models for the adoption of online shopping. *Information & Management*, 42, 543–559 (2005)
34. Chu, C., Smithson, S.: E-business and organizational change: a structurational approach. *Information Systems Journal* 17, 369–389 (2007)
35. Dehning, B., Richardson, V.J., Urbaczewski, A., Wells J.D.: Re-examining the Value Relevance of Ecommerce Initiatives. *Journal of Management Information Systems*, 21(1), 57-84 (2004)
36. Parboteeah, D.V., Valacich, J.S., Wells, J.D.: The Influence of Website Characteristics on a Consumer’s Urge to Buy Impulsively. *Information Systems Research* 20(1), 60–78 (2009)
37. Treiblmaier, H., Strebinger, E.: The effect of e-commerce on the integration of IT structure and brand architecture. *Information Systems Journal* 18, 479–498 (2008)
38. Wang, Y.-S.: Assessing e-commerce systems success: a respecification and validation of the DeLone and McLean model of IS success. *Inf. Sys. Journal* 18, 529–557 (2008)
39. Wightman, K.R.: The Marriage of Retail Marketing and Information Systems Technology: The Zellers Club Z Experience. *MIS Quarterly*. Dccember, 359-366 (1990)
40. Dou, W., Lim, K.H., Su, C., Zhou, N., Cui, N.: Brand Positioning Strategy Using Search Engine Marketing. *MIS Quarterly*. 34(2), 261-279 (2010)
41. Tambo, T.: Fashion e-commerce – etablering og driftsmæssige overvejelser. Præsentation fra workshop Dansk Mode og Tekstil 14.12.2010. (2010)
42. Aldin, N., Stahre, F.: Electronic commerce, marketing channels and logistics platforms—a wholesaler perspective. *European Journal of Operational Research* 144, 270–279 (2003)
43. Gensler, S., Dekimpe, M.G., Skiera, B.: Evaluating channel performance in multi-channel environments. *Journal of Retailing and Consumer Services*, 14, 17–23 (2007)
44. Kwon, W.-S., Lennon, S.J.: Reciprocal Effects Between Multichannel Retailers’ Offline and Online Brand Images. *Journal of Retailing*. 85, 376–390 (2009)
45. Wallace, D.W., Giese, J.L., Johnson, J.L.: Customer retailer loyalty in the context of multiple channel strategies. *Journal of Retailing*, 80, 249–263 (2004)
46. Webb, K.L., Lambe, C.J.: Internal multi-channel conflict: An exploratory investigation and conceptual framework. *Industrial Marketing Management*. 36, 29–43 (2007)
47. Keller, K. L.: Brand Equity Management in a Multichannel, Multimedia Retail Environment. *Journal of Interactive Marketing*, 24, 58-70 (2010)

48. Wang, W., Benbasat, I.: Interactive Decision Aids For Consumer Decision Making In E-Commerce. *MIS Quarterly*, 33(2), 293-320 (2010)
49. Williams, J.C.: *Organizing for Cross-channel Retailing*. Toronto: Williams Group (2008)
50. Zeng, Q., Chen, W., Huang, L.: E-Business Transformation: An Analysis Framework Based on Critical Organizational Dimensions. *Tsinghua Science And Technology*, 13(3), 408-413 (2008)
51. Karabeg, A.: Value Creation and its Visualization in E-business. *Proceedings of the Information Visualization Conf, 2006*. (2006)
52. Van de Ven, A. H.: *Engaged Scholarship: A Guide for Organizational and Social Research*, Oxford University Press, Oxford, (2007)

How fashion brands learned to click – a longitudinal study of the adoption of online interactive and social media by luxury fashion brands.

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Abstract. Most luxury fashion brands have yet to develop a clear and focused integrated online strategy, as they have struggled with the dilemma of interacting with fans and customers online. We observed how 35 luxury fashion brands utilized social and interactive online technologies since 2006 by formulating a framework for assessing fashion websites and brand controlled social media sites. Our findings illustrate that the observed luxury brands have increased their adoption of social and interactive digital technologies since 2006, and that with the help of Web 2.0 technologies fashion brands can create an immersing and innovative environment online. The findings also have relevance for practitioners, as the developed 8C framework can function as a checklist for fashion brand website creation.

Keywords: e-commerce, interactive, social media, Web 2.0, 8C framework, branding, fashion, technology,

1 Introduction

More than twenty years after the birth of the Internet and more than ten years after the launch of successful online multibrand fashion retailers such as Net-a-Porter, ASOS and YOOX, many luxury fashion brands themselves are still lagging behind in the online game, with brands such as Prada not having a functioning website until 2007. Nevertheless, the online fashion market is worth billions, and the before mentioned online fashion retailers were each turning over £120M, £223M and £138M respectively in 2009 [1][2][3]. Moreover, apparel and accessories account for one of the largest categories sold online and enjoys double digit growth rates year on year [4][5][6].

Still, established fashion brands struggle to rethink their traditional sales and marketing strategy to include the digital channels and hence make the brands fit for the future. They are hesitant due to the dilemma of maintaining exclusivity and brand control, and therefore fear implementing interactive elements on their websites where customers and fans can interact or customizing products. This attitude is now slowly

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changing, as the majority of fashion brands have realised the importance of Internet presence. Especially forced by recent declining sales in the physical stores, due to the economic downturn, fashion brands have turned their attention online where e-commerce still promises double-digit growth [7].

Interacting and shopping across channels is however exactly what the customers expect from brands. Previous research in the context of online fashion show that customers want a website experience that is engaging, memorable and interactive; a website that can offer social interaction, two-way communication and a personalized relationship with the brand [8][9][10]. Moreover, the interactive and collaborative aspects are also what industry reports from McKinsey and the Economist business surveys point out as opportunities for increasing a company's revenue and/or margins [11][12][13].

However, selling and branding fashion brands online requires a different set of tools than selling and branding any other commodity product online. Fashion brands combine emotion, image and perception. Hence the challenge is how to convey these characteristics of intangibility, tangibility, and multi-sensory experiences online using Internet technologies [14][8].

With the help of Web 2.0 technologies fashion brands can create an immersing and innovative store environment online [7]. Cartier (www.cartier.com) created a visual tour of their brick-and-mortar store which you can navigate and click through online. It is entertaining, keeps the visitor involved and creates emotional hooks by the use of videos and engagement [15]. According to Jennings [15], an e-business that does not provide an experience will not thrive. However there is to date no luxury website or community which allows the visitor to navigate through the store, see the current collection on the shelves and drag and drop them into the basket while being advised by a real time e-shopping assistant.

2 Problem

The purpose of this paper is to provide an overview and an assessment of the extent to which luxury fashion brands have adopted interactive and social technologies since 2006.

We have addressed this problem through the following research activities:

- A series of in-depth interviews with key informants to understand the why, how and what of luxury fashion brands using different Internet branding activities (here called *categories*)
- A formulation of a framework for characterizing the different types of branding interface categories
- Three empirical studies in 2006, 2008 and 2010 of around 30 of the most well-known brands in order to identify a sample of 15, which could be compared over the four years
- A set of more detailed examples of 'best-business practice' using these categories

The paper will conclude with some recommendations for further development in the way fashion brands might further exploit the opportunities of online interactive and social media.

3 Methodology

16 in-depth, unstructured and open-ended interviews were conducted to support the website observations. In 2006 four interviews with brand managers (Burberry, Mulberry, Tanner Krolle, Jean Muir) were conducted face-to-face and over the telephone. In 2008 nine interviews included brand managers (Fabergé, MCM, Richemont), internet professionals (Limestone, FAST, Microsoft), and fashion website professionals (Skywire, Galle, Winkreative) were conducted face-to-face or over the telephone. In 2010 three interviews were conducted face-to-face with brand managers (Faberge, Chanel, Boucheron). The interviews were conducted to evoke attitudes and opinion of luxury brand professionals in order to collect information based on insider experience and privileged insights. This helped understand the why, how and what of luxury fashion brands using different Internet branding activities [16].

For the framework, the development of categories and subcategories were inspired by observation of actual application of technologies adopted on websites and in parallel checked and validated by comparing with previous observations of fashion brand websites in the literature [9][8][10]. The observation of luxury fashion websites were as such not guided by a predefined framework in 2006, but was found to fit into Yang et al. (2008) 8C framework when studies were repeated in 2008 and 2010. Accordingly, we used the 8C framework to inspire a framework for assessing luxury fashion brand websites. In 2010 the subcategories were extended further according to recent advances in technologies including *augmented reality* and *3D* in the category 'Context', as well as *social shopping* and *shopable videos* in the category 'Commerce'. Also, one observation field code was changed, namely the subcategory *syndication* in the category 'connection'. In order to observe syndication in 2008, the two sites shopstyle.com and vogue.tv were selected due to their luxury fashion target market. However in 2010 the syndication phenomenon had exploded, so instead a general measure was used; measuring the brand on www.vitruve.com's social media index, which is an index score comprised of various mentions from blogs, sites, and social network sites.

Longitudinal observations of luxury fashion brand websites were conducted over a two week period in 2006 (of 25 brands), in 2008 (of 30 brands) and in 2010 (of 33 brands), which was validated by a research assistant who initially found a 12% inconsistency in the observation, mainly due to subjective interpretations of the websites and degree of interaction with the site). Following 15 brands were included in all three observations: Burberry, Chanel, Chloé, Dior, Donna Karan, Gucci, Hermes, Louis Vuitton, Marc Jacobs, Mulberry, Paul Smith, Prada, Ralph Lauren, Valentino, and Versace. The comparison of observations for this study will hence include these 15 brands only. The current study will use relative frequencies of the different 8C categories, but since the total sample size is only 15, we are obviously not going to do any quantitative analysis. Contrary, we shall try to identify especially

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relevant and potentially very effective types of categories by giving some ‘best-business practice’ examples.

4 The 7C’s Framework

One of the most recognised frameworks for evaluating brand websites is Rayport and Jaworski’s [23] 7C framework. The 7C framework was chosen for this research, as it emphasises the specific role of interface elements as a communication and sales channel between retailers and the customers. In other words, the 7C’s are the interface components through which retailers communicate with their customers to deliver the core value proposition the company wants to convey [24].

Rayport and Jaworski’s [23] 7C’s framework encompasses seven elements that enable the implementation of an effective framework for the online customer interface; context, content, community, customisation, communication, connection and commerce. Each of the seven elements represents a specific component of a web-based system. The authors claim that the success of a business depends on the extent of how well the Cs work together to support the value proposition of the business. The below table outlines the 7C’s and their definitions.

Table 1. The 7C Framework

Interface element	Description
Context	The context of the web site captures its aesthetic and functional look-and-feel.
Content	All the digital subject matter on the web site
Community	The interaction that occurs between web site users
Customisation	The ability of the web site or interface to tailor itself or to be tailored to each individual
Communication	The dialogue that unfolds between the web site and its users.
Connection	The extent of the formal linkages between the web site and other web sites
Commerce	The various aspects of e-commerce, such as shopping carts, security, order tracking etc

Source: Rayport and Jaworski (2001)

Researchers have applied, adapted or extended the 7C framework in several interesting ways. Lee and Benbasat [24] used the 7C framework as a reference framework for their conceptual paper on interfaces for mobile commerce. They proposed an extended framework of 7C to cover the important issues pertaining to m-commerce interfaces: the 2M’s and the 7C’s.

Georgiadis and Athanasios [25] used the 7C framework to evaluate ecommerce and mcommerce user interfaces. Their paper focused predominantly on five C’s: customisation, content, context, community and commerce.

Begalli, Codurri and Gaeta [26] analysed 272 high quality winery websites through an adapted version of the 7C framework: Content, Choice, Context, Comfort, Convenience, Customer services, and Community.

Yang *et al* [27] evaluated how the 7C framework could be updated to include Web 2.0 applications and hence extended the 7C framework with an 8th C, 'Collaboration', and created a reference model for evaluating and designing effective Web 2.0 applications.

Sabouri and Jalali[28] evaluated Web 2.0 application technologies based on the 7C framework and Yang *et al's* [27] 8C framework.

Our aim is to develop Yang *et al's* [27] 8C framework for assessing fashion luxury brands' websites and brand controlled social media platforms.

5 Luxury Fashion Brands' Use of Web 2.0 According to Previous Empirical Research

Empirical research conducted by Siddiqui *et al.*[8], Lacroix and Riley [9], and Seringhaus [10] show that most luxury brands do not have interactive, entertaining or engaging websites and are thereby not meeting consumer's expectations.

Siddiqui *et al* [8] evaluated 14 fashion websites and conducted two in-depth interviews with store personnel. Their research emphasise that consumers express a need for social interaction, two-way communication and a greater level of interactivity online which are not met by luxury brands. They found from consumer interviews and focus groups that visitors are disappointed by the low level of interactivity presented by the websites and further pointed out that *'it is evident that consumer's experience and expectations far exceed the retailer's ability to understand and satisfy consumer need online'* (p4). Siddiqui *et al* [8] concluded that here is a lack of human and social interaction online and that consumer expectations in product and services online are not met by fashion websites.

Lacroix& Riley [9] evaluated 26 fashion websites and conducted 5 in-depth interviews. Their research argued that internet presence is both an opportunity and threat, and recognised that consumers miss the opportunity to be involved in a relationship with a brand. They recommended that the degree of control over the brand may need relaxing so that unmoderated communities are built within the brand's website. *'This would enable the companies to engage in a more unfiltered dialogue with their publics'* (p2). Lacroix& Riley [9] concluded that websites' interactivity features are crucial to internet marketing success, but less likely to be used as a tool for commerce. The reason being, that the Internet would not be able to provide the pleasure experience and social experience of entering the physical store, together with the human contact and service offered.

Seringhaus [10] evaluated 190 luxury brand websites; wherefrom 45 were fashion and leather goods brands. The paper questions the feasibility of recreating the brick-and-mortar store online and recommends that luxury marketers must find a way to use the web to maintain a sense of drama. *"They should innovate not recreate store atmospherics online, but create a seamless integration of on and offline into a complementary experience"* (p16). Seringhaus [10] concluded that differentiation

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from competitors online are more difficult as critical points of distinction such as showrooms and store displays, personal selling and service and the experiential touch and feel are currently lacking.

More recently, Kapferer and Bastien [14] stated that luxury fashion brands are facing the Internet dilemma: “*A luxury product can communicate via the Internet, but should not be sold there*” (p207). Their viewpoint is that an Internet strategy is indispensable for luxury brands in the means of communications, advertising and as an experiential tool. But if a luxury product is placed for sale on the Internet, is no longer a luxury product.

6 The 8C Framework

The 7C framework is fundamental in the sense that it can be applied to any type and generation of Web applications whether it is Web 1.0 or Web 2.0 [27]. However Yang *et al* [27] states that collaboration and user-generated content are two closely related elements and two important features in Web 2.0 and therefore updated the 7 C’s framework for Web 2.0 applications and added ‘Collaborations’ as the 8th C. They argue that the ‘Community’ element is close to their 8th C ‘Collaboration’, but where ‘Community’ defines a set of methods and is not related to a specific task or goal, ‘Collaboration’ is task specific. By extending the 7C’s framework Yang *et al* [27] created a reference model for evaluating and designing effective Web 2.0 applications

6.1 8C framework applied to luxury fashion brand websites

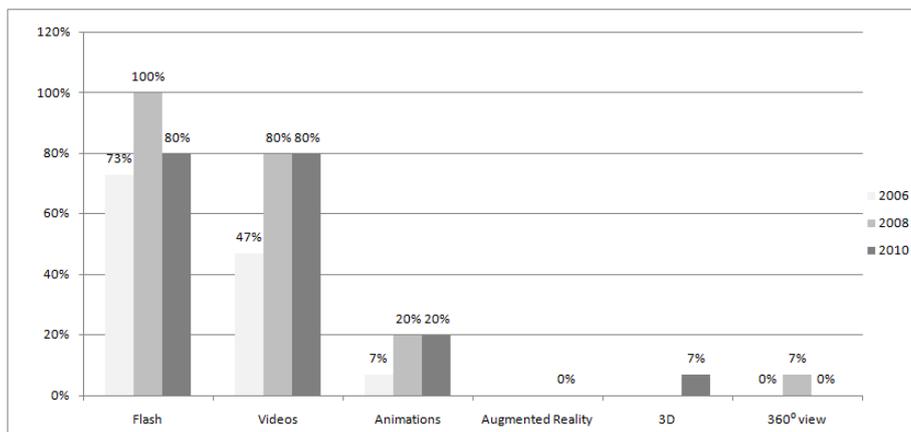
Table 2 which is adapted from Rayport and Jaworski [23] and Yang *et al* [27] sum up the relevance of the 8C’s for assessing luxury fashion brands websites.

Yang *et al*’s [27] table “The 7C Framework and the 8C Framework, in the contexts of Web 1.0 and 2.0”, describes the meanings and types of Web 1.0 in the first column, and the meanings and types of Web 2.0 in the second column. We have further developed the framework and operationalized the different constructs of Rayport and Jaworski as well as Yang *et al* to achieve a precise framework appropriate for a direct observation of the luxury fashion brand websites. Hence we added a third column to the framework describing the 8C’s applicability to luxury fashion brand websites. It describes via sub-categories how each of the 8C’s are relevant to luxury fashion brands and how we can assess the adoption of Web 2.0 on brand websites and brand controlled social media platforms. The framework was applied to between 25 and 33 luxury brand websites in 2006-2010 in order to get 15 observations of the same websites in all three observations. This enables a comparison of how the websites have evolved and adopted interactive and social technologies since 2006.

The following section will evaluate the development of luxury fashion brands’ adoption of Web 2.0 categories on their brand website and on brand controlled social media platforms. We shall also provide specific examples of noteworthy developments for each Web 2.0 category.

6.1.1 Context

Figure 1. Luxury Fashion Brands' use of the category 'Context' from 2006 -2010



There was a significant change in the use of flash on luxury brand's websites. In 2006 nearly one quarter (73%) of the observed brands were using flash on their websites, and in 2008 all brands (100%) used flash, whereas in 2010 brands started to steer away from flash (80%) again. Flash was traditionally used because of its live and interactive qualities, but is not viewable on iPhones and iPads and are thereby prohibiting the viewer from accessing the sites on these increasingly popular and important devices [29].

About half of the observed brands used video features (fashion shows, brand or campaign videos) on their websites in 2006, whereas the majority of brands did in 2008 and 2010 (80%). The videos are all very stylised and controlled and inherently with no video posts, blogs or interactive videos where the brand can talk directly to fans and customers as exemplified on social media platforms (i.e. Burberry's video posts to Likers on Facebook). Burberry furthermore utilised an interactive 3D video on its site where the user could drag the models and products in all directions on screen creating a very engaging and entertaining interaction.

Recently automobile and jewelry luxury brands like Faberge, Tissot, Boucheron and BMW have adopted augmented reality technologies in order to give the shopper the possibility of trying on products, getting a more real-live feel, and making the product come to live on screen. This adoption of technology has however not reached the luxury fashion brands yet. Berta de Pablos, Global Director of Marketing & Communications at Boucheron, talked about her experience with augmented reality, saying, *"You have to start with the brand, not the technology. You have to ask, how can we create the dream of the brand in the minds of the consumers? ..The Internet can be a catalyst of emotions. We experienced that people were intimidated going into our stores, but we wanted them to interact and connect with the brand. Augmented reality allowed for this."*

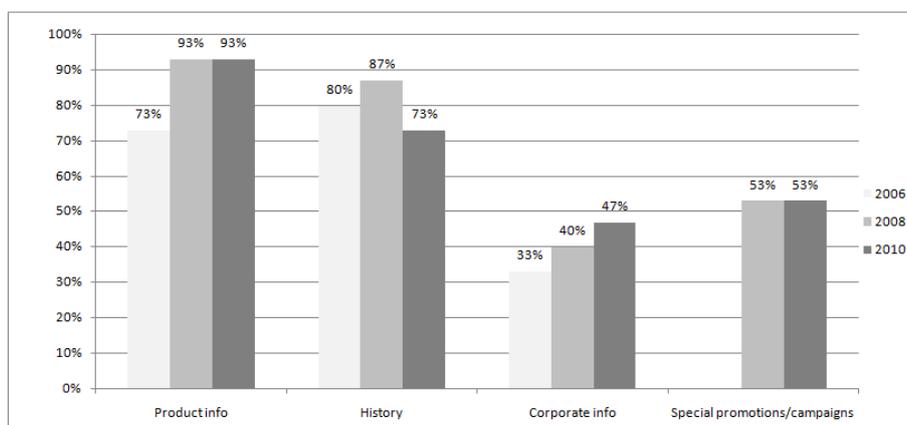
Photo technology like 3D scanning of products, which are displayed interactively on screen, thus enabling the visitor to turn the product around, as if she had it in their

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own hand, is increasingly popular on ecommerce stores. Brands like Nike and Apple, as well as online fashion stores like ASOS and Net a Porter use this technology as it enhances the buying experience and hence conversion rate significantly [29]. None of the observed luxury fashion brands utilised the 3D technology in 2010 nor 360 degree views.

6.1.2 Content

Figure 2. Luxury Fashion Brands' use of the category 'Content' from 2006 -2010



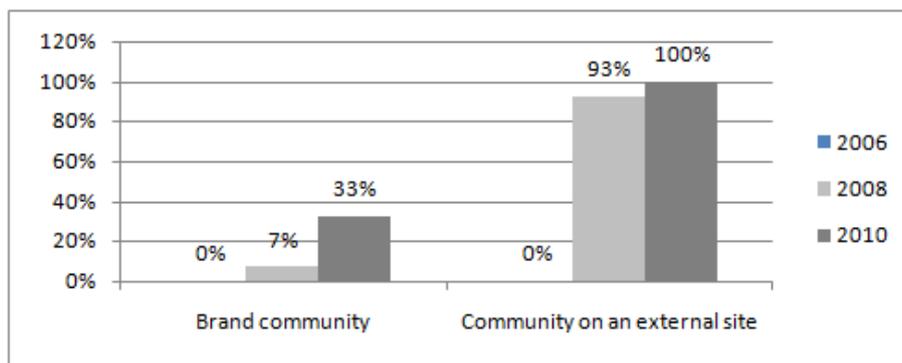
There has been a substantial development of the manner in which luxury fashion brands use product description. In 2006 brands offered very sparse descriptions, sometimes even just product codes. This has changed into a more descriptive lifestyle text where products at best are described as a sales assistant would when a customer enter a physical store; with feelings, atmosphere and a tone of voice which is characteristic to the brand. It is evident that brands with most developed descriptions (i.e. Burberry, Louis Vuitton, Mulberry and Smythson) have a greater digital focus and online turnover.

Traditionally luxury fashion brands focus on their history and timeline and most brands had a section on their website dedicated to history in 2006 and 2008. However in 2010, history did not necessarily have a separate section on the website any longer, it was instead integrated it in their overall communication. On the other hand, few brands offered corporate info in 2006 (33%), whereas it was increasingly offered in 2008 (40%) and 2010 (47%).

Around half of the observed brands from 2006 to 2010 gave space to special campaigns or seasonal campaigns; hence there was no real development in this subcategory. Alexander Galle, Director at Galle would though encourage brands to use the function as a shopping window update. *“Special promotions are what adds newness to the site and makes visitors come back regularly”*.

6.1.3 Community

Figure 3. Luxury Fashion Brands' use of the category 'Community' from 2006 -2010



This is the category where there has been the greatest development within the last four years. In 2006 and 2008 there were no own branded community sites, but by 2010 Burberry had launched “Art of the Trench” (in Nov 2009). Gucci had launched “Eye Web” in 2009 and “Gucci Connect” in 2010. Hermes had launched “jaimemoncarre” (“I love my scarf”) in 2010 and brands like Mulberry, Paul Smith and Smythson had launched blogs where readers could comment and interact with the brand. Contrary, Ralph Lauren, Louis Vuitton, Jimmy Choo, Dunhill, Donna Karan, Dolce Gabbana and Chanel had launched blogs and news channels without the possibility of commenting – which is inherently contradicting the whole point of blogs.

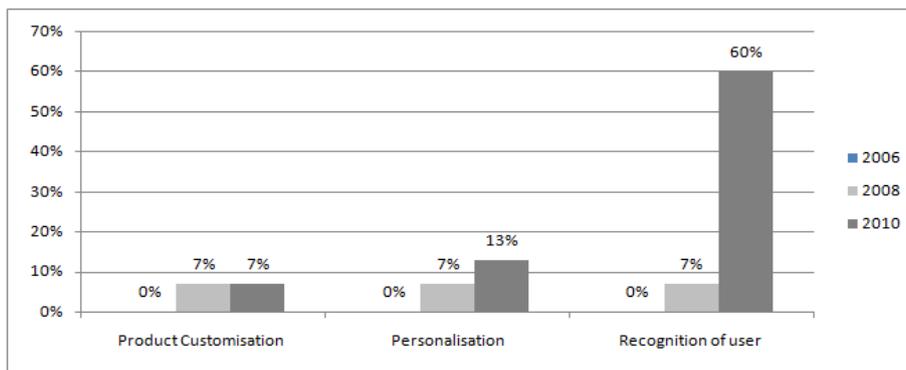
There were likewise a tremendous development in the way in which luxury fashion brands adopted social media platforms like Facebook, Twitter and Youtube. In 2006 none of these platforms were generally used. In 2008 all the observed brands had videos on Youtube, though not yet through branded Youtube channels, and most brands (90%) had a Facebook account. However these external sites were not managed and utilised very well. Most brands only had a logo as profile picture and nothing else developed in terms of content, pictures and features. Hermes did not even control their own Facebook profile, as there were 280 individuals pretending to be Hermes. Brands like Calvin Klein, Ralph Lauren and Dolce Gabbana had around 100.000 Facebook fans, while brands like Burberry, Donna Karan and Mulberry only had around 1000 fans. Burberry had managed to grow this direct fanbase into 3,5million fans in 2010.

All but two (MiuMiu and Victor & Rolf) of the total number of brands observed, had a Facebook profile and nearly three quarters had a Twitter profile. Around half of the brands posted something on their community site every day and around one quarter posted something weekly. Contrastingly, Alexander McQueen, Prada, Tods and Valentino had not taken control of and/or utilised their external community site, leaving the profiles in the hand of spammers.

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6.1.4 Customisation

Figure 4. Luxury Fashion Brands' use of the category 'Customisation' from 2006 -2010

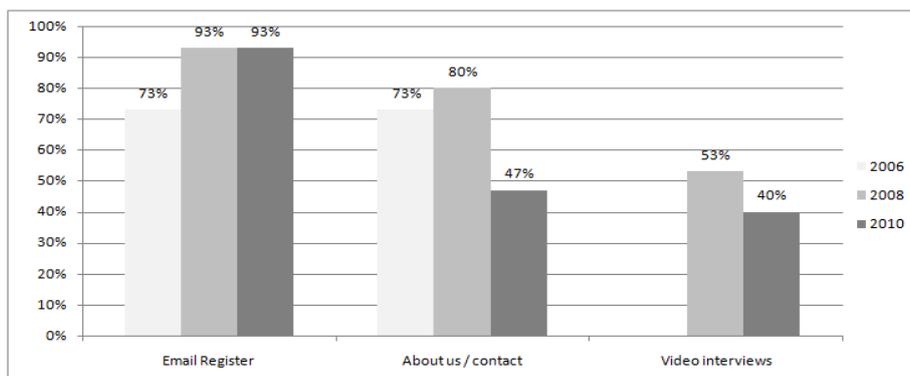


Product customisation and personalisation were the origin of luxury products; it was all about the individual and intimate relationship with the designer, craftsman and the customer. The internet offers the opportunity of connecting with the individual customer in this unique and intimate manner again. There are however very few luxury brands which make use of this opportunity. In 2008 only Smythson and Ralph Lauren offered customisation (where the customer is involved in the design of the product) and personalisation (where the customer can add their initials or personal mark). In 2010, Louis Vuitton also offered customisation on their website and on their Facebook profile.

The technology, which recognises the user, is widely used by ecommerce sites like Amazon (books and consumer goods), Tesco (groceries), New Look and H&M (high street fashion), for offering a personal experience on the website, however it was not widely used by luxury fashion brands. In 2006 no brands offered a "sign in" feature. In 2008 a few of the observed brands offered the feature, whereas in 2010 more than half (60%) of brands offered a "sign up" feature enabling the brands to recognise the visitors who logged in.

6.1.5 Communication

Figure 5. Luxury Fashion Brands' use of the category 'Communication' from 2006 -2010



Nearly all observed brands from 2006 to 2010 offered the option of signing up for newsletters. Only Versace did not offer this option of direct communication, which counts for around 10% of traffic generation [30]. What has changed significantly over the four year period is the prominent placement of the “email register”. In 2010 the important sign-up button was placed in the menu bar, meaning was clearly visible on all individual sites. Contrastingly, brands are not placing great effort in being transparent by sharing “about us” and contact details. In 2006 nearly three quarters (73%) of the observed brands shared contact details in the form of either phone number, email or postal address. In 2010 less than half (47%) of brands shared “about us” and contact details. Especially brands that didn’t offer ecommerce, like Chanel and Fendi, didn’t offer any contact details at all.

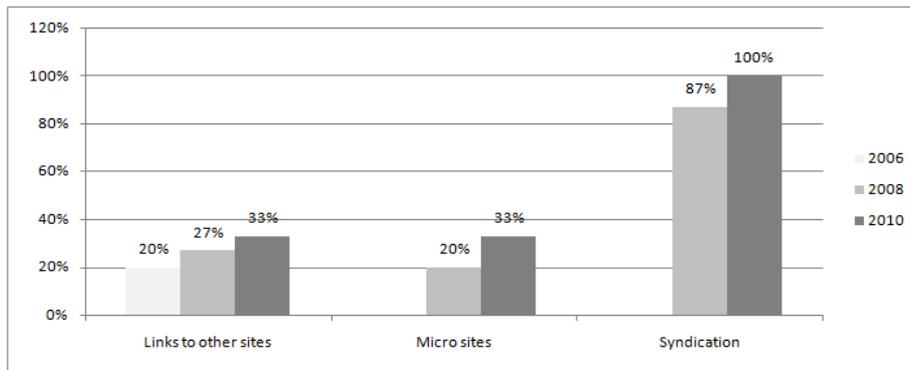
In 2008 half the brands (53%) used videos as a communication tool showcasing interviews with designers, craftsmen or celebrity ambassadors. Bally, BottegaVeneta, Donna Karan, Paul Smith, Tods, and Victor & Rolf had video interviews or messages from their designers. Ralph Lauren had interviews with celebrities telling about their favourite moments with the brand. Despite video content being hailed as the most important and compelling content in fashion [31][29]. (Okonkwo, 2010; the Retail Bulletin, 2010), the observation in 2010 indicated that fewer brands (40%) are utilising video interviews on their websites.

Martin Mason, CEO at MCM, explained that through video interviews you can get a unique feel for the brand and be invited into the world of the brand. “Videos give you a different experience to reading; you are living in the visual experience and being entertained, i.e. seeing the way the designer moves, talks and what her personality is like. This is something that cannot be explained in words and something that is exclusive to the website and helps bring it to life”.

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6.1.6 Connection

Figure 6. Luxury Fashion Brands' use of the category 'Connection' from 2006 -2010

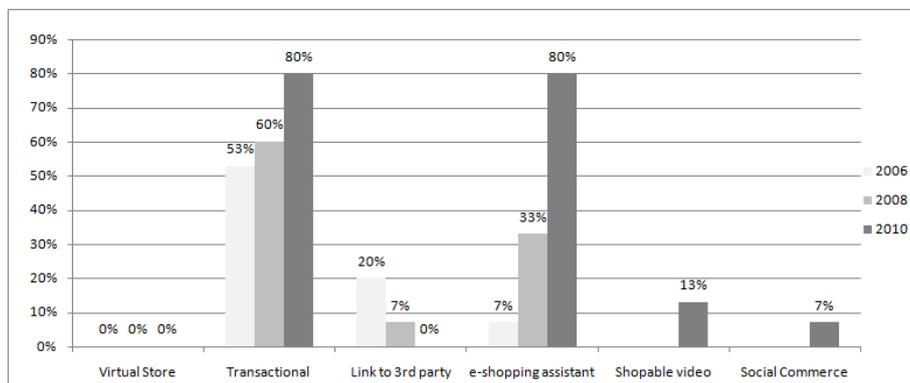


In 2010, brands were markedly linking traffic from their own site to their own social media platforms, increasingly integrating the brand platforms online. They were also increasingly taking control of their own sales channel online instead of linking to third party selling sites like eluxury, Net a Porter, and Neiman Marcus as they did in 2006.

The phenomenon of syndication (i.e. placing branded content or products from own site on other sites) had not emerged in the fashion industry in 2006, but in 2008 the majority (87%) of brands used syndication. However in 2010 the phenomenon had exploded with highest scores achieved by Gucci, Chanel and Burberry, whom also are more active on social media platforms and have many Facebook Likers – meaning many people and stakeholders spread the word of the brand and acted as online ambassadors.

6.1.7 Commerce

Figure 7. Luxury Fashion Brands' use of the category 'Commerce' from 2006 -2010



In 2006 a quarter of the brands observed offered ecommerce in the UK and half of the brands offered ecommerce in the US, though the majority only offered a small selection of accessories (only Paul Smith offered a selection of clothes as well). In 2008 more than half (60%) of the observed brands offered ecommerce on US commerce sites. Burberry, Hermes, Paul Smith and Mulberry were amongst the few brands that offered ecommerce to multiple countries. However in 2010 there was a significant difference; more than three quarters (80%) of the observed brands offered ecommerce to US, UK and most of EU. The majority of brands offered both accessories and clothes, except from Dior, Louis Vuitton and Prada who offered accessories only.

There were no virtual flagship stores with immersive and engaging lifelike shopping, as in gaming environments. Though Cartier had a navigational virtual store with a shopping assistant showcasing and explaining the products in 2008, and Tod's had a tour of their Milan store, and Victor & Rolf had a navigational tour of the house, shows, library etc. None of these had the option to actually buy the products on display. In 2010 Gucci launched a "digital flagship store" (PPR, 2010), and Marc Jacobs launched a "virtual store", where the visitors were welcomed by a guy (a drawing), opening the door, and different shopping assistants (drawings), at each product station.

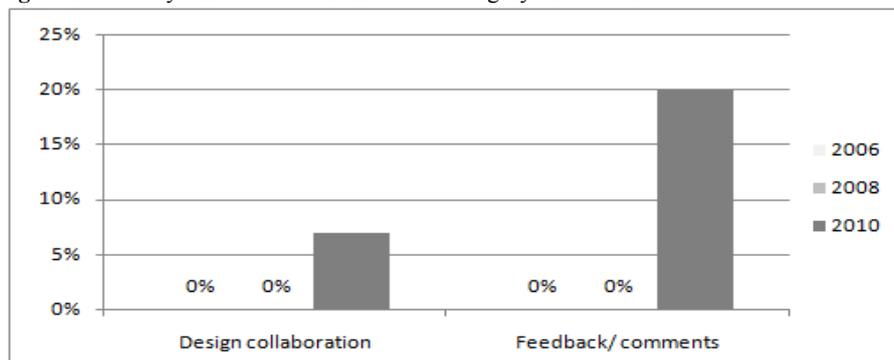
No brands offered a 24/7 real-time shopping assistant either in the form of online chat or video conferencing, as for example luxury jewelry brand Fabergé does. A third of the brands (33%) in 2008 claimed to have shopping assistance via phone, email or a fill-in form. In 2010 the majority (80%) claimed to have shopping assistance available, however when testing Gucci's contact form, it took more than two weeks getting a reply to a product question. It is worth noting that following completing the observation, Burberry did launch online 24/7 real-time chat and call function to their site in January 2011.

Mark Dunhill, CEO at Faberge, talked about bringing the human touch to the online platform, *"the online experience and service needs to be as special as in the physical store. Sales advisors can help retain the emotional and otherworldly experience of the brand and the product...Technology provides the opportunity to entertain and connect with your customer"*.

Ralph Lauren offered a shopable video "RL Gang", an immersive storytelling video of kids going to school, where the viewer could click on the clothes in the video and be directed to the chosen product's url where it could be purchased. Many retailers like Barneys, Next and online fashion shops like ASOS sell their collections on Facebook, also called social commerce or Facebook commerce, but only one of the brands observed, Louis Vuitton, offered this function on their Facebook page with completion of sale on their own website. Nevertheless, A third of the observed brands utilised social shopping in a related manner; they added a "share button" next to products on their website enabling the visitor to share the product on his/her social media profiles.

6.1.8 Collaboration

Figure 8. Luxury Fashion Brands' use of the category 'Collaboration' from 2006 -2010



In 2006 and 2008 the luxury fashion brand websites had no elements of collaboration, whether related to design collaboration, co-creation or feedback and comments regarding product development. In 2010 Smythson and Ralph Lauren involved their customers in designing products on their site. At Ralph Lauren customers could design their own Polo shirt (shape, colour, initials, badges etc), and at Smythson customers could design their own stationary paper and have their initials or text engraved in the leather stationary items.

Fendi, Gucci and Marc Jacobs had a function on their websites where visitors could “like” the individual products, which consequently gathered a pool of “likes” and helped other visitors see which products were most popular amongst fellow visitors.

In 2010 the observation of the category *collaboration* was extended to Facebook and Twitter i.e. observing how brands open up for feedback, comments and collaboration on Facebook. All brands with a Facebook profile had posted something on their wall, however only one brand, Smythson, replied to comments on its own posts on Facebook and Twitter, and to customers' posts. Burberry's Creative Director, Christopher Bailey, posted a video greeting once a month to Burberry's Facebook fans, wherein he replied to some of the comments, as well as telling the fans how much they meant to Burberry. Similarly, Marc Jacobs's CEO, Robert Duffy, took over the brand's tweets for a month leading up to their fashion show in the autumn 2010. He tweeted some very personal messages about the business, Marc and himself, and posted pictures of the seamstresses, designers, cutters and models, while answering all the tweets he got from followers. Marc Jacobs' Twitter profile grew from a few thousands followers to 75.000 followers in that period of time.

Julie, Internet Retail Development Manager at Chanel, however still had concerns about interacting with fans and allowing their unfiltered feedback: “*It's really difficult to control your brand in the social media. Brands are afraid of what people say and how they interact with the brand. You can only really control the brand on your own website*”.

6.2 Key Findings of the empirical research and analysis

Contrary to the previous literature's research findings and recommendations, our findings show that the majority of luxury brands are selling online in 2010 and brands like Gucci, Burberry and Mulberry have full fledged ecommerce sites. Supporting this, Gucci Group recently announced that they are creating an ecommerce division and expect 10% of total turnover to come from online sales [32].

Overall, the findings illustrate that the observed luxury brands have increased their adoption of social and interactive digital technologies since 2006.

The greatest development is within the category 'Commerce' where subcategories *transactional* and *e-shopping assistant* have increased significantly and the new digital tools *shopable video* and *social commerce* have been adopted in 2010. The category 'Collaboration' was not utilised in 2006 and 2008, but have been adopted in 2010, remarkably not on the brand websites, but on the brand controlled social media platforms. Here some brands have started to interact, share, collaborate and receive feedback from consumers. The subcategory *brand community* within 'Community' also show a significant increase in brands' creation of their own communities like Burberry's Art of the Trench. Lastly, the increase of the subcategory *recognition of the user* within 'Customisation' indicates adoption of internet technology which recognises the visitors coming on to the site and the possibility to offer them a customised site experience.

The slowest development is associated with new technologies such as *augmented reality*, *3D*, (within the category 'Content') and *virtual stores* (within the category 'Commerce'). No luxury fashion brands have adopted these technologies, though luxury jewelry brands have. Luxury fashion brands do not either take full advantage of the 'Customisation' and 'Collaboration' categories.

Interestingly, the interviews show an intention to adopt interactive and social Web 2.0 tools even more. The interviewees expressed that there are great opportunities to be harvested in all the categories which will enhance the overall website experience and ultimately support brand experience and sales. Christopher Baily, Burberry's creative director, summed this up perfectly at the S/S 11 fashion show in September 2010 "*We are now just as much a media-content company as we are a design company, because it is part of the overall brand experience*" [33].

Lastly, one could argue that the lack of contact details on the websites and the lack of two-way interaction on websites and social media sites indicate that luxury fashion brands are still cautious and keen to continually control the images and messages they push out to their customers and fans. Interaction does not flow both ways; it is still predominantly a one-way communication, dictated by the brands that are afraid of what their customers and fans might say about them. This is in stark contrast to previous research findings on consumers wishes and wants [8][9] and to how consumers in general are empowered by interactive and social media. Here consumers are defining their own perspective on companies and brands, thus shifting the balance of power from company to customer [17]. Henceforth, luxury fashion brands have to continuously work on creating dream value by providing exceptional experiences online with the help of digital technologies and by interacting with consumers [31].

7 Conclusions

Our revised and extended version of Yang *et al.*'s 8C framework has proven useful to characterise and assess the development of luxury fashion brands' adoption of Web 2.0 technologies. The framework has been easy to use and there has been high reliability in ratings between the two observers. The highly including framework captures all interaction interfaces of a website; however it does not show the value of the interaction. Further research is needed in order to demonstrate the value and benefits of the different categories for fashion brands.

The study demonstrates a clear growth in adoption of Web 2.0 technologies by luxury fashion brands from 2006 to 2010 and is thereby challenging previous empirical research conducted by Siddiqui *et al.* [8], Lacroix and Riley [9], and Seringhaus [10] which showed that most luxury brands do not have interactive, entertaining or engaging websites. Some of the most interesting developments include the adoption of ecommerce, the establishment of brand communities, and the way in which luxury fashion brands are embracing social media platforms like Facebook and Twitter. For example in 2006 Burberry didn't use Facebook, in 2008 the brand had 2000 Facebook fans, and in 2010 3,5million Facebook Likers. The sheer volume of fans and consumers in direct contact with the brand has forced and inspired Burberry to put digital innovation and interaction at the heart of its brand strategy [34].

Key insights were also gained from the interviews with luxury brands, which were more digitally advanced. I.e. Berta de Pablos, Global Director of Marketing & Communications at Boucheron, explained that Boucheron had started suffering from being perceived as being old-fashioned, but were able to revive the brand with the aid of interactive and social technology. "*Boucheron is a 150 year old brand, but because of technology we can be a brand of today*". Likewise Mark Dunhill, CEO at Fabergé, explained that interactive technology provided the brand opportunities to renew contacts with their customers and give them otherworldly experiences. "*Technology provides the opportunity to entertain and connect with your customer*".

The findings have relevance for practitioners as the revised and extended 8C framework can function as a checklist for any assessment, development and use of fashion brand websites.

References

1. Reuters (2010a) Richemont seeks to buy UK's Net-a-Porter. 1 April 2010. Available from <http://www.reuters.com/article/idUSLDE63004020100401>
2. Reuters (2010b) PRESS DIGEST - British business. (ASOS turnover). June 6 2010 Available from <http://www.reuters.com/article/idUSLDE65500620100606>
3. Yoox (2010) Annual report 2010. available from http://cdn2.yoox.biz/yooxgroup/pdf/2009AnnualReport_YOOX_Group_f.pdf
4. FDIH (2010) Dansk e-handels analyse. Online. Available from <http://www.fdih.net/dansk-e-handelsanalyse/download-center.aspx>
5. EC Ecommerce Report (2009) Report on cross-border e-commerce in the EU. COMMISSION STAFF WORKING DOCUMENT. Brussels, 5.3.2009, SEC(2009)

283 final

6. JC Williams (2008) Organizing for Cross-channel Retailing. A Shop.org Study by J.C. Williams Group
7. Okonkwo, Uche (2009) Sustaining the luxury brand on the Internet. *Brand Management* Vol 16, 5/6, 302 - 310
8. Siddiqui, N., McColl, J., O'Malley, A., Birtwistle, G. (2003) "Retailer and consumer perceptions of online fashion retailers: Web site design issues" *Journal of Fashion Marketing and Management*, volume 7 number 4 2003 pp 345-355
9. Lacroix, C., Riley, F. (2003) "Luxury branding on the internet: lost opportunity or impossibility?" *Marketing Intelligence & Planning*, vol 21, no 2
10. Seringhaus, F.H. Rolf (2005) "Selling Luxury Brands Online". *Journal of Internet Commerce*, Vol 4(1) 2005 haworthpress.com
11. Economist (2007) "Serious Business. Web 2.0 goes corporate" Report from the Economist Intelligence Unit 2007
12. McKinsey (2007) "How businesses are using Web 2.0: A McKinsey Global Survey". *The McKinsey Quarterly*, January 2007
13. McKinsey (2008) "Building the Web 2.0 Enterprise. McKinsey Global Survey". *The McKinsey Quarterly*, June 2008
14. Kapferer, Jean-Noël and Bastien, Vincent (2009) *The luxury strategy*. London: Kogan Page
15. Jennings, Morgan (1998) "Theory and models for creating engaging and immersive ecommerce website" [online] Available from www.educ.msu.edu.com. [accessed on 26/1/08]
16. Kvale, S. and Brinkmann, S. (2009) *Interviews. Learning the craft of qualitative research interviewing*. London: Sage Publications
17. Bernoff, J., Li, C. (2008) *Harnessing the power of the oh-so-social web*. MIT Sloan Management review, spring 2008, Vol 49, no 3.
18. Parameswaran, M., & Whinston, A., (2007) "Research Issues in Social Computing". *Journal of the Association of Information Systems*, Vol. 8, Issue 6, 2007, pp. 336-350
19. PEW Internet (2011) *The social side of the internet*: http://pewinternet.org/~media/Files/Reports/2011/PIP_Social_Side_of_the_Internet.pdf
20. Shao, G. (2009) Understanding the appeal of user-generated media: a uses and gratification perspective. *Internet Research*, Vol. 19 No. 1, 2009, pp. 7-2
21. O'Reilly, Tim (2005) 'What is really Web 2.0? Design Patterns and Business Models for the Next Generation fo Software'. [online] <http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-Web-20.html>
22. O'Reilly, Tim and Battelle, John (2009) *Web Squared: Web 2.0 five years on*. Web 2.0 summit
23. Rayport, J., Jaworski, B. (2001) *Introduction to E-commerce*. New York: McGraw Hill
24. Lee, W., Benbasat, I. Designing an Electronic Commerce Interface: Attention and Product Memory as Elicited by Web Design. *Electronic Commerce Research and publications* 2, 3 (2003).

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25. Georgiadis, C. and Athanasios, M (2005) Personalisation of user interfaces in ecommerce and mcommerce applications. IADIS International Conference e-commerce
26. Begalli, D., Codurri, S., Gaeta, D. (2009) Win and web marketing strategies. The case study of Italian speciality wineries. British Food journal, Vol. 111 No6, 2009
27. Yang A.; KIM, D.; CAHALWANI, V.; VU, T. (2008) "The 8C Framework as a Reference Model for Collaborative Value Webs in the Context of Web 2.0". Proceedings of the 41st Hawaii
28. Sabouri, Milad and Jalali, Ali A. (2009) Evaluating Web 2.0 Services Based on 7C Framework. 2009 Sixth International Conference on Information Technology: New Generations
29. The Retail Bulletin (2010) Comment: Luxury fashion retailers: functionality or flash? 23/9/2010 www.theretailbulletin.com
30. econsultancy (2011) Social media drives 3% of traffic to e-commerce sites: survey. <http://econsultancy.com/uk/blog/7120-social-media-drives-3-of-traffic-to-e-commerce-sites>
31. Okonkwo, Uche (2010) Luxury Online. Styles, Systems, Strategies. Hampshire: Palgrave Mcmillan PPR (2011)
32. PPR creates a New E-Business Development Unit. Corporate press release. <http://www.ppr.com/en/press/press-releases/ppr-creates-new-e-business-development-unit>
33. Telegraph (2010) Burberrys conquest of cyber space. By Hilary Alexander, 8/9/2010 <http://fashion.telegraph.co.uk/columns/hilary-alexander/TMG7989381/Burberrys-conquest-of-cyber-space.html>
34. Vogue (2010) Burberry's Theatre. By Ella Alexander, 8/9/2010 <http://www.vogue.co.uk/news/daily/100908-burberry-retail-theatre-launch.aspx>

Appendices

Table 2 The 8C framework applied to luxury fashion brand websites

Interface elements	Meaning/Types in Web 1.0(Rayport and Jaworski)	Meaning/Types in Web 2.0(Yang et al)	Applied to Luxury Fashion Brand Website Assessment
1. Context	How the site is organised and how the content is presented to the users. A: Functionalities: layout, performance B: Aesthetics (look and feel): colour schemes, visual themes, graphics	Web 2.0 sites have layouts that are more dynamic. The performance and dynamism increase greatly by the use of i.e. FLASH and AJAX technologies. Graphics and animations. Query and response on e-commerce pages.	Definition: <i>Importance of beautiful and aesthetically pleasing design. This can be measured by:</i> Flash. Does the site use immersive Flash graphics or e.g. HTML? Videos. Does the site have videos of fashion shows, of products, or any brand related material? Animations. Does the site use animations to convey the brand? Augmented Reality. Does the site offer augmented reality features which either allow to try on the products or offer extra brand experience? (Only for 2010) 3D. Does the site offer any 3D technology, enabling

			engaging interaction with products, campaigns or other features? 360° view. Does the site offer 360° view of the products, creating a 'live' and tangible feeling of the products through visuals and product rotation?
2. Content	What is offered by the site? Offering mix is the mix of products and service information on a Web site Appeal mix refers to promotional and communication messaging Multimedia mix deals with the choice of media Content type refers to the degree of time-sensitivity	Collective Intelligence mix is the new addition which deals with all traditional three mixes with users participating in the generation of the content. This is typical of Web 2.0 applications	Definition: <i>Enticing and informative mix of product information and comprehensive brand information. This can be measured by:</i> Product information. Does the site offer detailed and engaging product descriptions or only sparse information? History. Does the site offer a history section about the brand? Corporate information. Does the site offer corporate information related to the brand? Special promotions / campaigns. Does the site have special campaigns or sections functioning like a shop window which is changed seasonally?
3. Community	Non-interactive communication Interactive communication (instant messaging, message boards, member to member emailing lists)	Collaborative communication may be enabled via non-interactive and most likely interactive communication mechanisms	Definition: <i>Communities established by the brand where connoisseurs and fans discuss the brand. This can be measured by:</i> Own brand community. Does the site have a community section launched and controlled by the brand itself? Community on an external site. Does the brand have communities on external social sites such as Facebook, Youtube and Twitter? And how many fans have joined this community?
4. Customisation	Refers to the site's ability to tailor itself (tailoring) or to be tailored by each user (personalisation)	Web 2.0 enables the content of the site to be tailored in a collaborative manner, since the content will be user-generated. The customisation can be done in dynamic manners i.e. with a desktop-like feel	Definition: <i>Customising the site experience for the individual user. This can be measured by:</i> Product customisation. Does the site offer the possibility of customising products? Personalisation. Does the site offer the possibility of personalising products i.e. adding initials to a product? Recognition of user. Does the site recognise the users? E.g. is there a "sign in option?"
5. Communication	Site to user communications: Broadcast, Interactive and Hybrid	Site to user communications: Broadcast, interactive, Hybrid and Push/Pull i.e. RSS	Definition: <i>News, details and communication about the brand including getting behind the scenes. This can be measured by:</i> Email register. Can the visitor sign up for newsletters on the site? About us / Contact. Is there an "about us" section and contact details for the brand? Video interviews. Does the site have video interviews with the designer, brand owner or perhaps fans of the brand?
6. Connection	Refers to the extent of formal linkages from one site to others: outsourced content, percent of home site content and pathways of connection	Lots of content of external sites may be pulled in the form of blogs, advertisements, mash-ups etc	Definition: <i>Connection to other complementing sites. This can be measured by:</i> Links to other sites. Does the site have links to other sites and external sites? Micro sites. Does the brand have sub-sites for i.e. campaigns or special collections? Syndication. Does the brand have syndication of content (products, advertising etc) on other complementing sites? (in 2010 this was measured by Vitruve.com)

<p>7. Commerce</p>	<p>Deals with the interface that supports the various aspects of e-commerce, such as shopping carts, security, order tracking etc</p>	<p>Deals with the interface that supports the various aspects of e-commerce, such as shopping carts, security, order tracking, affiliates and advertisements etc</p>	<p>Definition: <i>Shopping the brand's products on the website. This can be measured by:</i> Transactional. Does the site offer ecommerce? Virtual store. Does the site have a virtual store which customers can walk through and purchase from? Link to third party. Does the site have links to other sites which sell the brand's products? e-shopping assistant. Does the site have a shopping assistant in the form of live chat, telephone line or live video advice? Shoppable video. Does the site have videos where customers can shop from? (only in 2010) Social commerce. Does the brand offer ecommerce on their social media platforms like Facebook or Youtube?</p>
<p>8. Collaboration</p>	<p>Generally in the form of feedback forms, forums, and bulletin boards</p>	<p>Refers to the sites ability to provide users with interface and services to carry out high degree of collaboration, such as collaborative editing, project management etc</p>	<p>Definition: <i>Collaborating and opening up for comments and feedback from fans and customers. This can be measured by:</i> Design collaboration. Is it possible to collaborate with the brand on either the brand site or on Facebook? Feedback & comments. Does the brand allow comments and does it interact with customers on brand site or on Facebook?</p>

Source: Author

Table 3 The 8C framework 2006

Brand	The 8C's																										
	Context				Content				Community		Customisation			Communication			Connection			Commerce			Collaboration				
	Flash	Videos	Animations	360° view	Product info	History	Corporate info	Special promotions/campaigns	Brand community	Community external site	Product Customisation	Personalisation	Recognition of user	Email Newsletter	About us / contact	Video interviews	Links to other sites	Micro sites	Syndication	Virtual Store	Transactional	Link to 3rd party	e-shopping assistant	Design collaboration	Feedback/ comments		
Burberry	video, flash, photo gallery Site to navigation	yes			Spain	yes	yes							yes	ch	no				yes only US	no						
Chanel	video, flash, photo gallery & animation features. Interviews and tours. Very entertaining content	yes				yes	no							yes	phone. No address or phone number		no				no	no					
Chloe	simple photo gallery				Spain	yes	no							yes	address or phone number		yes to NAP				no	no	yes to NAP				
Dior	video, flash, photo gallery and interviews. Many different pop up	yes			Spain	yes	yes							yes	mail and post		no				yes, only France US disabled	no					
Donna Karan	flash, photo gallery					yes	no							yes	mail and post		yes directory				no	no	no				
Gucci	flash, photo gallery					no	no, but at gucigroup.com							yes	Mail, phone, and address		no				yes international and local	no	no	yes	yes		
Hermes	flash, sketches				very sparse	yes	no							yes	Automated, phone & mail		no				yes - US and France US disabled	no	no				
LV	video, flash, photo gallery	yes				yes	no							yes	mail		no, directions				yes, only France US disabled	no	no				
Marc Jacobs	video & photo gallery. Employee features	yes				very sparse	yes	no						not possible	email addresses for each department		no				no	no	no				
Mulberry	flash, photo gallery					yes	no, but contact details							yes	ch and post						yes	no	no				
Paul Smith	flash, photo gallery with product details					yes	no							yes	mail & phone		no				yes like amazon	no	no				
Prada	environment, stylized, create own style					very sparse	no	no						not possible	none		no				no	no	no				
Ralph Lauren	environment, stylized, create own style	yes				yes	yes							yes	phone & assistance phone number		no				yes US only	no	no				
Valentino	simple photo gallery with product details				no, just a link	no	no, link to refergroup							not possible	no, only store address		no				no	no	no				
Versace	video of runway photo gallery, flash	yes				yes	no							not possible	no, only postal address in Milan		no				no	no					

Source: Author

Table 4 The 8C framework 2008

Brand	The 8C's																								
	Context				Content			Community		Customisation			Communication			Connection			Comerce			Collaboration			
	Flash	Videos	Animations	360 view	Product info	History	Corporate info	Special promotions/campaigns	Brand community	Community external site	Product Customisation	Personalisation	Recognition of user	Email Register	About us / contact	Video Interviews	Links to other sites	Micro sites	Syndication	Virtual Store	Transactional	Link to 3rd party	e-shopping assistant	Design collaboration	Feedback/ comments
Burberry				3 photos					1 Youtube video 2 Facebook: 2000 fans										shopable	26 countries			shop from catwalk		
Chanel					Sparse				1 Youtube video 2 Facebook: 67,000 fans						incl RSS										
Chloe					Sparse												hair		vogue.tv shopstyle				hair	phone email	
Dior	if product on catwalk			4 photos					1 Youtube video 2 Facebook: 359 fans						designer				vogue.tv shopstyle						
Donna Karan					Sparse				Facebook: 71,000 fans									corporate site	vogue.tv shopstyle					email	
Gucci									Facebook: 4000 fans										corporate site	vogue.tv shopstyle					
Hermes									Facebook: 40,000 fans						craftsmen-shp inspiration						selection				
Louis Vuitton				2 photos			soundtrack heritage etc		1 Youtube video 2 Facebook: 40,000 fans			video & text but can order online							vogue.tv		UK & US			phone	
Marc Jacobs					Sparse		special items	employee travel photos	1 Youtube video 2 Facebook: 62,000 fans						employees				shopable						
Mulberry				3 photos			Kathryn		Facebook: 400 fans									Kathryn	vogue.tv shopstyle						
Paul Smith				3 photos					1 Youtube video 2 Facebook: 19,000 fans										shopable					US, UK, Japan	
Prada							Fallen shadow		1 Youtube video 2 Facebook: 80,000 fans										shopable						
Ralph Lauren				3 photos					1 Youtube video 2 Facebook: 110,000 fans		photo	monogram on polo	login		se celebrities			to micro sites	to micro sites	vogue.tv shopstyle				US + Miscellaneous	email and phone
Valentino				3 photos			on corporate site	private collection	1 Youtube video 2 Facebook: 32,000 fans									corporate site	vogue.tv shopstyle					email	
Versace									1 Youtube video 2 Facebook: 32,000 fans										vogue.tv shopstyle						

Source: Author

Table 5 The 8C framework 2010

Brand	The 8C's																													
	Context				Content			Community		Customisation			Communication			Connection			Comerce			Collaboration								
	Flash	Videos	Animations	Augmented reality	3D	360 view	Product info	History	Corporate info	Special promotions/campaigns	Brand community	Community external site	Product Customisation	Personalisation	Recognition of user	Email Register	About us / contact	Video Interviews	Links to other sites	Micro sites	Syndication	Virtual Store	Transactional	Link to 3rd party	e-shopping assistant	Shoppable video	Social Commerce	Design collaboration	Feedback/ comments	
Burberry						1.7 items, 1 item					Facebook: 30,000 fans																			
Chanel						1 item & 1 item					Facebook: 1,000,000 fans																			
Chloe						1 item					Facebook: 30,000 fans																			
Dior						1 item					Facebook: 100,000 fans																			
Donna Karan						1 item & 1 item					Facebook: 30,000 fans																			
Gucci						1 item					Facebook: 1,000,000 fans																			
Hermes						1 item & 1 item					Facebook: 1,000,000 fans																			
Louis Vuitton						1.7 items					Facebook: 1,000,000 fans																			
Marc Jacobs						1 item & 1 item					Facebook: 1,000,000 fans																			
Mulberry						1 item					Facebook: 30,000 fans																			
Paul Smith						1 item					Facebook: 30,000 fans																			
Prada						1 item & 1 item					Facebook: 100,000 fans																			
Ralph Lauren						1.7 items with 1 item					Facebook: 1,000,000 fans																			
Valentino						1 item					Facebook: 100,000 fans																			
Versace						1 item					Facebook: 100,000 fans																			

Source: Author

E-Services – Software Design for Rationalisation and Empowerment

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Abstract. Today, many personal services are no longer conducted in interaction between customers and service professionals but they are produced in self-service situations by customers alone. This trend towards self-service jeopardizes jobs in the service sector or at least changes their job profiles, since service professionals are only needed as a fall back option for „service recovery“. This way, companies standardise and rationalise their services and make their customers work for them. Do these “working customers” get adequate support by current e-service software? How can companies improve their software? Can participatory design approaches be useful in this new context? This article characterises the current situation, discusses the questions above, and shows directions for future research in order to design for an empowerment of customers along with the process of rationalisation implied by the trend towards e-services.

Keywords. Service, E-Service Design, Working Customer, Participatory Design

1 Introduction

Since the 1950s, after the rise of the service sector in Europe, a strong trend towards self-service emerged. Goods in supermarkets became physically available to the consumer for inspection and only needed to be collected and paid at the check-out, later convenience restaurants and cash points were established. This implied that the consumers took over much of the tasks at hand themselves and sometimes the formerly flexible and rather comfortable interaction between a service person and the

consumer was even replaced by a strictly formalised interaction with a machine. During the last decade, this trend gained a new quality as companies increasingly provide their services via the Internet. Consumers now can do their investigations, their shopping or banking online without interacting with any service professional at all, only being supported by the e-service software they access via the Internet.

For software designers new questions arise with the advent of such applications that are aimed at a very diverse new group of users: everybody. They need to be supported well since – without much preparation - they take over tasks that were formerly carried out by professionals: What is different about this user group? In what contexts do they act and what hardware and software constellations do they use? What do they know or need to know? What do they want and like? E-commerce experts complain that a high percentage of online-transactions on their websites are cancelled. Many such sites seem to be designed very poorly and do not support the customers well enough. The design of e-service software will have to be studied in much more detail to match e-service with customers' needs.

In this article we take a particular perspective, perceiving customers as doing some kind of work.¹ We describe the difference between service, self-service, and e-service and provide basic insights into the new user group of “working customers” [22] and their ways of handling e-services. We further reflect on how requirements elicitation and software design has to proceed to gather more information about their contexts and demands. In the end, current research questions are presented to stimulate further discussion - and hopefully more research within this field.

2 The Rationalisation of Services

Make-or-Buy – self-service has become a real alternative for consumers since supermarkets were established in the US at the start of the last century. When the idea came to Europe in the 1950s, people were at first sceptical but in no time the concept proved to be a formula for economical success in Europe, too ([2], [3], [4], [5], [6]). Self-service is based on a decision for the rationalisation of service: The customer takes over much of the work that has to be done. As a benefit, self-services are promised to be cheaper, less time-consuming, more fun, and to allow more privacy for the consumer ([7], [8]).

After long years of poverty in the postwar period in many European countries, people started to enjoy the revived “cathedrals of consumption” ([9]). Now goods were plenty, directly accessible and aesthetically presented, and that way symbolized and

¹ Tuunanen et al. [1] chose a different approach, discussing “value co-creation in consumer information systems” under aspects like identity construction, sociality, playful consumption and hedonic utility of information systems.

advertised the promised upcoming prosperity during this era ([10], [11]). Convenience restaurants were established and also in department stores and at petrol stations people were no longer served. In the 1970/1980s self-service also became a promise of autonomy and empowerment in another context: in many areas self-help groups were formed where people joined their individual expertise in order to support each other and not only depend on expert knowledge ([12]). The concept of Do-It-Yourself furthered the sovereign handling of mundane handicrafts ([13], [14]).

While self-service in its classical form continually found and finds its way into more markets and areas of service, a structural change could be identified with the rise of “e-services” ([15], [16], [17], [18]) during the last decade: It is now possible to provide Internet applications that consumers use to do their shopping, to take care of their financial affairs, to administrate their own data or to customize services themselves – on their own and without any support of professional service staff. This way a strong qualitative change of the concept of personal services is under way. On the one hand, Internet-based self-service promises spatiotemporal autonomy for the users. It is available wherever and whenever a person has access to a computer connected to the Internet. On the other hand, e-services are a result of service rationalisation rendered perfect. Already in the early 1980s Berger & Offe identified three strategies for the rationalisation of service work: the externalisation of work steps, the reorganisation of modes of operation, and the introduction of technology ([19]). While self-service as a matter of reorganisation often means the externalisation of work to the customer, e-services as a technology set the rules for consumers to work completely on their own. That way, the rationalisation of the seemingly unrationalisable service sector now has taken place.

3 When Service Becomes E-Service

Personal service has formerly been characterised by the interaction of two persons: the service provider and the customer - both perform the service together. They negotiate the contents as well as the terms and conditions of the service. If the service professional works for an organisation she knows what it can provide, tries to find out what the customer desires, and presents offers that fit these needs. In doing so, she mediates between the interests of the consumer and those of the company. Nerdinger characterised this doublebind-situation as the “triad of service” ([20] p.72).

Building on this, Theißing describes what happens when technology is used in a service encounter, calling it the “pyramid of service” ([21] p.113ff; see fig. 1). He shows that technology has a strong impact on the provision of service but is unaccessible for the consumer: The company provides software to the service professionals to accomplish their tasks, e.g. a clerk in a bank, or a person who sells

tickets at a train station. However, such software not only supports, but also restricts what service professionals may offer to their customers. Sometimes it strictly determines their ways of acting, e.g. if it allows only certain sequences of transactions. In contrast, the customer is seldom allowed to even view what is on the screen, let alone to interact with the system.

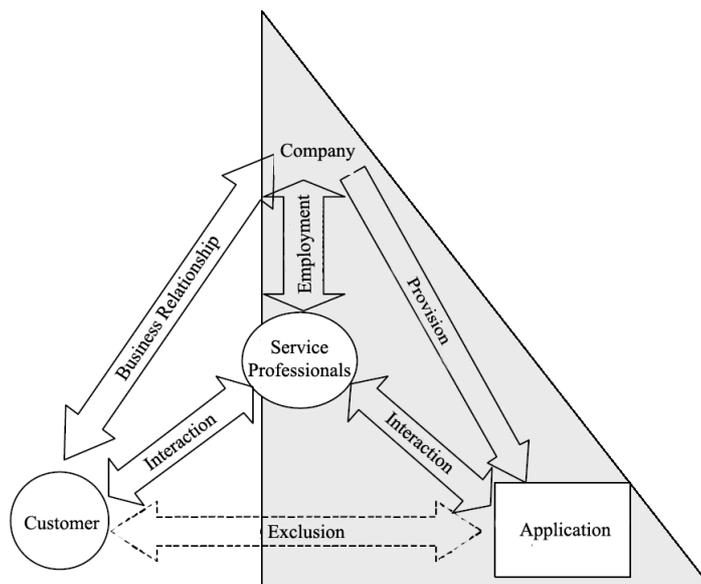


Fig. 1 Pyramid of Service ([21] p. 119)

With the provision of e-services the arrangement of the various constituents within the pyramid of service changes. Instead of the service professional, the application system becomes the central component (fig. 2). It mediates between the company and the customer. The customer now directly interacts with the system and that way performs tasks that have formerly been done by service professionals like clerks or vendors. Only in cases of emergency she contacts “a real person” – whenever the system is down, does not do what she expected, or is hard to handle. The job of service personnel is reduced to a fallback position or to peripheral activities like the actual delivery of goods. In this constellation new roles are ascribed to the customer, to the service personnel, and to the technology deployed.

Services are no longer co-produced in human interaction but conducted by the consumer alone supported (or lead) by a software system that was mainly shaped along the requirements specified by the service-providing organisation. Customers choose among given options, there is no room for negotiation. But unlike

professionals, “working customers”, as Voß & Rieder ([22]) named them², often lack basic competences and expert knowledge and they neither have colleagues nor technical or administrative staff to support them ([24] p.47). A customer can only act on the basis of the information she can elicit from the system. This is why they are entirely dependent on the quality of the e-service software, their only companion in the wide sea of e-services. In order to make it a good guide, the needs and wishes as well as the skills of potential customers must be anticipated when designing technology for self-service.

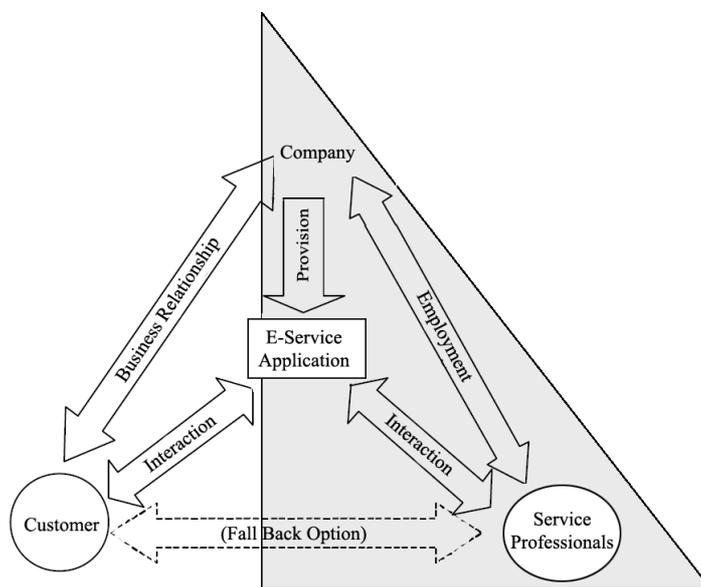


Fig. 2 Pyramid of E-Service

4 Adequate Support for the Working Customer

Following the idea that customers act like remote workers using a company’s (service) software, another argument emerges why e-service software must be designed very carefully: In countries of the EU the design of employed work with computer workstations is regulated by law, in Germany e.g. by the “Arbeitsschutzgesetz” (labour protection act) and more specifically by the “Bildschirmarbeitsverordnung”.

² Toffler introduced the more general term “prosumer” [23].

Legislation demands to ensure occupational health and safety by arranging workplaces, work environments, work procedures, and work equipment (hardware and software) in a way that minimises the mental and physical stress of employees. Measures range from good ergonomic design and spatial arrangement of furniture, screens and devices, to the assignment of versatile and challenging tasks with enough action latitude; they also include task-adequate and usable software design and adequate training of the personnel. These laws were established to ensure that employers take responsibility for the well-being of their employees by providing working conditions that prevent health hazards and foster the workers' personal and professional development.

Of course, companies have no formal obligation to care for their "working customers". The transfer of such claims seems likely but feels strange at the same time since customers are not compensated for their work - except for the advantages mentioned in the so-called "Bequemlichkeitsdiskurs" (convenience discourse; [25] p.122f.): the potential access to services anytime and anywhere. Customers also have no legal representation as workers. As their unpaid labour is not acknowledged as such, software for e-services - which is a crucial part of their work equipment - may be designed in any fashion, no matter how much customers struggle with it. In addition to that, e-services in most cases are used by choice and customers can simply turn away if they don't like them. But since companies want to capitalise on customers' unpaid labour and to cut down on personnel, they have to make sure that people are able and willing to use their e-services.

As customers decide where, when, and with what devices they use e-services, they are accountable for their physical work environment themselves. While interacting with the software, they may have to deal with various changing conditions of space, lighting, or noise, with interruptions and distractions. Companies have no influence on all that, however they are responsible for the main work instrument, the e-service software. Thus, they should provide software that is adaptable to many different conditions and that supports the given tasks well. The study of customers' conditions of work helps to see the particular requirements for the design of e-service software: It must be prepared to run on many different platforms and should be tolerant towards interruptions and small bandwidth. The software should be tested out on various hardware constellations. It should be easily configurable. Necessary configurations must be easily explained and made traceable.

These basic requirements due to the unpredictable physical working environments need to be complemented by an understanding of the special customer demands in regard to the various services they want to use. Most importantly, software must be tailored very well to the needs of consumers in service interactions since there are no professional intermediaries who react flexibly to unexpected customer requirements and translate them into regular system requests. No service personnel and no fellow "workers" will help and explain whenever a customer feels lost. The way information

is presented must be comprehensive and clear, including good instructions for use and a good guidance of visual attention. In e-service design diverse levels of customer knowledge and skills – both in regard to the service area and to the technical system – have to be dealt with when thinking about usability and user experience.

5 The Design of E-Services: Chances for Participation?

A particular challenge in e-service design is that the future users of the system, their individual needs and conditions of use are only known very vaguely. This makes a big difference compared to the design of custom-tailored software used in organisational settings. Furthermore, the potentially conflicting interests of the customers and the service providing company need to be balanced: Customers often use the Internet as an information media and wish to stay anonymous during their investigations, e.g. when they want to find out the conditions and the price for a liability insurance. Commercial suppliers tend to combine their information offer with an elicitation of customer data or they do not provide exactly the information required but present information about a reasonably priced combination pack for liability, life and accident insurances instead. Conflicting interests also exist in offline interaction, e.g. when service professionals strive for good numbers of sales and push customers for contracts while customers would prefer to find out more about alternatives before they decide. But with the design and provision of e-services such strategies and procedures get inscribed into software, so they define and restrict the available choices.

How is it possible to design user-oriented solutions under these circumstances? Researchers from the field of participatory design propose to engage end users and other stakeholders in order to allow different perspectives to be shared and discussed. They showed the challenges and benefits of bringing together and cooperating with those groups of people whose work will be affected by software changes ([26], [27], [28]). Especially in Scandinavia and Germany, researchers have claimed a workers right for co-determination in the shaping of their own job conditions - including the design of software ([29], [30]). In order to include the expertise and experience of users in the analysis and design process, participatory design advocates introduced methods that support communication among people with diverse professional backgrounds ([28], [31] p.63ff). The participatory methodology aims at giving all stakeholders a chance to be heard and at the same time to understand the perspectives, options, and limits of action of the others. Design teams include employees who will be affected by some new or modified software, software designers, experts for ergonomic design, and requirements engineers. Design problems can be viewed and understood from various angles, so that the solutions derived and decisions taken suit more requirements.

Can the ideas and methods of participatory design be transferred to the design of e-services? First of all, working customers might be considered as a special kind of employees who should have the right to influence their own working conditions. Their perspectives as end users are important since they are the only ones who know when, where, how, and why they are going to use the software. Secondly, various stakeholders are involved in the provision of personal services: As characterised by the “triad of service” (section 3), a service providing company, its service personnel and a customer interact – although not all stakeholders are actually present and directly in contact to each other. All three parties may pursue different interests that have to be negotiated in the interaction between service personnel and customers. For the participatory design of e-services, the knowhow and perspectives of all three

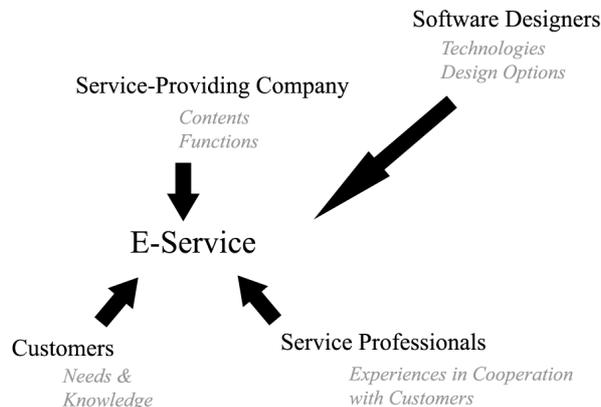


Fig. 3 Distributed Knowhow

parties should be combined in order to gain detailed knowledge about their various needs and wishes. This would help to contrast and negotiate their potentially conflicting interests before any service strategy is inscribed into the software and to make use of their different bodies of knowledge (fig. 3): *Companies* primarily know what products or services they want to supply online in what varieties and how these should be made accessible. They define what data the e-service system will work with. *Customers* are experts for their own needs and for what they expect from a service. They know for what purposes they prefer self-service to a technically mediated or direct interaction with service professionals. They set the spatio-temporal context, they choose devices and software, and they bring their personal experience from past encounters. Professional *service personnel* is versed in mediating between

demand and supply. They know customers' typical wishes and needs, and what makes a satisfactory service process. They also know what can be expected and required from users in interaction, what kinds of explanation and help are needed.

With the working customer a new stakeholder has entered the scene of participatory design: She neither belongs to the paid staff of a company nor is "just" a user of some product. While engaging with e-services, she enables the company to configure a product according to her needs and to sell it to her. She takes over parts of the tasks that have formerly been provided by service personnel. Still, she accomplishes work under conditions she herself is responsible for – except for the e-service software. To design e-services, information about her expectations and how she proceeds in service interactions is urgently needed in order to get the requirements for the software right. But customers cannot be individually empowered in a way that participatory design aims for, because the group of potential customers is too big, too diverse, too widely spread, and is generally too hard to get hold of. However, the inclusion of representatives of this group at least increases the chance that their interests are taken into account – not only in regard to the sales potential of services but also in order to make e-services and their design actually fit their needs. The methods applied and the modes of cooperation among the stakeholders may have to be adapted to the new constellation and to the cultural change in participatory design with end users in their role as working customers. Another question is, in what way service professionals can be included in design teams to contribute their experiences with customers if at the same time the introduction of e-services represents a major threat to their professional practices or even their workplaces.

6 The Future of E-Service Design

Customers today have little influence on the design of e-services. They may fight the increasing discontinuation of personal services only by not using e-services. However they risk economic sanctions, like increased costs for personal service, or exclusion from service, e.g. if train tickets are solely sold by machines. A systematic customer inclusion in design would strengthen their position, render their needs more visible and improve design solutions. As a result more people would be able to actually benefit from the promised advantages of individually tailored, "always available" services that are in line with the current trends toward individualism and autonomy in our western societies. Cooperative design and the resulting good services may help customers to raise their voices and allow consumerism to grow stronger; they may enable people to interact with each other, to stand up for ethical issues, to be well informed and make good choices when buying online. Service providing companies

will benefit from deeper insights into the needs and wishes of their customers, and will be able to offer more adequate and usable (e-)services.

A lot of technical research has already been done on topics like mass customisation of services ([32]), consumer decision support ([33]) and recommender systems ([34]). These three fields may help to compensate for the missing personal counselling in e-service, an aspect we regard as crucial in personal services. Economic studies have found out a lot about people's willingness or unwillingness to accept and use e-services ([35], [36]). But many current e-services are still designed very poorly and we lack knowledge of how people use or want to use those systems

Design of e-service software will have to be studied in much more detail. What makes up good service quality in general? Will it be possible to design more flexible e-service interactions? How can e-service systems provide more help to their users? How can they instruct users with regard to the service area as well as to the technical handling of the system? Are there any design rules that apply to e-service systems in particular, like e.g. transparency, anonymity or user control? What are the limits of service automation? We will have to find answers to these questions while keeping in mind the likely clash of interests between e-service companies and their remote workers, and in addition, reconsider how the jobs of the service professionals will be affected by the trend towards self-service. Then we will have a chance to design empowering solutions that are in keeping with the idea of a "service society".

7 References

1. Tuunanen, T., Myers, M.D., Cassab, H.: A Conceptual Framework for Consumer Information Systems Development. *Pacific Asia Journal of the Association for Information Systems*, 2(1), 47-66 (2010)
2. Hilke, A.: *Der amerikanische Supermarkt*. VELA, Essen (1956)
3. Gurtner, W.: *Der Selbstbedienungsladen: Eine betriebswirtschaftliche Untersuchung*. Haupt, Bern (1958)
4. Müller-Hagedorn, L., Preißner, M.: *Die Entwicklung der Verkaufstechniken des Einzelhandels: Siegeszug der Selbstbedienung und Aufkommen der neuen Medien*. Deutscher Fachverlag, Frankfurt/Main (1999)
5. Grün, J.C. & Brunner, O.: *Der Kunde als Dienstleister: von der Selbstbedienung zur Co-Produktion*. Gabler, Wiesbaden (2002)
6. Ditt, K.: Rationalisierung im Einzelhandel: Die Einführung und Entwicklung der Selbstbedienung in der Bundesrepublik Deutschland 1949-2000. In: Prinz, M. (ed.) *Der lange Weg in den Überfluss: Anfänge und Entwicklung der Konsumgesellschaft seit der Vormoderne*, pp. 315-356. Schoeningh., Paderborn. (2003)
7. Andersen, A.: *Der Traum vom guten Leben. Alltags- und Konsumgeschichte vom Wirtschaftswunder bis heute*. Campus, Frankfurt/Main (1997)

8. Lummel, P.: Der Supermarkt. In: Lummel, P., Deak, A. (2005): Einkaufen! Eine Geschichte des täglichen Bedarfs, pp. 105-116. Freunde d. Domäne Dahlem, Berlin, (2005)
9. Crossick, G., Jaumain, S.: Cathedrals of Consumption: The European Department Store. 1850-1939. Leicester University Press, London (2000)
10. Brändli, S.: Der Supermarkt im Kopf. Konsumkultur und Wohlstand in der Schweiz nach 1945. Böhlau, Wien (2000)
11. Wildt, M.: Privater Konsum in Westdeutschland in der 50er Jahren. In: Schildt, A., Sywottek, A. (eds.) Modernisierung im Wiederaufbau: die westdeutsche Gesellschaft der 50er Jahre, pp. 275-289. Dietz, Bonn (1998)
12. Borgetto, B.: Gesundheitsbezogene Selbsthilfe in Deutschland: Stand der Forschung. Nomos, Baden-Baden (2002)
13. Offe, C., Heinze, R.G.: Organisierte Eigenarbeit: das Modell Kooperationsring. Campus, Frankfurt/Main (1990)
14. Niessen, H., Ollmann, R.: Schattenwirtschaft in der Bundesrepublik: eine empirische Bestandsaufnahme der sozialen und räumlichen Verteilung schattenwirtschaftlicher Aktivitäten. Leske und Budrich, Opladen (1987)
15. Rowley, J.: An analysis of the e-service literature: towards a research agenda. Internet Research 16(3), 339-359 (2006)
16. Bruhn, M.: Electronic Services. Dienstleistungsmanagement Jahrbuch 2002. Gabler, Wiesbaden (2002)
17. Rust, R., Kannan, P.: E-Service: New Directions in Theory and Practice. Sharpe, Armonk (2002)
18. Wittke, V.: Online in die Do-it-yourself-Gesellschaft? In: Werle, R., Lang, C. (eds.) Modell Internet? Entwicklungsperspektiven neuer Kommunikationsnetze, pp. 93-112. Campus, Frankfurt/Main (1997)
19. Berger, U., Offe, C.: Das Rationalisierungsdilemma der Angestelltenarbeit. In: Offe, C. (ed.) "Arbeitsgesellschaft": Strukturprobleme und Zukunftsperspektiven, pp. 271-290. Campus, Frankfurt/Main (1984)
20. Nerdinger, F.W.: Zur Psychologie der Dienstleistung. Theoretische und empirische Studien zu einem wirtschaftspsychologischen Forschungsgebiet. Schäffer-Poeschel, Stuttgart (1994)
21. Theißing, F.: Shared Servicespace. Arbeits- und akteursorientierte Gestaltung computer-unterstützter Kundeninteraktion. Shaker, Aachen (2007)
22. Voß, G., Rieder, K.: Der arbeitende Kunde. Wenn Konsumenten zu unbezahlten Mitarbeitern werden. Campus, Frankfurt/Main (2005)
23. Toffler, A.: The Third Wave. Bantam Books: New York 1984 (1980)
24. Hecht, M., Maass, S.: Kundenarbeit gestalten! Wirtschaftspsychologie 11(1), 44-51. (2009)
25. Engemann, C.: Electronic Government - Vom User zum Bürger: Zur kritischen Theorie des Internet. Transcript, Bielefeld (2003)
26. Greenbaum, J.M., Kyng, M. (1991): Design at Work: Cooperative Design of Computer Systems. Hillsdale, New Jersey: Lawrence Erlbaum.
27. Schuler, D., Namioka A. (eds.): Participatory Design: Principles and Practices. Erlbaum, Hillsdale (1993)
28. Bødker, K., Kensing, F., Simonsen, J.: Participatory IT Design. Designing for Business and Workplace Realities. MIT Press, Cambridge (2004)

29. Bjerknes, G., Bratteteig, T.: User participation and democracy. A discussion of Scandinavian research on system development. *Scandinavian Journal of Information Systems* 7(1), 73-98 (1995)
30. Mambrey, P.: *Computer und Partizipation*. Westdeutscher Verlag, Opladen (1986)
31. Löwgren, J., Stolterman, E.: *Thoughtful Interaction Design: A Design Perspective on Information Technology*. MIT Press, Cambridge (2004)
32. Piller, F.: *Mass Customization. Ein wettbewerbsstrategisches Konzept im Informationszeitalter*. Deutscher Universitätsverlag, Wiesbaden (2003)
33. Hansen, H.R., Knotzer, N., Madlberger, M.: Empfehlungssysteme zur Verkaufsberatung im Internet-State-of-the-Art und Konsumentenakzeptanz. *Wirtschaftsinformatik* 49, 50-61 (2007)
34. Klahold, A.: *Empfehlungssysteme: Grundlagen, Konzepte und Systeme*. Vieweg+Teubner, Wiesbaden (2009)
35. Meuter, M., Ostrom, A., Roundtree, R., Bitner, M.: Self-Service Technologies: Understanding Customer Satisfaction with Technology-Based Service Encounters. *Journal of Marketing*, 64 (3), 50-64 (2000)
36. Walker, R.H. & Johnson, L.W.: Why consumers use and do not use technology-enabled services. *Journal of Service Marketing* 20(2), 125-135 (2006)

Why to outsource? Case municipal's IS in one region of Finland

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Abstract. Although Information Systems (IS) outsourcing has been researched widely during the last decades, the public sector emphasis in IS outsourcing literature has been lacking. In this paper we aimed to find reasoning for outsourcing based on theories which have been developed to explain the motives of outsourcing. We found that cost cuttings and efficiency are not seen a primary reason why decisions of outsourcing have been taken instead of doing the work internally. Instead of cost cutting there are reasons such as capabilities, quality of IS services and technology, which explain the growth of the outsourcing business.

The Finnish public sector IS has an increasing pressure to develop its capability to support wider processes for municipals. At the same time there is a strong demand to keep the cost level down or even decrease it. We collected data through interviews from 23 municipals in one region in Central Finland. Our cases demonstrate that the present costs are not the most critical issue but the capability to enable more efficient processes is important especially in the smaller municipals. We also researched the strategic position of IS in a municipal's hierarchy. By using a strategic framework approach it can be seen how functional and political risks are different in larger and smaller municipals. Based on our findings the conclusion can be drawn that the best choice especially for smaller municipals is to join a nationwide operator. However, friction amongst municipals to join or not can clearly be seen at the time interviews were carried out.

Keywords: IS Outsourcing, public sector, IS capabilities

1 Introduction

1.1 Motivation to this research

The reasons why companies do outsource their information systems (IS) functions have been an object of several studies during the past 20 years. According to Lacity, Khan and Willcocks [11] cost reduction has been the most common motive identified by researchers despite any other rhetoric. However, some studies support the approach of using outsourcing as a strategic tool to improve information quality and to create more value to the company [20]; [13]; [4]. Interestingly is also the dilemma that if IS costs represent only three percent of company's annual revenue on average [11] how is it possible that reducing this cost is the driver for any actions in a company.

In our case study we have 23 Finnish municipals who have currently the opportunity to join the merger of ICT functions so that their independent ICT infrastructure and sourcing tasks could be partly aggregated to a new company owned by Finnish municipals and facilitated by the Finnish innovation Fund, SITRA. When the data collection and interviews were done in autumn 2010, none of these 23 municipals in scope established their willingness to join in the new company. This result cannot be interpreted as a cost issue.

This situation attracted our interest and created also our research questions:

1. Why Finnish municipals in researched region are not interested in larger scale to outsource their IS or part of that?
2. What are the reasons besides cost reduction why outsourcing could be a tool for IS leaders and particularly in municipals in Finland?
3. Do municipals in Finland see IS as strategic level function or enabler and does that impact on outsourcing decisions?

1.2 IS outsourcing background

The IS outsourcing market has been growing rapidly since the end of 1980's and its growth has been significant also in the first decade of year 2000 [4]. This market began to evolve already in 1963, when EDS and Blue Cross Pennsylvania made an outsourcing deal where EDS took over the responsibility of Blue Cross IS people. In 1989, when Kodak announced its outsourcing to IBM, DEC and Businessland, it gave a boost and a legitimation to the whole outsourcing market and currently the market size is globally several hundreds of billions of dollars. [4]; [5]; [13]; [14]; [20].

In its broadest dimension, IS outsourcing means the provision of all ICT services including assets, processes and personnel, i.e. total outsourcing according to a taxonomy of sourcing decision options developed by Lacity and Hirschheim [12]. The original definitions by Lacity and Hirschheim are shown in brackets. Their definition of the taxonomy of sourcing decision options is shown in the Table1.

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Table 1. Taxonomy of sourcing decision options

Sourcing decision option	Description
Total Outsourcing (Total Outsourcing)	the decision to transfer to external ICT provision is more than 80% (The vendor is in total charge of a significant piece of IS work)
Total In-sourcing (Body Shop)	the decision to keep internal ICT provision on the level of more than 80% (Outsourcing is used as a way to meet short term demand by management)
Selective sourcing (Project Management)	external ICT provider's share is between 20-80% of ICT functions (A specific project or portion of IS work is outsourced and vendor is responsible for managing and completing the work)

According to Lacity and Wilcocks [13] selective sourcing decisions achieved expected costs savings more frequently than total outsourcing or total in-sourcing. Earl [6] calls selective sourcing as smart outsourcing and sees it as a way to simplify ICT function when it creates operational performance and the outsourced object is not central to company's strategy.

Since the early days of IS outsourcing it has been used widely as key tool when enterprises have been searching improvements in efficiency with their IT functions. It has been also widely researched during the last 20 years and that has created a good understanding why companies outsource. The main reasons according to research done are costs reduction, to have an access in needed resources and refocus internal resources on more strategic work [11].

This paper seeks to understand of why this industry of outsourcing has become such a popular tool for companies and their IS leaders and what is the reason why public organisations are less willing to do it. This study is structured so, that first there is a short description of frequently mentioned issues in the research papers. Chapter two concentrates to underlying theories of IS outsourcing. In chapter three there is the empirical study of Finnish municipals in Central Finland and after that in chapter four is presented findings from our study. Chapter five is our suggestion for discussion and further research in the field of public sector outsourcing.

1.3 Determinants, risks and reward issues

Dibbern et al. [4] have recognised three reasons to question "Why an organisation might consider IS outsourcing". These are *conditions* or *situations* (i.e. determinants or antecedents), *risks* and *rewards* (or advantages and disadvantages) which may lead a company to a decision to outsource. In this study the framework of Dibbern et al. [4] is used while describing the other frequently mentioned issues in the outsourcing literature related to our case study.

The determinants may be external to the company like industry level institutional pressures or country level diffusion drivers. These determinants may also be internal to the company but outside the IS level, like costs and financial situation, financial impact, strategy, size or business sector. And lastly, the determinants may be IS level, like asset characteristics, beliefs associated with outsourcing, perceptions towards environment or perceived risks of outsourcing. Lacity et al [11] conclude in their review of ICT outsourcing literature the same determinants, i.e. industry, financial and size attributes.

Risks are generally defined as the probability that an action will adversely affect an organisation [11]. Earl [6] describes 11 different internal risk factors in a company or its IS function, such as weak management, inexperienced or outdated skills of IS function, uncertainty of business or IS capabilities and loss of innovative capacity of IS function. Total outsourcing with a single supplier can be considered as a high-risk strategy including among others organisational, contractual, managerial, technological and financial risks. Some of the risks of this kind can be mitigated before contracting by using a multi-vendor approach or by a selective outsourcing with short-term contracts. [22]. However, the thumb rule is that the client company as an initiator of the deal is always responsible for outsourcing and therefore it has to know and be capable of managing the IS services first [11].

The advantages of IS outsourcing are generally seen as reduced costs or increased service levels including time schedule accuracy, even though success of cost reduction has been quite low. In the study of Lacity et al. [11] one of the most important findings was the reciprocal relationships among mutual trust, contract governance and IS outsourcing success. The trust between parties and the contractual governance seemed to lead higher levels of IS outsourcing success. Also to gain the trust the evaluation process for selecting suppliers seemed to be a consistent predictor for success.

In the following subchapters the most relevant determinant and risk factors for our case study are looked more closely.

1.3.1 Strategy issues

According to Dibbern et al. [4] interest in IS outsourcing is a consequence of a shift in business strategy and best understood as a management decision. Lacity & Willcocks [13] have found two primary phenomena to answer the question “Why to outsource”. Firstly, senior executives have a tendency to believe that they have to concentrate on what the organisation is doing better than anyone else and outsource the rest. Secondly ICT’s value delivered is unclear and therefore it remains as an overhead and these costs should thus be minimised. Whatever the reason is the research of outsourcing has revealed that top management commitment and support in IS outsourcing is a critical factor for success [11]. The first phenomenon is an external determinant to IS organisation while examining it through the framework of Dibbern et al [4]. But the second one can be evaluated as a consequence of IS organisation’s internal determinant, being incapable of creating IS as a valuable asset.

Collectively CIOs face a serious demand for both value creation and cost cutting and they need to consider how to deliver stable and well functioning ICT services at a

lower price. Dibbern et al. [4] call this a sourcing dilemma. So, at the end of the day, the question for CIOs is not “what to outsource” but “how should we source” as Wibbelsman and Maiero (1994) has put it [4].

1.3.2 Capability issues

The highly internal IS function's determinants are the issues of capabilities. Outsourcing is not a simple straightforward transaction to transfer agreed ICT services to a supplier. It is a complex bundle of different kinds of tasks of managing the transfer of ICT services delivery within a fairly long period of time [21]. IS outsourcing has been evolving from technology management focus to managing capabilities, with which the resources can be transformed into specific business activities. According to Willcocks, Reynolds and Feeny [23] these capabilities can be developed using three primary mechanisms which are processes, culture and structure. In addition to that, instead of being part of outsourced function, middle managers are the key resource for coordination the change and managing the risks [21].

While planning outsourcing, it is not enough to concentrate on resources like physical facilities, technologies, tools and workforce. Both the client and the supplier should pay attention to capabilities like a set of human based skills, orientations, attitudes, motivations and behaviors which can transform resources into specific business activities. [21]. In the research of Lacity et al. [11] they found IS technical and methodological capability most frequently mentioned while considering the operational capability of both parties. However, the most important capability for client organisations is the capability of supplier management after the outsourcing decision. Accordingly the most important capability for a supplier organisation is the IS human resource management [11].

Feeny and Willcocks [7] have defined nine core IS capabilities named leadership, informed buying, business systems thinking, relationship building, contract facilitation, architecture planning and design, vendor development, contract monitoring, making technology work. After that the research of IS capabilities have been extended to include BPO, ICT off-shoring and high-performing providers [23].

1.3.3 Contractual issues

The second most important IS organisation's internal determinant is the ability to contract. This issue could be examined also under capabilities, but being one of the significant determinants of successful outsourcing it is studied separately.

The underlying concept of IS outsourcing is the acquisition of services through continuous interactions between the client and the supplier as specified in the outsourcing contract [10]. The objective of the study of Lacity and Willcocks [13] was to develop an indicator of success in outsourcing and one of those indicators they found was the contract type meaning the level of details written in the contract. The detailed contracts where the contract includes special clauses for the scope, service levels, performance measures and penalties showed to be the most successful ones.

Also they found that contract duration matters in a way that short term three year contracts had a higher frequency of success than the long-term contracts.

The disadvantage of these findings is that the detailed contracts take a long time to be negotiated and the IS leaders have to know the target well enough to be able to take major requirements into account. Also renegotiation practically every second year takes time and effort from IS leaders. Therefore these aspects might affect the quality of the contract and the willingness of IS leaders to outsource.

While this study concentrates on the public sector, it must be mentioned that public sector acquisition differs from the private one. Especially in Europe, public sector procurement is regulated and controlled with laws and rules [15] which are not binding in the private sector at all. As few examples in EU, the government in UK has set out a rule that all the public contracts need to be public and Finland has the law for public acquisitions, which regulates the procurement process also for IS sourcing.

2 Underlying theoretical framework

Dibbern et al [4] classified all IS outsourcing research during the years 1992-2000 by the reference theory used in those papers and they found that transactional cost theory and strategic management theory are the most referred ones. Trying to answer the questions “*Why municipalities are not interested to outsource*” and “*What are the reasons besides cost reduction why outsourcing could be a tool for IS leaders and particularly in municipalities in Finland*” and being encouraged by earlier research, this paper concentrates on strategic management issues in outsourcing.

Traditionally, in 1970’s strategic management was defined as a formal strategy planning process, in a form of sequenced steps building on objective settings and analysis, through the evaluation of different options, and ending with the careful planning of the strategy implementation [8]. In 1990’s Johnson and Scholes [8, p. 22] defined strategic management as a process by which strategies develop in organisations on the basis of managers’ experience, their sensitivity to changes in their environments and what they learn from operating in their markets.

Burrell and Morgan [2, p. 151] describe Simon’s concern of building a realistic administrative behaviour theory, taking sufficiently care of a theory of human choice or decision making. For Simon the behaviour of managers in organisations is a kind of bounded rationality: human beings “satisfice” instead of maximize their work behaviour. i.e. the behaviour of individuals in an organisation never reaches any high degree of rationality. In our study we emphasize that the concept of bounded rationality has to be taken into account while evaluating the reasons for IS outsourcing.

In the study of Teng et al. [20] strategic management is looked as a concern of strategic deployment of resources, i.e. both resource-based and resource dependence theories point of view. In *resource-based theory* resources provide competitive advantage if they are valuable to the company, if they are unique or rare among the company’s competitors, if they are not imitable and if they cannot be substituted with another resource by competitors. *Resource dependence theory* emphasise the

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necessity of adapting to environmental uncertainty, coping with the complex interdependence and actively managing resource flows.

Teng et al. [20] in their research come to a conclusion that information quality and IS support quality may be important reasons for IS outsourcing, whereas a company's cost considerations including financial performance may not be as important in motivating outsourcing. This means that if IS ability to provide high quality information and support service is low in the company there might be a stronger tendency to take advantage and use outsourcing as an instrument to better quality.

The other perspective of strategic deployment of resources is the effect of outsourcing on the current ICT organisation. Quite often companies downsize their ICT workforce and the remaining people take new roles and tasks for resizing the ICT organisation. Outsourcing part of the ICT personnel may also break informal social ties which have been built over many years. If the ICT resizing is not done with care it can lead to loss of trust and reduced commitment among retained ICT employees and thus cause a potential loss of valuable expertise [19].

In the research of DiRomualdo and Gurbaxani [5], they argue that while the importance and growing role of information and communications technologies are being recognized, the question of business performance must be raised as a strategic intent of IS outsourcing. IS outsourcing is filling the gap of disparity of necessary capabilities and skills needed and the reality of their in-house competencies. According to DiRomualdo and Gurbaxani [5] the other aspects of strategic intent of outsourcing besides business performance are IS improvement by means of cost reduction and commercial exploitation of leveraging technology related products and services in the marketplace. Even though Lacity et al. [11] criticize the outcome of DiRomualdo and Gurbaxani saying that many of their example companies actually have been failed to deliver the expected benefits in a long run, the strategic intents are still valid. And these intents are not carved in stone, but they are evolving over time and therefore both formal and informal outsourcings relationships must change to stay align with the changing intentions [5].

Quinn's approach in his research [18] is that outsourcing is a strategic decision. He claims that "properly developed, strategic outsourcing substantially lowers costs, risks and fixed investments while greatly expanding flexibility, innovative capabilities and opportunities for creating higher value-added and shareholder returns". Quinn uses Dell as an example of that. Even the statement sounds a bit idealistic for us as researchers and practitioners each having more than 30 years experience in the field, the bottom line is that outsourcing can be used as strategic decision in company's management boards.

Clemons, Thatcher and Row [3] state in their study of risks in big-scale IS projects that a company's future strategy or operating environment are restricted by the company's current strategy, business environment and technical capabilities. They say that most companies have at all times two classes of strategy held by personnel, strategy espoused and strategy in use. The first one is the official truth and the latter describe what personnel actually believe about the future.

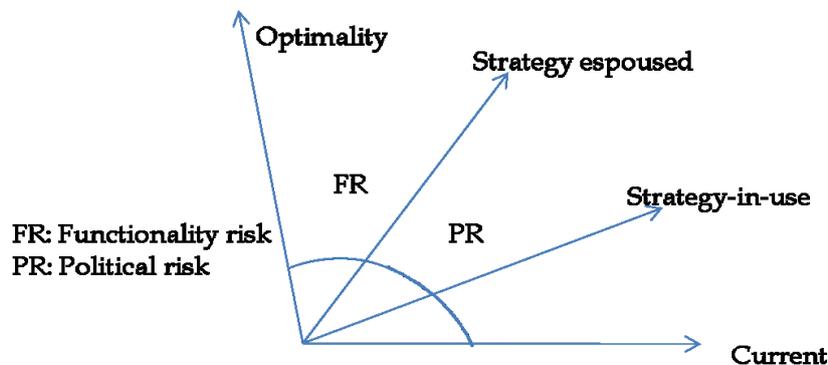


Figure 1. Strategy framework [3]

In this strategy framework [3] two kinds of risks are demonstrated. The more the strategy-in-use differs from strategy espoused the bigger the political risk in the organization. If the change resistance is sufficient the organization fails to implement the projects consistent with the proposed strategic reorientation. The more the strategy espoused differs from the optimal the more the future of the whole organization is risked. This gap shows the level of change that the organisation has not even acknowledged it needs to make.

3 The empirical case study

We used multiple case study method [9] while collecting data. We created structured questionnaires with which the municipals representatives were interviewed. The interviews were done during the autumn 2010. The collected data is qualitative and based on the answers to the interviewees. Our target in the research is to test existing theories how well they fit to our findings based on collected data.

3.1 Case description

Finland is divided to 19 regional councils. We had a possibility to collect the data in one of those councils which consists of 23 municipals. All these municipals are independent in decision making but decisions and municipal processes and functions are regulated by laws and rules.

A municipal ICT has been developing during the last decades from strictly mainframe based infrastructure and applications to distributed ones. Every municipal has their own rights to choose ICT vendors and their products independently and this is seen as a problem today in municipals themselves because of poor compatibility and a wide demand of different system knowledge.

The Finnish Innovation Fund, SITRA, is an independent and public fund, which has a target to improve the welfare of Finnish society. SITRA established in the

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beginning of 2009 a program called KPK ICT for merging municipals ICT functions, infrastructure and sourcing into a new company. The program was initiated by calculations that Finnish public sector could save billions of euros on public sector [16]. Municipals have had an opportunity to review the offering of the KPK ICT and during the program ramp-up phase over 100 municipal entities has established their aim in the letter to intent to join in this new municipal owned company, which was established in 15.9.2010.

None of these 23 municipals in scope established their willingness to join in this new KPK ICT during autumn 2010. However, many of them were interested to see, what this new operator would bring to public sector ICT field.

At the same time there is also a massive infrastructure program in Finland. The Finnish government has decided that until the year 2015 more than 95% of Finnish households shall have an opportunity to join in less than 2 km distance to a wide band network, in which available capacity has to be more than 100 mbps. Municipals have to react to this initiative and to find ways of organising the wide band network. One of the issues is the geopolitical situation in Finland having a lot of sparsely populated areas in the municipals.

3.2 Data gathering

In our multiple case studies we interviewed in all of those 23 municipals during autumn 2010. The Regional Council was a key stakeholder in our study. We went through all of the 23 municipals ICT structures and the result of this study led also to update ICT Strategy for the Regional Council. We created an interview consisting of 78 questions and these were reviewed by Jyväskylä University Information Technology leading faculty professionals. At first we tested our interview method with two municipals (one fairly large and one small municipal).

We got valuable review comments and test results and the list of questions was updated to respond better our needs. The results are collected to attachment 1 and an example of data collection sheets is in attachment 2. After that we carried out interviews which took maximum three hours and depending on the municipal there were normally ICT manager or municipal manager, financial manager, administrative manager at present. The received answers were entered to data collection sheet and mutual key comments were filled in as fulfilling information to data collection sheet. However the interviewed teams differed depending on municipal and the size of it. These interviews were carried out in four months during September - December 2010. Overall the number of interviewed people was 51. Average length of interviews was 2,5 hours. The transcripts were attached to interview blankets as interviewer's notes.

The municipal interviews were done in slightly different ways, because not all the municipals wanted to come to face-to-face meetings they proposed different way to provide needed information, which was agreed with research team. 14 municipals were interviewed in single municipal interview and seven municipals were carried out in two larger interviews. In the first interview there were five municipals in place and in the second there were two municipals. With the rest, two municipals we agreed to advise them how to fill in interview questionnaire after which they sent their responses and we reviewed open topics with them later on.

The most relevant questions with calculated results which are used in our analyses and findings are listed in the attachment 1.

4 Findings

4.1 General Findings

We decided to examine municipal IS using two different frameworks. The first one is the framework of Dibbern et al. [4] defining three reasons for outsourcing, determinants, risks and rewards. We are assessing our findings in determinant categories, which are defined as external, internal at municipal level and internal at IS level. The second one is the strategic management framework of Clemons et al. [3]. The reason to use strategic management framework was based on our findings in gap between municipal's IS personnel's opinion in interviews and information and strategies we found in nationwide plans how municipal's IS will be re-structured. One example was by a middle size municipal's ICT manager: *"In case we would be a part of coalition between municipals that could create political situation quite surely"*.

The municipals have big differences in personnel and budget size. The biggest municipal's total personnel count is 7500 people and budget size is 924M euro while the average (without the biggest municipal) personnel count is 400 and budget size 40M euro. However, size does not seem to affect the findings except when separately stated.

The IS outsourcing contractual status of municipals is not known, it was not covered in data collection.

4.2 External Determinants

In our case study the external determinants for municipals are KPK ICT Oy as a new operator providing services and other existing external IS providers, but also the laws and rules in Finland and in EU and finally the other municipals. In large IS sourcing decisions municipals are forced by law to lead a public process of bidding and competing IS vendors. This affects to small municipals ability to organize and implement IS outsourcing project.

Municipals overall outsourcing level based on our data collected from municipals IS professionals was 33,4 %. The highest outsourcing grade 80,7% was in expertise healthcare and the lowest one 10,0% was in IS architecture management. Municipals were relatively satisfied with their external suppliers average being 3,6 (scale from 1 poor -5 excellent) but mostly external service providers were seen highly expensive and unresponsive when a contract or delivery was closed. This raises a question, what is the capability of ICT supplier management especially in small municipals. However, sourcing is seen as challenging in larger municipals such as one statement by the large municipal's CIO sounded: *"We are clearly under resourced in sourcing concerning our number of ICT contracts"*.

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Our interview conveys that cooperation across municipals was quite limited. Municipals prefer to have a leading role local/regional operator than a country level operator. Based on our interviews using a regional level leader vs. country wide operator was 3,9 vs 2,0 – (scale 1 - not preferred 5 - highly preferred). There were comments when data was collected, that IS personnel in municipals were worried about their jobs if the municipal will join in bigger operator. Without real results external operator KPK ICT Oyj had not earned trust and this came up in comments as well.

4.3 Internal determinants at municipal level

Internal determinants at municipal level are a municipal's IS budget and political decisions. Finnish municipals invest very limitedly in their ICT having ICT cost percentage 0.92 % of their budgeted revenue while the average spending in most companies is three percent of their revenue per annum on ICT [11]. ICT budget growth is also seen in some municipals necessary. As an example, one head of smaller size municipal said, that it is necessary to arrange slightly growing budget from 1% level to the 1,2-1,3% level. Also based on our study, 84% of the municipals' annual spend are directed to operating and maintaining the current systems. Municipals can invest only 16% of their yearly ICT cost budget on developing new IS, which could enable municipals processes to get developed further. In these percentages there were no differences between big and small municipals.

Especially in smaller municipals there is no nominated IS managers, who has ICT responsibility. In total, only eight municipals out of 23 have a CIO or ICT manager position established. Five of those eight were in large municipals category (over 10000 people) and 3 small municipals had ICT manager amongst 17 municipals in small category. This situation demonstrates that ICT function is not seen as a strategic function in municipals' organisational hierarchy. This also means that municipals' leaders should be able to negotiate the outsourcing contracts and manage the suppliers' services after the outsourcing.

We found also that the average willingness to invest to wide band network in municipals was 7,6 with a traditional Finnish scale used widely at school grades 4 (nothing) -10 (all what is needed). The interesting perception was that big municipals (more than 10 000 people) were very reluctant to invest in enabling high speed IS infrastructure to people who does not live centrally. The average result in big municipals was just 5,8 compared to the response of 8,2 from small municipals.

4.4 Internal determinants at IS level

Internal determinants in IS organisations are the number of personnel and competences. IS capabilities are very modestly resourced in municipals. Our finding is that there is only 0.61 full time equivalent IS persons per 100 municipal worker and the average IS personnel size is 3,7 FTE within all municipals and 2,2 FTE if the largest municipal is not included. Regarding the plans to grow the headcount of IS

persons it was planned only in five municipals, 16 planned to stay flat and two planned to cut the amount of IS personnel.

However, information systems, infrastructure and new technology such as mobile devices, demand more service capability and wider knowledge from IS experts in municipals than earlier based on our interviews. As an overall understanding of this finding we state that the internal IS expert head count and IS budget of these municipals is too low to enable needed development of IS assets in these municipals excluding the three biggest municipals. Teng et al. [20] state in resource-based theory, that resources provide competitive advantage if they are unique and cannot be substituted. Based on the results of our interviews there is a lot of cumulated experience in very few hands in municipals' ICT functions and if changes in IS structures and organisation are not done with care, this can lead to loss of trust and motivation. When planning the change this potential risk of losing motivation must be considered thoroughly. As example in one smaller municipal, the ICT manager said: *"Our virus scanning and security works but continuity arrangements are very weak"*.

Only in eight municipals out of 23 have a CIO or ICT manager position been established. Therefore it is probably fair to draw the conclusion that IS decisions are mainly done by municipal leaders, not in specific ICT functions. Further, this affects our understanding of the overall position of the IS function, its value creation and cost evaluations.

Both to the questions of costs and quality with the scale of 1-5 (1= not important, 5=very important) municipals' answers were quite similar. IS cost factor average score was 4 and IS quality factor was even more, 4,3. Based on our interviews, municipal leaders were somewhat satisfied to their current status of IS function (score average of 3) and they resist having a country level operator (score average of 2). Our interpretation of these results is that even though municipals understood the value of IS quality and they were not too happy with their current position but they were afraid of joining to a country level organisation KPK ICT. Our conclusion is that municipals do not trust the KPK ICT organisation by means of cost savings and quality at the time the interviews were conducted.

4.5 Strategic Management Framework

The strategic framework [3] earlier described in this paper also includes a hypothesis for several type of situations, depending on how much proposed strategic business reengineering requires competence-destroying change in the organization. In case of smaller change it will be less resisted and the political risk is decreased while strategy in use is closer to strategy espoused. Our interviews indicated that especially in the smaller and mid-size municipals the common worry among personnel is losing jobs to some external suppliers or operators. Our case study results also indicate that the willingness to choose a regional operator instead of a country level operator like KPK ICT is very high. The local leading force is seen much more desirable, although they both can have the same goal to get needed consolidation development to happen.

In the framework [3] it is also stated that in radically changing environmental conditions, avoiding competence-destroying change will lead to a big gap from an optimal new strategy. The Finnish public sector needs clearly radical changes and if

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municipals will not accept clearly needed changes, the functional risk will stay and even grow in coming years which means that public sector will not progress.

During autumn 2010 a work group worked out an ICT Strategy for these 23 municipals. The strategy paper was shared with municipal managers and the relevant ICT persons. This paper includes execution plan for getting the consolidation development ahead. The planning for the next steps is ongoing and Regional Council is going to organize planning and related execution resources. We can identify based on our data two categories of these municipals:

- 1) Large or mid-size municipals having more than 10 000 people. In our research material six municipals belong to this category. Characteristics for these municipals are larger amount of IS personnel (3-37), IS budget size average 1,1% of total budget, new IS solutions like electronic on-line services quality of 6,7 (scale 4 poor-10 excellent).
- 2) The same characteristics for category 2 municipals are small amount of IS personnel (0-2,5), IS budget size average 0,8% of total budget, new IS solutions like electronic on-line services quality of 5,7 (scale 4 poor-10 excellent).

We could clearly identify that the bigger municipal the better capabilities to provide IS. Therefore we decided to use the strategic framework [3] from these two categories point of view and to create an evaluation of the current situation in municipals based on the framework.

4.6 Optimality

The optimal situation from our point of view would be a government wide consolidated IS operator offering high quality services including infrastructure covering all municipals needs. This would include a fluent cooperation over municipals borders and usage of shared resources. Also health care sector would be integrated enabling patient information sharing between regional and municipals health care points. The precondition for success is a good detailed contract with defined service level agreements. All IS decisions could be based on common Enterprise Architecture definitions. Municipal could have also development capabilities resourced adequately and development projects managed under systematic governance model and portfolio management.

4.7 Strategy Espoused

The strategy espoused is regional IS development and operations centers, where needed capabilities would have been searched from the present professionals and their capabilities would have refreshed in cooperation with local university. In this model there is a need of clear governance, a well functioning steering body and defined responsibilities. Also common Enterprise Architecture and portfolio should exist.

4.8 Strategy in-Use

Strategy in use by municipals shows low level cooperation between a few municipals and especially in sharing any infrastructure. There is a little application provision by the bigger municipal with smaller municipal. There is no visible resource sharing between municipals. Enterprise Architecture is scattered and only partly existing. Limited resources are used to do mostly urgent tasks and the majority of ICT infrastructure services are arranged or negotiated separately by each of the municipals.

4.9 Current

The current situation is very close to the present Strategy in-Use situation and political risk is very low, when municipals have not clearly expressed their will to change their way to operate. The current way of working does not lead to any remarkable change and thus, it does not bring the capability destroying risk to the ICT personnel. Limited resources are doing mostly urgent tasks and majority of ICT infrastructure services are arranged or negotiated separately by each of the municipals.

4.10 Functional and Political risk

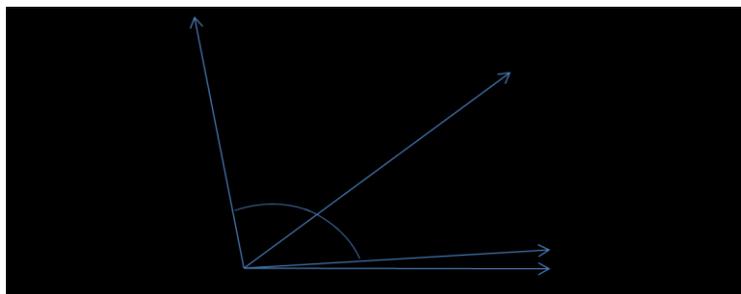
The functional risk in the present situation is very high and political risk is very low. However, about half of Finland's municipals are in financial crisis. According to the Statistical Centre of Finland, all municipals total financial coverage was only 96% of depreciations and the financial coverage was only 48% of investments. The numbers are seemingly unhealthy. There is also very strong pressure to improve the public sector's processes and service provision, especially in the health care sector. According to the National Institute for Health and Welfare (THL) the calculated total spend of health care was 15, 5 billion Euros, which means 8, 4% of GDP in Finland in the year 2008. Without decreasing the functional risk which clearly leads to an increase of political risk, the situation is not going to improve as required in public sector processes.

According to our research, municipals have the biggest gap in system capability in electronic on-line services and related processes. The grade we got for this capability was 5.9 (scale 4=lowest, 10 highest). This is alarming because of planned improvements to be developed for electronic on-line services. Based on this finding one criteria to outsource their IS development or part of that is to get capability to be able to develop these services in shorter time with continuous support.

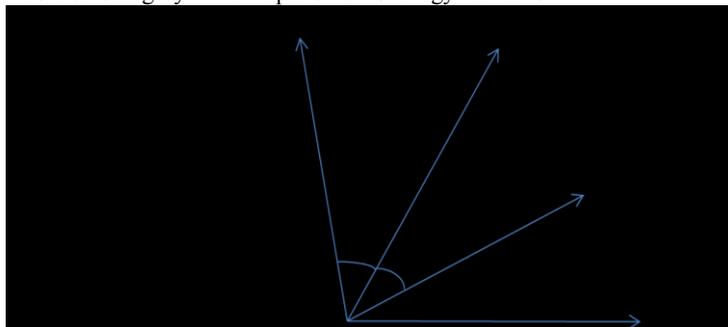
Our analysis and findings above described the following strategic framework for Finnish municipals ICT status. The category 2 municipals have the current situation and strategy in-use very close to each other. Political risk is quite modest but functional risk is very high. Therefore we think that they should urgently find the ways to lower functional risk even though the political risk may be raised.

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Table 2: Category 2 municipal's ICT Strategy framework

The category 1 municipals have the strategy in-use and strategy espoused closer to each other and in that sense the status is better than in category 2. These category 1 municipals are closer to their present strategy in-use and strategy espoused the optimal one. Political risk is higher than in category 2 municipals but on the other side, the functional risk is lower. In this category the choice to use selective outsourcing is better.

Table 5: Category 1 municipal's ICT Strategy framework**5 Discussion**

In our research we aimed to find the reasons why Finnish municipals are not interested in large scale outsourcing of their IS even partly, and why outsourcing still could be a tool for IS leaders in municipals. Also is the IS function seen as a strategic function and how is that affecting outsourcing decisions? As a start we analyzed relevant literature and theories of IS outsourcing and studied the basis why to outsource in Finnish municipals. We also collected empirical data from municipals to find out how these theories could work in practice.

We found, especially in small municipals, IS departments were so small that there are no needed resources and thus, no capabilities even to take care of the new IS

needs in the municipal area. Therefore it might be hard to them to create needed processes and structures for outsourcing and furthermore, vendor management after the transition. Probably also the ability to contract at the needed detailed level is difficult. We found also mistrust to external consolidations and change resistance. Because of these internal determinants in the IS function the municipal leaders should commit and take part of the outsourcing strategy and start to think IS as a strategic enabler to fulfill the service needs in municipalities. Currently municipalities handle IS as a strategic enabler in very limited ways. As stated also in the literature chapter, it is known that top management support in IS outsourcing is a critical factor for success in outsourcing.

While the Finnish public sector has an urgent need to renew structures and related processes these require changes in IS structures and new IS development. This new value creation can be done efficiently only by utilizing limited resources more efficiently and by agreeing that the service provider provides solutions for a large number of municipalities. Our conclusion is that outsourcing in public sector and municipalities in Finland needs a wider set of criteria's than just cost savings.

The strategic framework by Clemons et al. [3] can be applied as an approach to look at what is the strategic position of IS in municipalities. We found that this framework is used rarely in other research. However, it gives a good understanding why transformation of services in a municipal's IS has not proceeded as fluently as expected. In our category of smaller municipalities the functional risk is very high and most of the municipalities are in urgent need of expanding new IS enabled processes to inhabitants who might live far from municipalities' centres. They also need to increase the efficiency in public services such as health care by renewing processes and IS. Therefore we conclude that because of the lack of resources and competence to provide this value-addition, the best solution is to join in municipalities owned KPK ICT Oyj.

The strategic framework also considers important factors such as political risk, which has a strong influence on success in transformation. There is a need to negotiate continuation for the present IS personnel and offer further education to more value-adding tasks in municipalities processes when a municipal joins in KPK ICT Oyj. In that way, the municipalities can continue keeping the experimental knowledge, which importance e.g. Alaranta and Järvenpää [1] have found critical in their longitudinal case study in a Finnish public sector organisation's IS outsourcing. Our findings demonstrate that cost alone is not in this case the key driver and the continuation of services need to be focused on especially.

The public sector is ahead of large transformation and IS has a key role in making it happen. We found quite a limited number of articles, which researched public sector IS outsourcing, especially focusing on municipalities transformation. Instead, there is large number of papers, which handles the topic generally. Therefore we find it necessary that existing theories and models tested with empirical cases as well as new theories and models development should continue in coming research work especially on public sector and with municipalities' IS functions. Further research is needed especially in trust factors between outsourcing parties and in the contract negotiation phase. Currently these negotiations seem to be opportunistic approaches for both parties creating mistrust already in early phases. Also topics to be researched further

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could be the development of life-cycle cost analyses and calculation models in IS outsourcing.

References

1. Alaranta Maria, Järvenpää Sirkka L. Changing IT Providers in Public Sector Outsourcing: Managing the Loss of Experiential Knowledge. Proceedings of the 43rd Hawaii International Conference on System Sciences (2010)
2. Burrell Gibson, Morgan Gareth. Sociological Paradigms and Organisational Analysis. (1. edition 1979). Ashgate Publishing Limited, England (2006)
3. Clemons Eric K., Thatcher Matt E., Row Michael C. Identifying sources of reengineering failures: A study of the behavioral factors contributing to reengineering risks. Journal of Management Information Systems, Vol 12, No. 2, pp. 9--36 (Fall 1995)
4. Dibbern J., Goles T., Hirschheim R., Jayatilaka B. Information Systems Outsourcing: A Survey and Analysis of the Literature. The DATA BASE for Advances in Information Systems, Vol 35, No 4, pp. 6--102 (Fall 2004)
5. DiRomualdo Anthony, Gurbaxani Vijay. Strategic Intent for IT outsourcing. Sloan Management Review, Summer 1998, 67-80. (1998)
6. Earl Michael J. The Risks of Outsourcing IT. Sloan Management Review, pp. 26--32. (Spring 1996)
7. Feeny D., Willcocks L. Redesign the IS function around core competencies. Long Range Planning Vol 31, pp. 354--367. Elsevier Science Ltd (1998)
8. Johnson Gerry, Scholes Kevan. Exploring Corporate Strategy. Third edition. Prentice Hall International (UK) Ltd (1993)
9. Järvinen Pertti. On Research Methods. Opinpajan Kirja, Tampere, Finland (2004)
10. Kern Thomas, Willcocks Leslie P. Exploring information technology outsourcing relationships: theory and practice. Journal of Strategic Information Systems 9, pp. 321--350. (2000)
11. Lacity M., Khan S., Willcocks L. A review of the IT outsourcing literature: Insights for practice. Journal of Strategic Information Systems, Vol. 18, Issue 3, pp. 130--146. (September 2009)
12. Lacity Mary C., Hirschheim Rudy. Information Systems Outsourcing, Myths, Metaphors and Realities. (1. edition 1993). John Wiley & Sons Ltd, England (1995)
13. Lacity Mary C., Wilcocks Leslie P. An Empirical Investigation of Information Technology Sourcing Practices: Lessons from Experience. MIS Quarterly, pp. 363--408. (September 1998)
14. Nam K., Rajagopalan S., Rao H. R., Chaudhury A. A Two-Level Investigation of Information Systems. Communications of the ACM, Vol. 39, No. 7, pp. 36--44. (June 1996)
15. OGC, An Introduction to public Procurement, Office of Government Commerce (GB), http://www.ogc.gov.uk/procurement_the_bigger_picture_policy_and_standards_framework.asp London (2008)
16. SITRA Kuntien Palvelukeskus - Liiketoimintasuunnitelma, <http://www.sitra.fi/fi/Ohjelmat/kuntaohjelma/hankkeet/kuntienpalvelukeskus/kuntienpalvelukeskus.htm>, 2009
17. The National Institute for Health and Welfare (THL), <http://www.stakes.fi/FI/Tilastot/Aiheittain/Terveyspalvelut/terveysmenot> (2011)
18. Quinn James B. Strategic Outsourcing: Leveraging Knowledge Capabilities. Sloan Management Review, pp. 9--21. (Summer 1999)
19. Ranganathan C., Outlay Christina N. Life After IT Outsourcing: Lessons Learned from Resizing the IT Workforce. MIS Quarterly Executive, vol. 8, No 4, pp. 161--173. (December 2009)
20. Teng James T.C., Cheon Myun Joong, Grover Varun. Decisions to Outsource Information Systems Functions: Testing a Strategy-Theoretic Discrepancy Model. Decision Sciences, Vol. 26, No 1, pp. 75--103. (Jan/Feb 1995)

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21. Willcocks Leslie, Griffiths Catherine. The Crucial Role of Middle Management in Outsourcing. *MIS Quarterly Executive*, Vol. 9, No. 3, pp. 177--193. (September 2010)
22. Wilcocks L. P., Lacity M. C., Kern T. Risk mitigation in IT outsourcing strategy revisited: longitudinal case research as LISA. *Journal of Strategic Information Systems* 8, pp. 285--314. (1999)
23. Willcocks Leslie, Reynolds Peter, Feeny David. Evolving IS capabilities to leverage the external IT services market. *MIS Quarterly Executive*, Vol. 6, No. 3. (September 2007)

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Attachment 2. Interview data sheets (4 pages) example from one municipal (Note; real names are changed)

	<i>Kunta; XXX</i>		
	<i>Paikka; XXX</i>		
	<i>Mukana; N.N ATK tukihenkilö, M.M hall joht, Haastattelija 1, Haastattelija 2</i>		
	<i>Päivämäärä; x.xx.2010</i>		
	IT:n hallinnointi ja budjetointi	Tulos 1	Tulos 2
1	Mikä on kuntasi budjetin suuruus (keur)	13	
2	Mikä on IT kustannusten (lähinnä tietokoneet ja työasemat, ohjelmistot, tietoliikenne, IT-henkilöiden palkat, IT -konsultointi, IT -palveluiden osto, puhelinkulut) osuus koko budjetista (%)	1,154	
	<i>It kustannukset jaettu hallintokunnittain</i>		
3	Mikä (arvio) on IT kulujen osuus koko budjetista kolmen vuoden kuluttua (%)	1,154	
	<i>Hankintoja on tulossa jatkossa, ei kasva. SOTE kulut kasvaa ja absoluuttisesti kasvaa myös IT kuluissa</i>		
4	Paljonko IT kustannuksista kohdistuu uusien palveluiden kehittämiseen (%) - "tulos 1" ja paljonko palveluiden tuotantoon % - "tulos 2"	15	85
5	Mikä on oman työn osuus ICT kustannuksista (%) - "tulos 1" ja mikä on hankintojen osuus (%) - "tulos 2", summan ollessa 100 %	40	60
6	Mitkä ovat allaolevien ICT osa-alueiden kustannusosuudet (%)		
7	- konsultointi	5	
8	- laitteet	20	
9	- ohjelmistot	20	
10	- tietoliikenne	10	
11	- IT palvelut	45	
12	- en osaa sanoa	-	
13	Arvioi kouluarvosanalla (4-10) kuntanne ICT hallintomalli (roolit, vastuut, oikeudet) toimivuus	8,5	
	<i>vaikka hallinnonaloilla jaettu, hallintomalli toimii, on pieni ja ketterä, on haavoittuva kuitenkin</i>		
	Mikä on työasemien määrä	110	

Henkilöstö		
1	Kunnan IT henkilöstön määrä tällä hetkellä	1
	<i>pieni prosentti hallintojohtajalta lisäksi</i>	
2	Kuntasi henkilöstön kokonaismäärä	150
2	Monellako henkilöllä (arvio) IT henkilöstön määrä muuttuu seuraavan 3-5 vuoden aikana (+/- lkm)	0
	Kuinka paljon seuraavia IT kyvykkyyksiä kaivataan kuntasi ICT toiminnoissa; 1) ei ollenkaan, 2) vähän, 3) jonkin verran, 4) paljon, 5) erittäin paljon	
3	- Arkkitehtuuri (prosessi-, tieto-, infra-, data-...)	4
	<i>tulevina vuosina tarvitaan lisää, prosessipankkia käytetty ja on hyvä. Ratkaisut jotka tehty tehty aikoinaan ja tähän asti ok ja nyt niitä pitää uudistaa</i>	
4	- Järjestelmäkehitys (jos tässä korkea tarve, millaisia ohjelmisto-osajia tarvitaan?)	1
5	- Järjestelmien käyttöönotto	3
	<i>hyvin tuettuja toimittajan puolelta ja toimii</i>	
6	- IT projektien suunnittelu ja johtaminen	3
7	- IT palveluiden tuotanto ja sen johtaminen	3
	<i>4 palvelinta omassa hoidossa, pieni määrä hyödynnetään, esim sähköposti toimittajan hoidossa</i>	
8	- IT Hankinnat	3
	<i>hankintarenkaassa mukana (liittymät, kännykät, läppärit), järjestelmät hankitaan itse</i>	
9	- IT käyttäjä tuki	5
	<i>tämä perustyötä mitä tehdään</i>	
10	- Tiedon johtaminen (järjestelmissä olevien tietojen harmonisointi, raportointi)	4
	<i>tätä tarvittaisiin kovasti</i>	
11	- IT:n johtaminen	4
	<i>kasvavassa määrin tulee olla</i>	
12	- Muut kyvykkyydet (mitä?)	
	<i>muutosvastarinnan torjunta</i>	
13	Onko kunnassasi nimetty IT päällikkö (kyllä/ei)	0
	<i>Hallintojohtajalla tietohallinnon johtaminen</i>	

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Sisältö	Tulos 1	Tulos 2
Miten arvioisit seuraavien ICT toimintojen tilan kunnassasi (kouluarvosana 4-10) ->"tulos 1" sekä seuraavien IT järjestelmien ulkoistusaste (asteikko %) -> "tulos 2"		
1 - ICT hankinnat, toimittajan- ja sopimuksenhallinta ja osto-osaaminen (sis. ICT ulkoistus) <i>peruslaitteistot ok, saadaanko järjestelmistä riittävästi irti</i>	8	0
2 - Projektinhallinta toimittajan projektipäälliköt toki mukana	9	50
3 - Kokonaisarkkitehtuuri <i>arkkitehtuuri kuvaus ja toimintasuunnitelma retuperällä</i>	6	0
4 - Tietoturva ja IT- riskienhallinta (virustorjunta, toiminnan jatkuvuus, SPAM) <i>toiminnan jatkuvuus haasteellinen</i>	8	0
5 - Käyttäjätukimalli ja tapahtumanhallinta (sis. service desk) <i>ollaan tyytyväisiä, tapahtuman hallintaa ei tarvita, sähköpostilla hoituu</i>	9	0
6 - Sovellusten ylläpito, kehitys ja käyttöönotto <i>Toimittaja pitkäaikainen kumppani, koulutus haasteellinen. Pitäisi kyseenalaistaa ja pitäisi osata vaatia. Kunnassa n 50 erilaista tietojärjestelmää, n 1 järjestelmä per henkilö.</i>	8	100
7 - Infrastruktuuri <i>työasemat ja ohjelmistot ok, tietoliikenne jäänyt jälkeen</i>	8	0
8 - Asiahallinto (ml. arkistointi) <i>projekti käynnissä, hyvin siskioasteella mutta paranemassa. Nyt verkkolevytasolla</i>	5	0
9 - Talous- ja henkilöstöhallinnon järjestelmät <i>irralaan toisistaan mutta integraatio järjestelmien välillä kehoaa, ohjelmien välillä manuaalityötä. Raportointi on oleellinen, hallinto ei itse ota raportteja vaan taloussihteeri hakee raportit esim toteumista. Sähköiset laskut ei käytössä.</i>	7	100
10 - Kunta-asiakkaiden sähköinen asiakaspalvelu (ml. sähköinen asiointi) <i>pilotti sähköiseen rakennuslupahakuun, kysely kuntalaisille</i>	6	0
11 - Palveluohjaus ja palvelusetelijärjestelmät	5	0
12 - SOTE/Perusterveydenhuolto <i>kuntayhtymän kautta, xxx järjestelmäpohjaisia</i>	na	100
13 - SOTE/Erikoissairaanhoido	na	100
14 - SOTE / Sosiaalityö <i>xxx järjestelmä, SHPn kautta, hidas on infraongelmia</i>	8	0
15 - SOTE / Vanhustyö <i>xx järjestelmä, SHPn kautta</i>	8	100
16 - SOTE / Kotihoito <i>effica, SHPn kautta. Mobiiliratkaisujen tarve.</i>	8	100
17 - SOTE / Päivähoito <i>ei erillistä järjestelmää, kaupungin kanssa seudullinen ratkaisu mutta tietojärjestelmää ei otettu käyttöön, Toimittaja olisi ottanut tästä xxxxx euroa.</i>	7	0
18 - SIVISTYS / Perusopetus <i>sähköpostitse hoidetaan tiedonvaihtoa. XX toimittaja toimittaa ja hoitaa tuen, softa omilla servereillä.</i>	8	50
19 - SIVISTYS/ Toinen aste	na	na
20 - TEKNINEN TOIMI / Yhdyskuntatekniikka <i>rakennusvalvontaan voisi tuoda sähköisen asiointin kautta apua</i>	7	0
21 - Hankintatoimi ja logistiikka	5	0
22 - Paikkatietopalvelut <i>ei käytössä kutenXX kaupungilla, esim vapaat tontit ei käytössä. Toimittajan kuntanet, vesisofta . Karttaohjelmaa hyödynnetään</i>	7	0
23 - Yhteisölliset työkalut & etäpalvelut <i>ei ole saatu eteenpäin, ei ratkaisua. Koko henkilöstön etäkäyttöä olisi tuettava. Tämä asia pitäisi jollakin aikataululla saada eteenpäin.</i>	4	0
24 Entä mikä on laajakaistan tilanne tällä hetkellä (asteikko 4 heikko-10 kiitettävä) <i>Laajakaista parantunut viime kuukausina. Mokkuloiden käyttö pelaa syrjäkylilläkin, ADSL rakennettu kylillä (2mbs) 2005, nyt Operaattori kerää kuparia pois täälläkin.</i>	8	
25 Onko kuntasi halu panostaa rahallisesti laaja-kaistan investointiin asteikko (4 vähän -10 erittäin paljon)	8	

Yleistä		
1	Millaista palautetta paikalliset yrittäjät antavat kunnan IT palveluista - (asteikko 4 huonoa -10 kiitettävää)	na
2	Tuleeko kunnan lisätä ICT tukea alueen yritysten suuntaan jatkossa - (1=paljon, 2=jonkin verran, 3= ei muutoksia)	3
3	Jos palvelut ovat riittämättömiä, niin missä ovat suurimmat ongelmat 1) IT infrastruktuuri, 2) tietojärjestelmät ja sovellukset, 3) IT palvelut ja palveluprosessit - kouluarvosana-asteikolla kysymällä millaiseksi seuraavien palvelun laatu on arvoitu ...	na
4	Oletko saanut riittävästi tietoa SITRA / KPK valtakunnallisista hankkeista 1) ei ollenkaan, 2) vähän, 3) kohtuullisesti, 4) paljon, 5) erittäin paljon	4
<i>tietoa on tullut runsaasti, ei ole oltu aktiivisesti kuntiin yhteydessä. Seudullinen yhteistyö parempi ratkaisu. Nähdään peikkona.</i>		
5	Oletko saanut riittävästi tietoa Valt.varainministeriö/KuntalT valtakunnallisista hankkeista 1) ei ollenkaan, 2) vähän, 3) kohtuullisesti, 4) paljon, 5) erittäin paljon	2
<i>saisi kyllä tulla tietoa enemmän</i>		
6	Oletko saanut riittävästi tietoa Valt. varainministeriö/ValtiT valtakunnallisista hankkeista 1) ei ollenkaan, 2) vähän, 3) kohtuullisesti, 4) paljon, 5) erittäin paljon	2
7	Mitä tietoa pitäisi saada enemmän?	
<i>selvityksiä, visioita tulee liikaa, prosessipankki on hyvä</i>		
8	Näetkö, että kuntasi IT toimintoja pitäisi muuttaa / tehostaa 1) ei ollenkaan, 2) vähän, 3) kohtuullisesti, 4) paljon, 5) erittäin paljon	3
<i>ei itseisarvo ja parantaa samalla toimintaa</i>		
9	Oletko valmis liittämään kunnan ICT palvelut suurempaan kokonaisuuteen (1=lähes varmasti ... 5=lähes varmasti ei)	3
<i>tietyissä rajoissa, jos on hyvät ratkaisumallit</i>		
10	Milloin tämä voisi olla ajankohtaista?	0-10v
Kun muutosta toteutetaan, minkä ICT osuuden (%) kuntanne yleensä ostaa ulkopuolisilta seuraavista muutoksen vaiheista;		
11	- kehitys	100
12	- käyttöönotto	100
13	- tuki	50
<i>tarvitaan ehdottomasti lähituki</i>		
14	- ylläpito ja jatkokehitys	100
Kuinka tärkeitä ovat seuraavat asteikolla 1=ei lainkaan tärkeä ... 5=erittäin tärkeä;		
15	- kustannus	4
16	- palvelun häiriötön toiminta	4
17	- palvelun laatu	4
18	- palvelun muunneltavuus	2
19	- asiantunteva käyttäjätuki	5
20	- varmuus kehityksestä mukaan lukien lainsäädännön muutosten toteuttaminen	5
21	Käytättekö KL-Kuntahankinnat OY:tä hankintoihin? (1= ei koskaan ... 5= kyllä aina)	1
<i>Mahdollisesti lisenssien kautta ja tulostimet. Tällä hetkellä ei olla mukana.</i>		
22	Tarvitaanko muutoksen tekemiseen paikallista / maakunnallista toimijaa (1= ei koskaan ... 5= kyllä aina) - ja miksi	4
Keiden seuraavista pitäisi toimia muutoksen veturina asteikolla 1-5 (1=ei lainkaan panosta ..5=erittäin suuri panos)		
23	- maakuntaliitto tai kuntien välinen yhtymä	4
24	- valtakunnallinen KPK ICT	1
25	- muu julkinen toimija, esim yliopisto	4
26	- joku muu (mikä)?	4
<i>iso kunta, ulkopuolinen toimija. Voisi olla paikallisia tekijöitä.</i>		
27	Kuinka tyytyväinen nykyisiin ICT palveluiden ja tuotteiden toimittajiin olet yleensä (1=erittäin tyytymätön, 5=erittäin tyytyväinen)	3
<i>Yksi iso toimittaja, hinta kova, ei yhteensopivuutta. Toisaalta pitäisi itse osata "kyykyttää".</i>		

Requirements Engineering in Information Systems Desing in a Governmental Organisation – Findings from a Case Study

Timo Ingalsuo, Pasi Paunu and Marko Mäkipää

Abstract. Requirements specification is one of the most important, though too often badly neglected, element of the systems engineering process and technical information systems development. It can save or sink the whole product development but managing such a process can be a tedious job. Leading and managing requirements demands experience and it has been seen challenging in many organizations. This case-study examines those challenges faced in one Finnish governmental organization's requirements management process emphasizing implementation and acquisition stages. The base research comprises of series of interviews of personnel involved in the requirements engineering process at different levels. The interviews have been used to identify the main challenges and shortcomings of operating procedures and the use of methods and tools. The aim was to investigate the organization's total requirement management process, and how the different methods, tools and guidelines were operating in that context. Primary emphasis was, however, to focus on one sub-part of the organization, and their requirements management processes. The main results showed that the information systems development methodologies and project work management skills must be developed further but also other aspects of work, which could influence the success of requirements management process, should be examined more critically. Despite of these development needs in the organization the basic processes are in good order and work towards higher maturity level is happening in the organization.

Keywords: Requirements specification, requirements engineering, requirements management, systems engineering, information system development, application lifecycle management

1 Introduction

Requirements engineering is without a doubt one common part in all information system development. The fast development in information and communication technologies domain has continuously opened up new possibilities to implement technologies and that way to gain benefit in leading organizations [1]. Thanks to this fast development, there is an ever increasing number of information systems implementations all the time, while the significance of those systems is increased from the organisational success point-of-view. At the same time there has been a transition from one purpose systems towards integrated networks of systems [2]. In organisations, the fluent flow of information is critical for the effective and influential leading [3]. Integrated systems and effective communication solutions have made it possible to have more flexible organisation structures, but at the same time they have made organisations more dependent of information systems. Because of this reason the succes or the failure of information system implementation project may have tremendous impact on organisation.

However, a large proportion of IT projects are reported to fail [4]. Information system projects are typically always late and they exceed the budget while still does not produce all the desired functionality [5]. Standish Group's CHAOS's 2004 survey showed that less than 30% of the projects are succeeding in line with expectations and the figure has changed little since being tracked over 10 years [6]. In this same study it is mentioned that an average of more than 80% of the projects exceeded the schedule and more than 50% exceeded budget.

There have been found many reasons for failure, such as poor user involment, stakeholder conflicts, poor cost and schedule estimates, tasking which do not correspond to knowledge and skills (and others) [5]. The main reason for failures, however, is seen as insufficient and too vague collections of requirements, which leads to failure to meet the requirements [7]. Requirements management is clearly a critical part of any information system project [8].

This research report at hand describes the findings of a study concerning the requirements engineering processes and methods in one Finnish governmental organization (in text referred as FGO). Organization is quite large, and there are several departments and sections which are operating in information management domain. The need for the study arose from the perception that there was a constant gap between the defined requirements and actual implemented product. It was considered that the implementation was falling behind and costs were increasing because of poor quality requirements elicitation, and in some cases whole information system project failed.

The aim of the original study was to identify the requirements management process and how the different methods, tools and guidelines, which were in use in one sub-organisation, were operating in that context. Research focus area was, however, at

requirements management processes in a sub-organisation, which is responsible for information systems development. The original study was a case study, based on interviews of key personnel in FGO.

2 Theoretical framework

In literature the requirement specification process has been described in many different ways and from different perspectives. Part of the research literature focuses to describe the requirement definition process as a linear succession of stages and phases of the objectives. Other part focuses on requirements specifications intermediate and final outputs and their contents. One part considers that requirement specification process is defined by the tools and special techniques. One group rejects all forms of structured activity and describes the requirement for the definition of non-linear and chaotic activity [9].

Process-driven theories such as Browne and Ramesh [10] describe the requirements management as a multi-level process, where each level can be described in stages of [input] - [objective] - [output]. Similarly, Chakraborty et al [9] describes the requirements definition from the phase-transition perspective, when in the requirements definition process there is fluctuation between different phases and transitions between these phases. Each of the phases is affected by the objectives of contributing factors and complicating factors.

In strategy-oriented information system design the process starts from strategic goals and higher level requirements, and goes towards more detailed technical specification, which finally is detailed enough for application development or configuration of COST-software. User-oriented design on the other hand starts from the user needs, and then constructing from individual requirement the entity of requirement specification, so that the entire system can be realized. Both of the approaches the original requirements are developed either through linear or iterative processes towards technical specification, with the help of which the actual software application is produced.

On the other hand requirements specification can be seen from the actor-network point-of-view, in which requirement specification are constructed through the series of human interaction, and in which different kinds of documents, applications and guiding processes are the mediating factors [11]. This study builds a synthesis of these two points-of-view, in order to create a holistic viewpoint to both requirements specification process and the methods of creating requirements specification documentation.

Chackraborty et al. [9] describes the entire requirements engineering process as an interactive activity, in which the representatives of the user and the requirements engineer share, acquire and build the requirements together. The requirement specification document is the boundary object as well as the end result in this process,

combining the knowledge and understanding of participants. Interactivity is very important in this process, since those participating in the requirements specification bring with them the context specific language vocabulary from their own environment, which might be difficult for other participants to understand. Information system projects are typically such that there is a need for knowledge from several domains, and that knowledge has to be combined in the end result [12] [13].

The more complex and unique the target system (which is described in requirement specification) is, the higher the level of knowledge exchange is needed between the parties. Carlile [14] states, that technical information transfer is enough when the issues are simple and understood by both parties, but to transfer more complex issues there might be a need for translation or transformation of information. If the object of knowledge is such that the different parties might not understand immediately what the information (e.g. requirement) given by the other party could mean in their context, translation is then needed. This could for instance be giving a functional requirement, the translation of which into system requirement requires interactive requirement handling, in which a common vocabulary is negotiated. In extremely complex issues or those completely unfamiliar to the other party information transformation may be needed, in which case both parties need to increase their understanding of the other party's domain, in order to create a new understanding that combines different domains and agree upon contradictory goals to achieve the solution. Path dependency and recipient's absorptive capacity are factors which limit the complete transfer of knowledge.

Thus requirements management is seen as a process, with certain phases and phase-transitions, factors that affect on different phases and both factors which either contribute or complicate achieving phase's objective. In each of the phases a variety of means like documents, tools and guidelines are used to achieve objectives. What is essential to achieve a good end result is to ensure the coherence of the knowledge process, meaning that the understanding about the produced requirement at the production end complies with the higher level requirement.

2 Findings

The research paper at hand is based on the interview study in on Finnish governmental organization. The original research was conducted at the autumn 2010. The output aimed the utility point-of-view, with the intent to develop the currently utilized tools and processes. For this purpose there was approx 20 interviews conducted, collecting experiences from the key personnel in various posts along the entire process. Based on the interviews formed a rich description of present situation of the requirement management process in this studied organization.

The interviews shows that the requirement management process is not an easy task for a big organization, where the most of the efforts is focusing on to something other than developing information systems. The organization studied is such that it acquires

information systems either by implementing ready-made or cost-of-the-shelf (COTS) software, or defines parameters of configuration. Only relatively small amount of the software which is needed is developed from the scratch.

The information system development process starts in the organization from the front end; there the managerial level of the organization defines the target and concepts of the developed system. Through some transformation the process reaches the production-end, where the project team defines the parameters, negotiates and communicates with the vendor.

Throughout the process there was some challenges seen in managing the requirements in the organization. However it can also be seen, that to the wide share of these challenges there is at least some kind of a solution or a plan to improve it, indicating that it is better to talk about challenges in developing the everyday action rather than unresolved problems. This organization has a long history of utilizing information technology in its operations, and naturally gained lots of experiences on the way. It was clear at least in this case, that there is development happening, and the organization has a good change to reach the maturity in information system development and acquisition.

With the help of interviews and going through existing guidance and tools configuration we were able to collect a wide range of findings. There were findings in four categories: process related, organization related, tools related and skills related findings. The findings are categorized in rather freely, loosely following the production factors from theories in organizational behavior. The most important from the entity point-of-view were:

- The processes and methods were in adequate level or at least there was a plan for development.
- The whole process was missing links to back from lower level (detailed) requirements to higher level concepts.
- Requirements management and project management skills were deficient. Knowledge was not able to accumulate.

As the key finding which emerged from the study was that the various actors had a very different and diverse view of the overall picture about the development of the information technology and management systems. Also they did not have well formed overall view of different stakeholders, other parts of the organization, activities or relationships between those.

In the process point-of-view the action is divided to the front-end of the process and the production-end of the process, as described earlier. The front-end of the process carries the responsibility for drafting the innovation, initial requirements, and the concept, while the production-end of the process focuses on the project work. The

biggest concerns in the process challenges were related to transition of outputs in different phases of the project. Since the staff in different end of the process were not the same, and the process itself could take several years long to pass, there was a need to transfer the higher level outputs to later level inputs. That transformation was seen problematic but with several underlying factors. One of those was poor outcomes; concepts were vague, initial requirements were too abstract, investment decisions were prepared hastily. In generally the front-end of process was done in that way, that the performance was not satisfactory as a starting point for actual project.

At the production-end there were some problems of their own. While the inputs from the earlier phase of the project were vague, on the project-end there was appointed project manager, who had to start the requirement management process using those inputs, and form the project group. Since the organization is governmental, the appointed project manager rarely had previous experience in the information system design, but more often on his own domain of expertise. Project manager was able to use some technical resources to assist in project management.

At projects there were also lots of small factors compromising the achievement of the results. Often the workload was underestimated, which led to too small project organizations. The process diagrams defined roles in general level, leading to those as de-facto standards in the actual work, without possibility to add extra roles. Also the contribution from the front-end was considered as a nonnegotiable, leading to situation where the project manager tried to fulfill also poorly prepared projects. One common factor was that the project personnel were not able to realize the implications of the poor preparation to the future success or more over to the lack of it.

Organizationally the challenges are related to the organizational structure in general, but also especially relating to the project organizations. As mentioned earlier, the organization generally is somewhat scattered in IT domain, and it is easy to state that the members does not have very good overall picture of other parts of the organisation, other ongoing projects, stakeholders and the relations between them.

In project level the challenges are also related to the changes in project staff. Staff can be appointed to new tasks in the middle of the project, mostly due to the fact that they are not working as full-time system designers, but moreover they have some other main area of expertise. For many of the project managers the one project is the only one in their career, leading to situation, where the project manager is very often inexperienced one.

Skills and knowledge are the one theme arose during the interviews. Throughout the entire process it was mentioned that there is at least some lack of knowhow; in project work and in project managing, using tools, using guidance and normative document etc. It is not necessarily that surprising that there was a deficiency in knowhow; the result might be the same in most of the organizations when looking at the management information systems projects. What was noteworthy was that the lack of knowhow was so severe even when there was a separate organization for managing information systems.

The biggest shortage of knowhow was in managing big projects, and in using application lifecycle management (ALM) functionality and tools. Challenges often related to the fact that project staff were doing project on top of their own work, or the workload was underestimated, but also to the lack of the basic knowledge of information systems design principles and practices.

It seems then that the deficiencies in knowhow are divided into two main points; the individual knowhow (in the field of information system engineering), and the organizational knowhow (in the field of administration, resourcing and knowledge management domains). The lack of individual knowhow in IS-engineering domain seems to focus on understanding the methodology of IS design, to knowledge on how to use ALM tools, to project work skills and skills on managing projects.

Requirements engineering tools can be a double-edged sword at times. On one end these tools can bring order and control with methodologies that can be fitted to almost any development style imaginable but on the other hand if the organization and its personnel are not skilled enough and have no real experience how to utilize these acclaimed tools everything can be shot to pieces. In our case-study we saw evidence for both.

The development process in the case organization itself is fairly simple but the crippling problems for the whole development lay in the front-end of innovation and in the production-end of process. There was multiple RE-tools and thousands of pages of guidance and support material available in the organization so what was the problem? The first notion is that on the front-end side of the process there was no clear understanding on the importance of application lifecycle management and how to apply its methodologies. In requirements management the use of right tools is of paramount importance but no system guarantees that they are used correctly. The initiation phase in the process does not currently see what, why, when or where to put their output. Several tools were bought to clarify and help in the situation but their usage has remained next to nothing. There are also usage problems and availability issues which hinder the usefulness of the tools as their focus is connect the different points of the whole development process.

The second point of problem is also related to the availability and understanding of the tools but on the production-end of the process where the lack of understanding systems engineering process with information systems development and project management has created a whole new set of challenges. Majority of these challenges at this stage of the process comes up with the inexperience of the project manager regarding genuine product development and the roles associated with it. One cause for this was revealed in the case study as a position interchange. Rather inexperienced personnel were made as project managers who had either very little or no experience on project working with any sort of IT-product development. No large amount of support material can help in a tightly scheduled development situation if one has too little of experience and does not have the needed base knowledge to understand the context what the support and guidance material offer. The product-end-of-innovation

ended up using ad-hoc approach with reactive handling in the project rather than proactive and more controllable process guiding. In summary there are major challenges at the initial phase- and in the end phase of the development process and their intertwined co-operation with each other. Examples on this were architecture plans which are more understood in the front-end of the process but rather unknown requirement at the production end.

4 Discussion and conclusions

Guidance and counseling as well as the development of a knowledge-based database can support the requirements management, but only on their own are totally inadequate means to better requirements management and means to achieve success in managing information system projects. Guidance, control and knowledge base can support the project managers if they only have enough time to acquaint themselves with the guidance contents and to the knowledge database. In the interviews, however, it is shown that the project staff and time are often insufficiently allocated to projects, which makes it impossible for the project staff to learn project activities, methods and tools during the project. In this case, project staff has no other choice than to lead the project by ad-hoc methods and by their previous experience, often leading to poor results. While the main objective of the research was to develop methods, processes and tools, it was found out that the biggest deficiency in information systems engineering success was the lack of knowhow, skills and knowledge. Generally it was noted that the organization itself had adequate level of application lifecycle management tools, methods, processes and guidance material. The lack of individual and organizational skills might be even more generalized idea affecting the success or failure of information system projects in governmental organizations.

This understanding is also backed up by some other researchers and news as well. After the case study on autumn 2010 there was another report published in Finland by the National Audit Office, about the implementation of national IT projects in social and health care. The report also states that the one of the main reasons for unsatisfactory results in developing health care information systems results partly from the lack of professional leadership and monitoring tools [15]. Same kinds of results have been presented also in United States, where in several news the knowhow has been highlighted as a major reason. One case was the report of US DoD, where the quality or requirements of defence systems were evaluated, and claimed that both requirement elicitation process is modest, but also that project personnel is lacking the necessary knowhow [16].

While there is a good and wide contribution in academic literature about information system planning methodology, there might be a space to look into the organizations maturity and skill level on adopting methods into practicality.

5 References

1. Benamati, J. S, Lederer, A. L. and Singh, M.: *Changing information technology and information technology management*. Information & Management, Vol. 31, pp. 275-288. (1997)
2. Lee, J, Siau, K. and Hong, S.: *Enterprise integration with ERP and EAI - Comparing internal and external approaches to enterprise business integration*. Communications of the ACM, Vol. 46 issue 2, pp. 56-60. (2003)
3. Boland, R J and Hirschheim, R A, [ed.]. *Critical Issues in Information Systems Research*. New York. John Wiley & Sons Ltd., p. introduction (1987)
4. Armour, P.: *The business of software*. Communications of the ACM, Vol. 50, issue 6 pp. 21-23. (2007)
5. May, L. J.: *Major causes of software project failures*. The journal of Defence Software Engineering, pp. 9-12. (July 1998)
6. Preuss, D.: *Info Queue*. Interview-Johnson-Standish-CHAOS. [Online] August 25, 2006. [Cited: 11 21, 2010.] <http://www.infoq.com/articles/Interview-Johnson-Standish-CHAOS>.
7. Mathiassen, L.: *A contingency model for requirements development*. Journal of the Association for Information Systems, Vol. 8, issue 11 pp. 569-597. (2007)
8. Hickey, A. and Davis, A.: *A unified model of requirements elicitation*. Journal of Management Information Systems, Vol. 20, issue 4 pp. 65-84. (2004)
9. Chakraborty, S, Sarker, S. and Sarker, S.: *An exploration into the process of requirements elicitation: a grounded approach*. Journal of the Association for Information Systems, Vol. 11, issue 4 pp. 212-249. (2010)
10. Browne, G. J. and Ramesh, V.: *Improving information requirements determination: A cognitive perspective*. Information & Management. Vol. 39, pp. 625-645. (2010)
11. Gasson, S. A.: *Geneological study of boundary-spanning IS desing*. European Journal of Information Systems, Vol. 15, pp. 26-41. (2006)
12. Iivari, J, Hirschheim, R. and Klein, H.: *Towards a distinctive body of knowledge for information system experts: coding ISD process knowledge in two IS journals*. Information Systems Journal, pp. 313-342. (2004)
13. Curtis, B, Krasner, H. and Iscoe, N.: *A field study of software desing processes for large systems*. Communications of ACM. Vol. 31, pp. 1268-1287. (1998)
14. Carlile, P.: *Transferring, translation and transforming: an integrative framework for managing knowledge accross boundaries*. Organisation science. Vol. 15, pp. 555-568. (2004)
15. *The implementation of national IT projects in social and healt care*. Helsinki : National Audit Office, 2011.
16. Kosola, J.: *Amerikkalaisilla ongelmia vaatimusten hallinnassa*. Sotilasaikakauslehti, p. 72. (February 2011)

Usability Problems for Users' Inaccurate Interpretations of Web Signs: A Semiotic Perception

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Abstract. Usability is considered as a key quality for a well designed web application that offers a satisfactory user experiences. As a result, designing user intuitive web interface signs is essential to retain users' satisfactions. The design principles of interface signs are semiotics by nature since semiotics is the doctrine of sign, i.e., science of signs. This paper is a progress report on the author's research into "*semiotics perception on web interfaces: evaluation and optimization of web usability and end user experience*" to reveal the reasons of web usability problems from semiotics point of view. Towards accomplishing this goal, a systematic empirical case study was conducted on a web application, the Ovi Calendar of Ovi by Nokia (<http://calendar.ovi.com>) during the late 2010. This study was replicated with seven participants and followed a strict case study methodology to ensure the validity and reliability of research outcomes.

Keywords: Semiotics, think aloud usability testing, interface signs, usability problems, web application, user experiences.

1 Introduction

The growing demand of internet world radically increased the competitions for not only with the millions of other web applications who advertise/produce the same products/services, but also for the users' attentions, times, and satisfactions. Usability that measures the easiness with which users interact with the web interfaces contributes to user satisfaction, happiness, as well as pleasure; and conversely a lack of this contributes to user dissatisfaction and frustration, and thus eventually will result in the total abandonment of the system. Therefore, usability is considered a key quality for a web application and usability evaluation methods are considered as an important quality assessment technique in website evaluations [3]. Whitefield et al. (1991) classified evaluation methods into four groups [4]: (i) analytic methods, e.g. task analysis [5]; (ii) usability inspection, e.g. heuristic evaluation [6] [7], cognitive walkthrough [8], features inspections [7]; (iii) observational methods, e.g. co-discovery [9], think-aloud[8][10]; and (iv) users reports, e.g. questionnaires [10] [11] and interviews [10] [11]. All these evaluation methods are lacking the evaluation of semiotic issues of web applications. Since these methods do not analyze the intrinsic values of user interface, especially the interface signs of user interface. To allow the

analysis of intrinsic values of interface signs during usability evaluation, a semiotic engineering approach has been evolved [12].

Therefore, the purpose of this research was to provide two important concerns of web usability from semiotics perspective. This research, firstly showed that how users' interpretations of interface signs significantly allied to produce web usability problems, and secondly introduced few semiotics guidelines for designing the user intuitive web interface signs and these guidelines also might be used as heuristic checklists for usability evaluations of web applications. In this research a systematic empirical case study on a web application was conducted and revealed the reasons of web usability problems from semiotics point of view. It is worth to mention that this study is also used to show the significance of semiotics to design and evaluate the web interface signs to boost the web usability and the outcome of this along with all the experimental data are reported in paper [17].

This paper is structured as follows. In section 2, semiotics theories and these relations to interface sign interpretation are discussed. These semiotics theories were also the sources of motivation for us to design and articulate this paradigm. This section also highlights the spectrum of issues that were encountered in interface sign intuitive test. The steps of experimental method for empirical study on web application are briefly discussed in section 3. In section 4, semiotic analysis and results are presented. Finally, the conclusion concerning semiotics perspective to interface sign design as well as ideas of future research is provided in section 5.

2 Interface Sign and Semiotics

Signs take the form of words, images, sounds, odors, flavors, acts or objects, but these things have no intrinsic as well as intended meaning and these things become signs only when designers provide these with meaning (or, sense) [15]. In the present day, navigation tools as well as the content of typical Web pages consist to a large extent of interface signs, whether we call them links, indexes, images, buttons, icons, or even animations (few examples of Ovi calendar interface signs are presented in figure 4) [19]. The study of signs (or, science of signs) is called semiotics. A complete definition of semiotics is "the study of signs, signification, and signifying systems" [18] Among the many different semiotics models two models are presented here which were more relevant to this research work: (i) Peirce's semiotics model [2] consists of a triadic relationship containing: the *representamen (representation or sign)* - this stands to somebody for something in some respect or capacity. It addresses somebody and creates in the mind of that person an equivalent, or perhaps more developed sign; the *object (referent)* - is the actual thing the sign stands for and the *interpretant (meaning)* - is therefore the sign created in the mind of the perceiver or the reaction caused by the object in the perceiver [13]. For these, a sign requires the concurrent presence of these three constituents. As an example, consider a panel at the entrance of a company with "Reception office" written on it. The textual shape of the sign (the text string "Reception office", the font used, its color, its background, its size, etc.) is the sign. The concept that the sign evokes in the mind of the reader, that is, the idea of a *reception's office* and what it means is the interpretant. The actual

object in the real world, that is, the reception's office as physical object is the referent. (ii) Semiotics theory by Gottlob Frege's terms for the three vertices of a semiotic triangle were *Zeichen* (sign) for the symbol, *Sinn* (sense) for the concept, and *Bedeutung* (reference) for the object [14]. As an example of the semiotics triangle, Frege cited the terms '*morning star*' and '*evening star*' and both terms refer to the planet Venus as their meaning, but their senses are very unlike the way in which the planet is presented (one term refers to a star seen in the morning, and other one refers to a star seen in the evening). Therefore, there is no one-to-one link between the object and the sign; various signs may have a single meaning in spite of several meanings. Different signs vehicles can refer to the same object since each sign vehicle has its own flavor or sense that leads it to the same object.

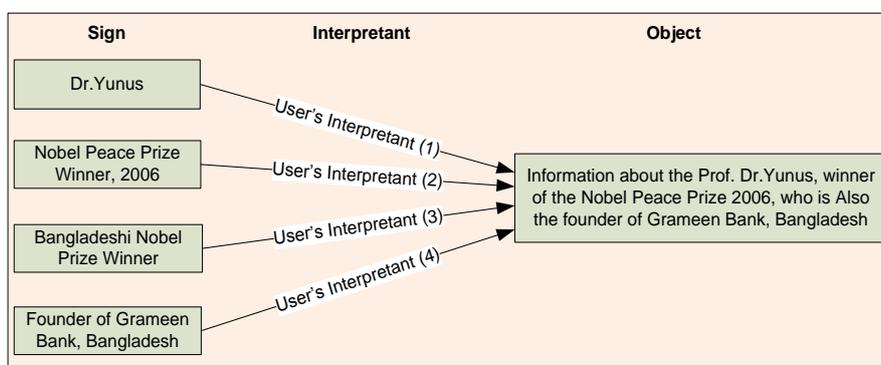


Fig. 1. Different signs referring to the same object

From the above discussion on semiotic theory as well as semiotic model these were found that generally, users guess the sign meanings through the *creation and interpretation* of 'signs'. An example of Frege's semiotics theory depicted in figure 1, observes that different signs may lead to the same object by different interpretants. Pierce's model depicted in figure 2, observes that the same sign may refer to different objects by different interpretants.

For these, the user interpretation (an example is depicted in figure 2) of interface signs were classified into the following categories based on the accuracy level of user interpretation with respect to the designer's interpretation for an interface sign: *a) accurate*- user's interpretation completely matches the designer's interpretation and this category reflects the semiotics theory, *(b) moderate*- user's felt more than one distinct object, one of which was the right one about the interface signs and probability to obtain the right object at the first attempt may be less than the accurate interpretation (for example, if a user proceeds with a sign to obtain a particular object but the sign does not really stands for that), *(c) conflicting*- user's felt more than one distinct object in his/her mind about the interface signs and user felt confused about choosing the right object that will match to the designers intention, *(d) erroneous*- user's interpretation referred to a completely different object other than the designer's interpretation, and *(e) incapable*- user could not able to interpret the interface sign at all. These categorizations were also used in empirical studies in section 5.

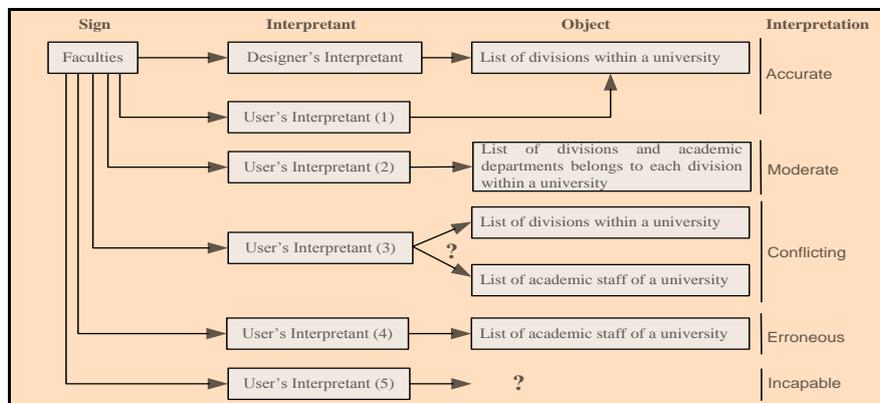


Fig. 2. Possible Interpretation of a web interface sign

3 Experiment Method

A systematic empirical case study by an interface sign intuitive test and a conventional laboratory based usability test was conducted on a web application, the Ovi Calendar of Ovi by Nokia (<http://calendar.ovi.com>) during the late 2010 at usability testing laboratory of Åbo Akademi University, Finland. This study was replicated with seven participants from five different educational institutions in Finland and followed a strict case study methodology to ensure the validity and reliability of research outcomes. Both tests sessions were made audio-video record. To conduct this empirical study, seven sequential steps were followed (see figure 3). Briefly these are the seven steps.

Step 1: The problem statement and test objectives were clearly defined to reflect the purposes of conducting the tests and appropriately derive the remaining steps. This study objective was to obtain the answer of a basic research question address as: *Which are the possible reasons of users' inaccurate interpretations of interface signs?* Apart from obtaining this, the study also showed that how users' inaccurate interpretations of interface signs significantly allied to produce web usability problems.

Step 2: Tasks list were prepared (see table 1). After finalizing the tasks list, an inspection (heuristically) was carried out very meticulously to prepare the list for (i) all interface signs, and (ii) related interface signs to each task (task-related signs).

Step 3: Students were recruited and scheduled as test participants. Since, anyone who wants a personal, free calendar service that can be accessed from any location from any web browser might be the users of Ovi calendar. Moreover, due to the limitations of time and money, it was easy to access students. A series of questionnaires were designed to qualify the potential users. The overall study involved seven participants aged 21 - 30, selected from five different universities in Finland. All participants had good experience in using the personal computer, the

internet, the real world calendar and three users had prior experience in using a web calendar, but no participant had prior experience in using the Ovi calendar (see table 2).

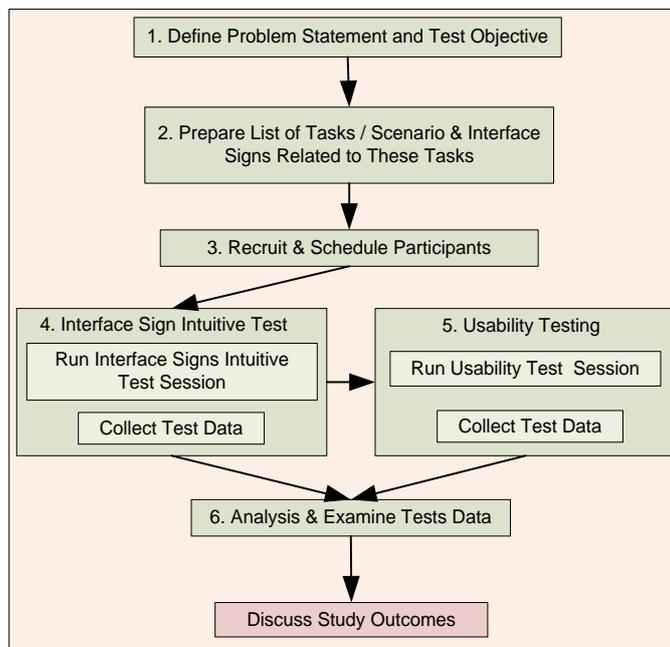


Fig. 3. Structure of our experiment method

Step 4: An interface sign intuitive test was conducted to understand the users' interpretations of interface signs listed in step 2 and collected the data in a systematic way. This test was conducted through user interviewing mainly. The user interview was conducted one by one following the thinking aloud method [1]. At the beginning, the interviewer gave a very short lecture to the participant regarding the purpose of the interview and web application being tested. The questionnaires used to conduct this test session were: *What do you think about the intended meaning of this sign? / What could be the purpose of using this sign? / What is your guess about the referential content for this sign?* The author as interviewer and a participant, as interviewee were seated together in front of a computer, showed the list of all interface signs of web application being tested. Selected participants were asked to formally interpret these interface signs (base on the questionnaires raised for this test session), talking aloud and described their understanding of each interface signs. Page snapshots of studied application from where signs were listed were also showed and they were asked to "re-comment" on any signs if they thought their past comments were not appropriate to any particular sign. The fundamental purpose of asking these questions was to obtain an indication of their understanding and classify their interpretation into: accurate, moderate, conflicting, erroneous and incapable (see

section 2). The interviewer noted these data during test sessions and these entries were checked again with the video record of the test sessions.

Table 1. List of scenarios and related tasks

Scenarios	Task no.	Tasks
<i>Log-in & event entry</i>	T1	log-in to Ovi calendar (data was provided)
	T2	create an event
	T3	create an event with advanced options
<i>Search & edit event</i>	T4	search for an event (event entered previously)
	T5	edit an event
<i>check, delete and log-out</i>	T6	check weekly event list
	T7	delete an event
	T8	log-out to leave Ovi calendar

Step 5: User testing to do the given tasks was conducted following the conventional laboratory based think-aloud method and collected the data in a systematic way. The discount usability testing approach [16] was followed to test the Ovi calendar. To perform this test with each participant, the following activities were followed. A short lecture was given about the system and usability testing in general. Activities during test sessions consisted of observing users performing their tasks in a usability test laboratory. Their activities were recorded in videos and they were observed through a one way mirror. Post-task questionnaires were used to obtain immediate feedback of the users after completing each scenario. The users were asked about the ease and difficulty of tasks and provided options to write comments on different issues they felt during the completion of tasks. It helped to obtain feedback when users' memory was fresh. At the end, when users finished last scenario, post-test questionnaires were delivered. Later the video record of the test sessions were examined and coded using data-logging software (Observer 5.0) to obtain test data. Apart from this, more data were collected from different kinds of questionnaires, i.e. pre-test, post-task, and post-test.

Step 6: Finally, these tests data were analyzed and examined in two folds: *firstly*, to observe the user behavior focusing the users' understanding of interface signs and how these understandings affect users' performance to assess the significance of semiotics perception on web usability. *Secondly*, to observe from semiotics perspectives the possible reasons of users' inaccurate interpretation of interface signs and the usability problems faced for these inaccuracies. Analysis details and results of the former one are published in [17] and this paper discussed the analysis details and results of the later one.

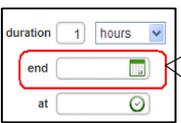
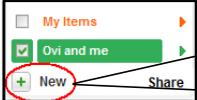
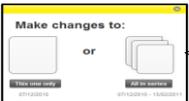
Sign	Interpretant	Object	Interpretation
	Designer P4	Retrieve deleted item	Accurate
	Designer P1	Textbox accept input data (date) in fixed format (dd / mm / yyyy) from keyboard or by cursor interacting with the calendar icon append with text box. Textbox accept input data (date) only from keyboard (do not get any hints about acceptable date input format) and appended calendar icon has no interactivity but it used only to give an indication that this text box is for date value.	Moderate
	Designer P2	Create / add a new category Create / add a new event	Conflict
	Designer P7	See all deleted items See all stored / entered items	Erroneous
	Designer P7	Choose option to select whether changes (of entered events with repetition) will effect to all repeated events or only the current one. ?	Incapable

Fig. 4. Examples of users' interpretations of interface signs and its categorization (labels P1 means participant1, P2 means Praticipant2, and so on)

Table 2. Test participants profile in brief (H: High, M: Medium, L: Low, N: None)

Features	P1	P2	P3	P4	P5	P6	P7
Familiarity with personal computer	H	H	H	H	H	H	H
Internet familiarity	H	H	H	H	H	H	H
Age	21	22	22	26	25	29	24
Education	M	M	M	H	M	H	H
Familiarity with real world calendar	H	H	H	H	H	H	H
Familiarity with online Ovi calendar	N	N	N	N	N	N	N
Familiarity with other online calendar	L	N	H	N	N	H	N

4 Semiotics Perception

4.1 Data Collected

From interface sign intuitive test, data of - (i) users' interpretations of all 104 interfaces signs (see table 3) as well as (ii) users' interpretations of each task-related signs were collected. From think-aloud usability test, data of – (i) task completion time (TCT), min and max time for task completion (see table 4); (ii) number of times tried / failed to complete each task; (iii) number of input error, system error as well as

Table 3. Categorizations of participants' interpretations of all interface signs

Participants	Accurate	Inaccurate				Accuracy (%)	Inaccuracy (%)
		Moderate	Conflict	Erroneous	Incapable		
P1	67	18	3	12	4	64,42	35,58
P2	65	13	8	16	2	62,50	37,50
P3	79	16	0	8	1	75,96	24,04
P4	73	14	5	4	8	70,19	29,81
P5	71	14	3	11	5	68,27	31,73
P6	77	11	2	9	5	74,04	25,96
P7	76	9	4	13	2	73,08	26,92

number of times despaired, smile, angry, asking help for each task; (iv) number of interaction and interact variation (difference between the interactions actually needed and user's performed to complete a specific task *i.e.*, *user interact - required interaction*) for each task; (v) time spent in despaired, smiley, or angry state; (vi) time spent in confused & wrong navigation (C&WN) state; (vii) subjective rate in the scale

of 1-5 based on how easy or difficultly felt to perform each task as well as overall satisfaction of using the studied application; and (viii) examples of verbal comments related to interface sign interpretation were collected.

Table 4. Task completion time (mm:ss); min and max time cell are coloured as light turquoise and rose respectively

Participants	T1	T2	T3	T4	T5	T6	T7	T8	Total
P1	01:28	05:44	08:26	00:44	05:40	02:19	01:10	00:07	25:38
P2	01:00	04:02	18:53	00:55	04:55	02:02	02:59	00:03	34:49
P3	00:38	02:57	06:47	01:44	15:18	00:29	00:36	00:03	28:32
P4	01:15	03:08	02:54	00:59	03:16	05:35	00:44	00:05	17:56
P5	01:24	06:23	07:43	00:54	01:19	06:25	01:01	00:03	25:12
P6	01:03	07:00	02:21	01:35	11:40	05:08	03:22	00:03	32:12
P7	01:12	03:11	14:07	03:04	21:27	04:39	00:14	00:03	47:57

4.2 Observed User Experiences

Systematically collected data from both tests were analyzed and examined from semiotics perspective to observe- (i) users' understanding (accuracy level) in interpreting the intended meaning of interface signs, (ii) the possible reasons of users' inaccurate interpretations of interface signs, (iii) users' behaviors to do a specific task with respect to his understanding (accuracy level) of the task-related interface signs, and (iv) the usability problems raised by users' inaccurate interpretations. To observe these four things the following steps were followed for each participant- (a) Firstly, re-viewed the data of user's interpretation of task-related interface signs. (b) Then, observed user's behavior to interact with a task-related sign while his understanding of that sign was not accurate. (c) After that, observed how user's behavior (observed in step b) creates usability problems. (d) Finally, enumerated the important considerations of designing the user intuitive interface signs to reduce the usability

problems from semiotics point of view. For the lack of space, only few example cases are discussed in this paper and at the end of this section, all the semiotics considerations came out from this study are presented.

Example case I: Test participants were confused to grasp the real meanings of two similar linguistic signs - “end”, used in the same page. The first “end” sign stands for giving indication to enter the end date of a single event and the second one stands for giving indication to enter the end date of event repetition (if the event has repetition). But users treat the first “end” sign for entering the last date of event repetition. Therefore, to perform the task T3, participants enter the date 05/03/2011 in to the both text boxes appended with the “end” signs. Whereas, the accurate input for the first and

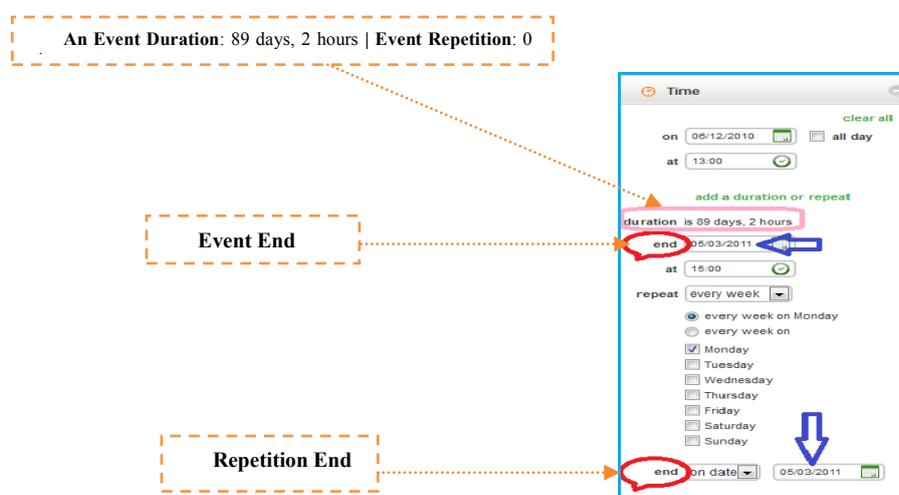


Fig. 5. Snapshot of Ovi calendar for example case I and an example of possible re-design

second end date should be 06/12/2010 and 05/03/2011 respectively. As a result of saving the incorrect input, the calendar body showed this event as a single event for the whole duration (06/12/2010 to 05/03/2011). Therefore, users were spent comparatively long time in confusing and wrong navigation, failed to solve this task at the first attempt, made input errors, increased the task completion time and interact variation, facial expressions showed despaired, asked help, and gave poor rate of satisfaction. A snapshot of event entry page is presented in figure 5, where the “end” signs are marked by red colored circles and input dates are marked by blue color arrow symbol. The users behaviors presented here showed two important consideration of sign representation from semiotics point of view: (i) same signs used for two different purposes led users for inaccurate interpretations (e.g., “end” sign), and (ii) unclear as well as confusing text of indicative sign amplify user’s inaccurate understanding of duplicate signs (e.g., “duration is 89 days, 2 hours” appended in above of the first “end” sign).

There could be a number of solutions of this problem by redesigning these signs semiotically. One solution could be to re-write the first and second end sign as “Event End”, “Repetition End” respectively to explicitly indicate the date of event end and

repetition during entering an event. And re-write the indicative sign “duration is 89 days, 2 hours” as “An Event Duration: 89 days, 2 hours | Event Repetition: 0 times”. So that users may grasp the meaning of interface signs very easily and thus reduce the usability problems as well.

example case II: There were few navigational paths to reach at event entry page of Ovi calendar. Depending on the path chosen by participants, interface signs of entering the event’s title and description of event were appeared inconsistently. These signs were appeared in two ways as presented in figure 6 (above two). For the left side appearance, participants treated the first text box for entering title but they were in doubt for second text box to figure out its real purpose- whether it was for entering the sub title / event descriptions like place, time, etc., / other details, as well as also confused to grasp whether it is optional or mandatory to write something in this box. Again for the second left side appearance, participants thought that the box was for adding title since a sign “Add title” was appeared in upper right corner of this box. Users written the title in this text box and saved it. Therefore, users were failed to see the event having title “Usability Test” in the calendar body. Users felt the problems and then returned to the event entry page and tried to solve this problem. Thus complete the task with worst performance (e.g., high TCT, C&WN, task failure, high interaction variation etc.). The users behaviors presented here showed five important considerations of sign representation from semiotics point of view: (i) interface signs are presented inconsistently for the same web page; (ii) lack of proper indication to understand the exact purposes of text boxes; (iii) all the signs related to data input of Ovi calendar was appended in left side of text box but these two signs “Add title”, “Remove title” were appended in the right side; (iv) users were failed to grasp the interactivity of “Add title”, they thought that this sign has no interactivity but used only for indicative purpose of writing the event title in the below box; and (v) All the green colored linguistic signs of Ovi calendar have interactivity but participants failed to understand its interactivity for the improper placing of “Add title” (see the above two snapshot of figure 6) sign though this linguistic sign was green color.

There could be a number of solutions of this problem by redesigning these signs semiotically. One solution could be to redesign these signs as the figure 6 (below two); so that, whatever the navigation path were followed to reach at this page their appearances will be consistent like this. The black color indicative signs “Title” and “Other details” appended in the upper left corner of text boxes will help users to obtain the concepts of input data/text for these text boxes. The green color “Remove title” sign could assist to understand its interactivity. And if users remove the title, then the appearance could be look like the below- right side one of figure 6. So that, participants may easily understands the purpose of second text box and the interactivity of green color sign “add title”. Here green colors are used to present the interactivity since all the green color signs available in the current page were used for presenting interactivity.

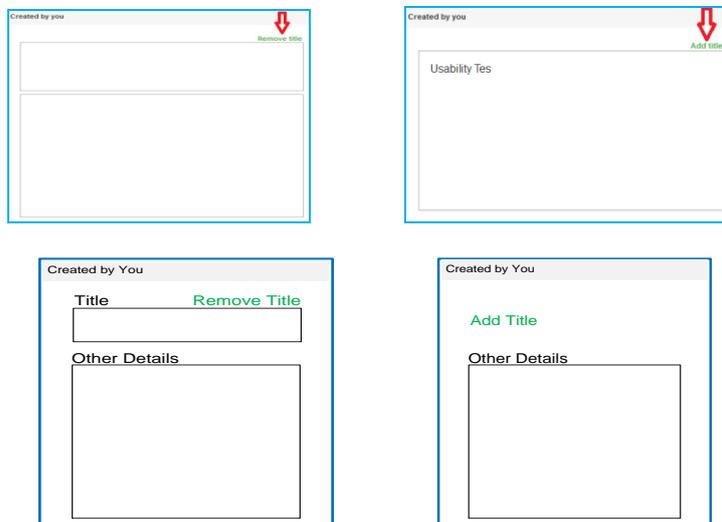


Fig. 6. Snapshots of Ovi calendar for example case II (upper two) and examples of possible re-designs (below two)

Example case III: At event entry page, the check box appended with “all day” sign always showed as selected by default. The input text box appended with a linguistic sign “at” and an iconic sign of time showed constantly enable to take input data (see figure 7). Since the system was selected the “all day” option by default, therefore this input box of time entry was not accepting any input data. Users were tried for comparatively long time by clicking on the test box and also the time icon. Their facial expression was despaired and interact variation was increased. These eventually led them to complete the task with worst performance. The users behaviors presented here showed two important considerations of sign representation from semiotics point of view: (i) dependency relation between these two signs were not clearly presented in event entry page; and (ii) absence of providing functional message for wrong interactions, users took comparatively more time to realize the problem he did.

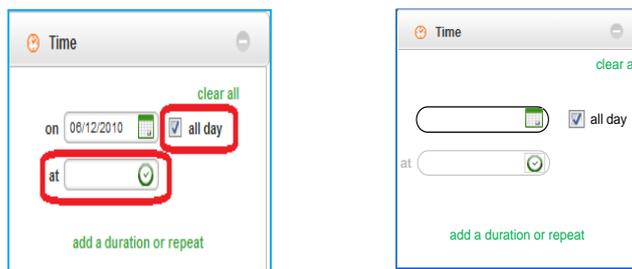


Fig. 7. Snapshot of Ovi calendar for example case III (left one) and examples of possible re-designs (right one)

Among a set of semiotic ways to solve this problem one solution could be to present the input time entry box, and its appended signs as disabled. An example look is presented in figure 7 (right one). This presentation could easily make user sense and led him to try to find out the reason of disabling this sign. These eventually increased the task completion performance. Again for a wrong interaction with the time input box and time icon while “all day” are selected, providing a proper message like “*please clear the ‘all day’ check box*” could be another useful solution to realize the problem he did.

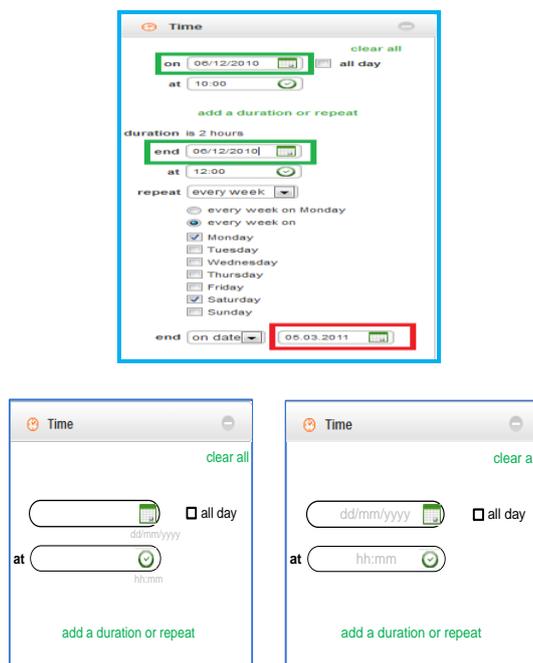


Fig. 8. Snapshot of Ovi calendar for example case IV (above one) & examples of possible re-designs (below two)

Example case IV: The date input text boxes of event entry page accept data (date) from keyboard and also by cursor interacting with the calendar icon appended with the test boxes. A participant thought that the text boxes accept input data (date) only from keyboard. He also thought that the appended calendar icon has no interactivity but it used only to give an indication that this text box is for date value. Therefore, he entered the date value in to the text boxes in two different formats. In figure 8, the square marked showed his date input, red color used to preset the incorrect date format and the green color used to present the right one. As a result of saving the incorrect input, it obviously made an input error and this input error generated a system error and failed to perform this task at the first attempt. Then, these failure and errors showed the way of asking help twice, spend confused & wrong navigation state for 32 second thus made navigation errors and these eventually directed him to increase the interact variation (51.85%). Then, these all affected to increase the task

completion time (8:26, whereas min time was 2:57) comparatively and finally these also affected his subjective rating (rate to 3). The users behaviors presented here showed important considerations of sign representation from semiotics point of view: (i) do not provide any hints about acceptable date format; and (ii) text boxes accept data in both ways (keyboard and icon) and for this, while user uses the calendar icon for entering the date then by default it entered as acceptable format but while user uses keyboard for entering the date then chose the date format arbitrarily (possibly the format he is more familiar with).

There could be a number of solutions of this problem by redesigning these signs semiotically. Among these, one solution could be to append an indicative sign to provide the idea of acceptable input date and time format for entering in to the text boxes (below two snapshots in figure 8). This presentation could be useful to make users' sense and led them to enter the accurate date and time while keyboard was used for entering these data. This obviously reduced the input error, system error as well as increases the overall task completion performance.

4.1 Findings

Two important results were turned out from the analysis and observations conducted on the study data. These findings were: (i) lack of semiotic considerations in interface design led users to inaccurate interpretations of interface signs and these eventually made a number of usability problems. Usability problems raised for the lack of semiotic considerations are presented in table 5. An example reading of table data for the row 7 - the lack of semiotic consideration number *g* (i.e., do not provide any hints of acceptable date format), 14.29 % users made all the usability problems (marked as "X"), written as the column heading. The observation for this (row 7) data is discussed in example case IV; and (ii) few semiotics guidelines for designing the web signs were introduce based on the observed lacks of semiotics considerations. Semiotics guidelines (considerations) are:

- (a) Keep away from using the identical signs for different purposes, otherwise each sign needs clear indication of its specific purpose.
- (b) Interface signs of a particular page should be consistently present, no matter what navigation path are used to reach at this page.
- (c) Every sign should have clear indication of its interactivity so that user may easily interpret whether this sign is used for interactive, or decorative, or indicative purpose.
- (d) Every input sign (i.e., text box) should have clear indication about the input text/data so that users may easily grasp the concept of input data/text.
- (e) Dependency relation (if present) among interface signs for performing a particular task should be clear enough so that user may easily grasp this.
- (f) Provide understandable message for wrong interaction with an interface sign so that users may realize its functionality effortlessly.
- (g) Provide the clear indication of input data format to reduce the input as well as system errors.
- (h) Strive to avoid confusing conjunctive word (e.g., or, and, etc.) to present an interactive sign.

- (i) An interface sign could be strongly related with other signs to express its intended meaning and for this, strive to adhere this relation so that users may easily grasp the purpose of this sign.

Table 5. Semiotic considerations, usability problems and % of participants face these problems

Lack of semiotic considerations no.	Usability Problems									% of users faces the problem
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
(a)	X		X	X	X	X	X	X	X	42.86
(b)	X		X			X		X		57.14
(c)			X	X		X		X		71.43
(d)	X		X			X		X		57.14
(e)			X	X	X	X	X	X		28.57
(f)			X	X	X	X		X		85.71
(g)	X	X	X	X	X	X	X	X	X	14.29
(h)			X		X	X	X	X		42.86
(i)			X	X	X	X	X	X	X	85.71
P1: Input error P2: System error P3: High interact variation P4: Spent comparatively longer time at C&WN P5: Facial expressions (despaired and angry)						P6: Comparatively high TCT P7: Asking help P8: poor subjective ratings P9: Task failure				

5 Conclusion and Future Work

This research provided two important concerns from semiotics perspective as research outcomes. These concerns were: (i) how users' interpretations of interface signs significantly allied to produce web usability problems, as well as (ii) introduced few semiotics guidelines for designing and evaluating the web interface signs. A small set of semiotics guidelines formalized from this study were not claimed as novel and complete to design and evaluate the interface signs. Because, most of the guidelines e.g., semiotic consideration number b, d, f, etc., are known by the designers from HCI literature (i.e., heuristic and cognitive walkthrough evaluation) and a few of them are quite new e.g., semiotic consideration number e, h, etc. In fact, this study supports both the familiar as well as unfamiliar guidelines with a semiotic rationale and thus contributes to the HCI community.

A number of experiments will be carried out in author's research project to produce a complete set of semiotics considerations for designing and evaluating users' intuitive interface signs. A prototype website will be developed based upon the guidelines suggested. This prototype should then be tested and evaluated, and obtained results will be used as a tool to aid in the further refinement of the guidelines. In addition, there were a few main limitations of the present study also. Firstly, the case study was conducted only on a web application; secondly, the number of participants were also rather small; and thirdly, this study did not focus on other

contents (e.g., navigation, graphics, etc.) of the web interface therefore there is no evidence of their perfectibility from the usability perspective. The author hopes to consider these issues in future tests.

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References

1. Lewis, C.: Using the Thinking-Aloud Method in Cognitive Interface Design. In *IBM Research Report RC 9265*, Yorktown Heights, NY (1982)
2. Peirce, C. S.: *Collected Writings (8 Vols.)*. In: Ed. Charles Hartshorne, Paul Weiss & Arthur Burks, Harvard University Press (1931-58)
3. Al-Wabil, A. and Al-Khalifa, H.: A Framework for Integrating Usability Evaluations Methods: The Mawhiba web portal case study. In *IEEE International Conference on the Current Trends in Information Technology (CTIT)*, pp: 1-6, Dubai, UAE (2009)
4. Whitefield, A. et al: A Framework for Human Factors Evaluation. In *Behavior and Information Technology*, vol. 10, pp. 65-79 (1991)
5. Diaper, D. and Stanton, N.: *The handbook of task analysis for human-computer interaction*. In Mahwah, NJ: Lawrence Erlbaum (2003)
6. Nielsen, J.: *Designing Web Usability: The Practice of Simplicity*, In New Riders (1999)
7. Nielsen J. and Mack, R.L.: *Usability Inspection Methods*. In Wiley, New York (1994)
8. Hertzum, M., and Jacobsen, N. E.: The Evaluator Effect: A Chilling Fact about Usability Evaluation Methods. In *International Journal of Human-Computer Interaction (15:1)*, pp 183-204, (2003)
9. Barnum, C. M., and Dragga, S.: *Usability Testing and Research*. In Longman Publishers, New York (2001)
10. Nielsen, J., 1993. *Usability Engineering*. In Academic Press, Inc., London, UK (1993).
11. Usability Net, 2010. <http://www.usabilitynet.org/home.htm>. (accessed on Nov 8, 2010).
12. Souze, D.: *The Semiotic Engineering of Human Computer Interaction*. In The MIT Press, ISBN: 0262042207 (2005)
13. Andersen, P.: Computer Semiotics. In *Scandinavian Journal of Information systems*, Vol. - 4, pp. 3 -30 (1992)
14. Frege, G.: *Begriffsschrift*, English translation. In J. van Heijenoort, ed., pp. 1-82, Harvard University Press, Cambridge, MA (1879)
15. Morris, C.: *Foundations of the Theory of Signs*. In *International Encyclopedia of Unified Science*, vol. 1, no. 2, University of Chicago Press, Chicago (1938)
16. Nielsen, J.: Guerrilla HCI: Using Discount Usability Engineering to Penetrate the Intimidation Barrier. In: Bias, R. G. and Mayhew, D. S. (eds.), *Cost-Justifying Usability*, Academic Press, Inc., pp 245-272 , Boston, MA (1994)
17. Islam, M.N.: *How Does User Interpretation of Web Interface Signs Affect Web Usability: An Empirical Case Study of a Web application*. Published in *Turku Centre for Computer Science (TUCS)*, TR No - 1000, ISBN: 978-952-12-2555-0, Turku, Finland (2011)
18. Robert, S., Robert, B., and Sandy, F.L.: *New Vocabularies in Film Semiotics: Structuralism, Post-Structuralism and Beyond*. Routledge, London (1992)
19. Neumuller, M.: *Hypertext Semiotics in the Commercialized Internet*. Ph.D. Thesis, Wirtschaftsuniversität Wien, Austria (2001)

Information Security Culture in Russian ICT Small and Medium Sized Enterprises

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Abstract. Information security culture is currently seen as a promising phenomenon to be developed and studied regarding information security in organizations. This paper presents research in progress concerning the study of information security culture in small and medium sized (SMEs) ICT enterprises in St. Petersburg area. Based on interview data, the results of an open coding phase of the Grounded Theory method are presented to show the further delineation for theoretical sampling. The initial categorization discloses the essential features of information security culture in Russian ICT SMEs. Finally, in the conclusions the issues for further research, i.e., theoretical sampling, are stated.

Keywords: information security culture, information security, small and medium sized enterprises, Russia, grounded theory

1 Introduction

Information security (IS) issues exist since people have realized the importance and power of information especially within the modern business. While computers and telecommunication networks became as major means to store, process and transfer information and data, IS requirements reached a higher level. Together with the development of information security measures also malware and other risk technologies are being improved, creating a need for new frameworks for organizational IS management and research.

During recent history, there has been various approaches to prevent IS risks to come true. Often the different approaches are categorized by three phases or so called “waves” of IS development [1]. The first phase is called the technical wave. This period, from 1960s to 1980s, is characterized by the fact that information security was ensured by technical means only. The second phase refers to a management wave which took place in 1980s and 1990s. Management wave emerged as a consequence to the limitations of the technical wave. At this phase, in addition to the technical means to ensure information security, management measures and IS policies are used to increase a common level of information security in an organization. Unfortunately, even a systematic use of management procedures and monitoring tools in order to ensure high IS level does not guarantee solving the IS problems comprehensively, because the root of such problems is often seen in the so-called “human factor”: users of IT at large are considered to be a major threat for IS in organizations [2, 3]. Finally, the third wave is called institutionalization. This phase involves both the development of the two prior IS elements as inherent elements of organizational information security culture (ISC), which stresses also the significance of end-user security behavior and awareness as well as usability of security-oriented software. Giving justification to the concept of “culture”, ISC also seen to include shared beliefs, values and tacit assumptions of people as elements of end-user security behavior in organizations [e.g., 16].

At present, ISC is seen as a promising framework to develop and study IS in organizations. Especially the problem of ISC is typical for small and medium sized enterprises (SMEs) because of their often limited resources to provide comprehensive IS services. This object of this research in progress is to study the level of ISC in SMEs as part of a project¹ aiming to benefit Finnish-Russian corporate IS and international business activities. Qualitative research methods are used for studying this particular problem. During the study face to face semi-structured interviews were conducted with representatives of North-West Russian SMEs and gathered data was analyzed using Grounded Theory (GT) method. In this paper the results from the first phase, open coding, are presented to show the further delineations for continuing theoretical sampling. This initial theoretical categorization is essential in that it is the basis for both the emerging

¹ additional information from the project’s responsible director Adjunct Professor Hannakaisa Isomäki, University of Jyväskylä.

theory and further data collection decisions. Therefore, it is important to present the results of the initial coding process.

The rest of the paper is structured as follows: first, the concept of ISC is depicted by referring to the current literature; second the method is presented followed by results and discussion. Finally, conclusions are presented.

2 Information Security Culture in SMEs

Despite the importance of ISC and its research, challenges continue to define the concept. It seems that at present ISC is a somewhat vaguely defined concept due to its relative novelty as a research theme. Many recent studies have drawn on prior solid definitions of concepts related to elements of ISC as theoretical foundations for destabilizing the ISC concept. According to a recent literature review [4], these theoretical foundations of ISC concept are diverse including notions of organizational culture, organizational behavior, education and organizational learning, conscious competence learning, and knowledge creation.

Schein's [7] theory of organizational culture as consisting of the levels of visible artefacts, espoused values and basic shared beliefs and assumptions which partially determine employees' behaviour is often used as a theoretical foundation in ISC studies [e.g., 5, 17, 18, 19, 20]. Also by combining the works of Schein with the research on competing values and organisational culture profile [8] and management [16], definitions of cultural dimensions were derived and applied to study ISC. Moreover, ISC studies refer to the notion of organizational behaviour in terms of change as a prerequisite for the emergence of ISC [6, 21]. The conceptualization of organisational behaviour has also been connected to the study of ISC by proposing a referential process maturity model for assessing Information Security Management System, in which maturity is seen as changes in ISC reflecting the views and attitudes of organisational actors [22]. Also Information Security Capability Maturity Model (CMM) has been referred to in ISC studies to evaluate to what extent IS is embedded in organizations' culture [25]. The CMM assumes that individuals' competence progresses from unconscious incompetence, through conscious incompetence and conscious competence, to the stage of unconscious competence. It is assumed, that at the final stage, critical IS practices both adhere to the vision of the top management and become an element of the corporate culture.

Further, ISC studies draw also on prior conceptualizations of education and organizational learning. For example, outcomes based education has been proposed as an expedient towards increased information security awareness, which is seen to establish ISC [17]. Also other education and learning models are presented for educational programmes increasing IS know-how in organisations, such as the NIST security training model and the Malhorta's organizational learning model [4]. In addition to education and learning models, theories for organizational knowledge creation are cited by ISC studies. For instance, beliefs, attitudes and skills inherent in tacit knowledge interacting with explicit knowledge according to Nonaka's [24] model of knowledge creation have been applied in ISC research to facilitate the creation and dissemination of IS-related knowledge throughout an organization [24].

Moreover, beyond theorizations originating from other disciplines, recently a variety of ISC definitions have been proposed, but the attempt to create a universal one has not yet succeeded². For instance, Martins & Eloff [5] define ISC as a set of IS characteristics valued by the company and also an employees' behavior towards information and its security [6]. An organizational viewpoint is emphasized in definitions such as ISC as a part of organizational culture [5, 17, 19], ISC as a management tool which reflects how management handles information security in the company [8], and ISC referring to socio-cultural measures that support technical security measures [9]. Often ISC definitions tend to be normative, indicating a desirable state of reality. A healthy or proper information security culture is then defined as a work environment where ethic of security permeates the organization and a carefully nurtured and proactive habit rather than improvised effort [10]. ISC then usually refers to an acceptable and/or encouraged personnel behavior towards information and its security [6].

In brief, most often in the current literature ISC has been seen from five different viewpoints: 1) a set of IS characteristics valued and measured in an organization (managerial view), 2) the assumption about what is an acceptable stance or attitude towards IS, 3) the assumption about encouraged normative information

² Noteworthy is that many ISC related issues are studied without reference to this particular concept. This may reflect the ongoing maturation of the field of IS studies in general: researchers make a difference between issues included in ISC but not operationalizing the whole concept of ISC.

security behavior, and 4) the way people behave towards information security in an organization. It has been also often defined as 5) the set of shared, taken-for-granted or learned assumptions and beliefs. [4].

In our work, we adhere to a comprehensive definition which involves various security-related aspects at different cultural levels. This is important because every person working for an organization is influenced by several ethical, national and organizational cultures, which influence the way the person interprets the meaning and importance of IS [11]. Therefore, we distinguish three major levels of ISC applicable to an arbitrary ICT-enabled organization:

- *national, societal and governmental*: ethical culture, societal attitude towards security, IS-related governmental initiatives; legislation, etc.;
- *organizational*: organizational culture, top management's attitude towards security, leadership, managerial security measures (e.g., security policies, budgeting, risk analysis, etc.), learning, awareness measures, etc.;
- *individual*: behavioral traits and beliefs, e.g., trust, responsibility, IS education, etc.

While influences on the first level are rather external or contextual to companies and, conversely, factors residing on the second and third levels are rather internal, all three levels should be seen, from our viewpoint, as integral basis for information security culture in a single organization. In the same vein, Dojkovski, Lichtenstein & Warren [12] provide a holistic framework depicting external and internal influences on SMEs' ISC related to Australian national context. Our research is aimed to study ISC in SMEs in the field of ICT in St. Petersburg area, NW Russia.

3 Methodology

3.1 Grounded Theory

In our research we use Grounded Theory (GT) to collect, process and analyze data for theorization [13]. The major objective of this research is to examine the state-of-the-art organizational ISC, its particular aspects and the actual level of development in SMEs. In addition, we see ISC as a cultural issue to an extent that necessitates an open starting point for theorization. Therefore, a qualitative analysis method seems to suit our research much better than a quantitative method. A qualitative method makes it possible to analyze performance of a company in general and behavior of every employee in particular [14]. GT method provides a researcher with a flexible set of tools to explore the subject phenomenon in depth.

While implementing a GT research process, the researcher is able to see potentially important issues as soon as the data collection and initial coding in analysis takes place. A central tenet in GT referred to as theoretical sampling which facilitates in understanding and guiding the integral data collection and analysis processes aiming to a theorized view of the phenomenon under study. This means that the initial theoretical framework emerging from the initial coding process - open coding - guides data collection and analysis. Thus, the initial theoretical categorization is essential in that it is the basis for both the emerging theory and further data collection decisions. Glaser and Strauss [13, p. 109-111] emphasize the role of theoretical sampling together with joint data collection also in that they facilitate the integration of a theory. Therefore, it is important to present the results of the initial coding process.

3.2 Data collection

Data collection plan was developed on the basis of a literature review [4] and four phone interviews made prior to the development of the final interview framework. The final framework consisted of main categories depicting ISC [4, 12, 8] and the included questions were developed on the basis of the results from the phone interviews. The interview framework (Appendix) totalled 20 ISC-related questions which were categorised around four main issues:

- *ethical, national and organizational culture*: questions in this category were mostly concerning national IS practices and habits, existing governmental and private sector programmes related to IS, impacts of IS on inter-company cooperation;

- *managerial issues*: questions in this category were aimed at exploring typical attitude of company's management towards IS, commonly applied IS measures and policies and risk management mechanisms, existence of a dedicated IS infrastructure and documentation;
- *learning*: question in this category were mainly concerning necessity of IS-oriented personnel education, methods of such education, and information sharing at different levels of an organization;
- *behavioural issues*: questions in this category were concerning such sensitive behavioural concepts as trust, IS-related breach of trust, individual liability, etc.

For gathering the rich data semi-structured protocol was used to allow asking additional questions during the interview on the basis of answers presented by an interviewed person. This approach to data collection also suits our purposes well as the company representatives interviewed are top managers and business owners whose free time is very limited. Data collection was carried out with respondents from North-West Russian ICT SMEs. Altogether 19 face-to-face interviews were then conducted in the period from November 2009 till May 2010. Both the construction of the questionnaire and transcription of data included double-checking of Finnish-English-Russian translations in order to maintain the intended meanings of utterances in different languages [15]. Participating companies are described in the table 1.

Table 1. Participant companies' description

Respondent/ Company characteristic	Value range/ Category (amount)	Average (if applicable)
Position in organization	Internationalization: top management (11), middle management (4), worker or lower management (4); Information security: top management (9), middle management (5), worker or lower management (5)	
Working experience	0-15 years	4.9 years
Year of foundation	1989-2009	
Number of personnel	5-220 persons	74 persons
Ownership	independent local SME (14), subsidiary of a foreign company (3), subsidiary of a large local company (2)	
Main scopes of activity (multiple choices possible)	packaged software (6), customized software (11), electronic products (design) (5), electronic products (production) (5), IT services (8), telecommunications (7), other (4)	
Sales distribution by customer groups	business-to-government (35%), business-to-business (57%), business-to-consumer (7%)	
Geographical distribution of sales	local (32%), regional (15%), federal (29%), near abroad (3%), far abroad (21%)	
Share of R&D in company's expenditure	0-95 %	37 %
Respondents TOTAL	19	

Interviewees can be described as managers. That is, people who are responsible for making critical decisions for the organization as a whole or for the main part of the organization, including information security. Business owners, as well as hired managers participate in the interviews. This choice was dictated by the fact that company' managers, owners and information security specialists are very much aware of the state of affairs in the company.

The information presented in the table 1 is given in order to provide transferability of research results whenever necessary. That is, the table contains information about a context where the research results are valid.

3.3 Analysis

Open coding process is the first stage in GT development. Open coding stands for a breakdown, analysis, comparison, conceptualization and categorization of data [14]. Further analysis is impossible without this fundamental analytic step [13, p.109]. The open coding process helps to identify concepts that relate to the research matter.

The goal of open coding stage is identifying, naming and categorization of concepts [13, p.109]. The open coding stage started by line-by-line reading through the preliminarily transcribed data and naming concepts related to the studied subject – the level of information security culture in SMEs. That is, the data were processed, step by step, via breaking them into pieces, identifying and naming every single case, event, or idea found in the piece of data related to the issues of ISC in SMEs by using the method of constant comparison [27, p.60]. The naming can be done by answering the questions "What is the data about? What the data describes?".

The result of such analysis is the list of identified and labeled concepts within the data. Labeled concepts which, apparently, belong to the same phenomenon, are grouped into appropriate categories. The phenomenon, representing the category, gets the name which depicts phenomenon on a more general than concepts grouped under this category.

The open coding process allows researchers to detect not only the category but also their properties and dimensions. This is an important step of the open coding stage since detected properties and measurements of categories will be used during the axial coding to link the categories and subcategories together. In the following section the results of the open coding analysis are briefly described.

4 Results

The purpose of the study is to develop a theoretization that describes the North-West Russian ICT companies' corporate information security culture. Below we describe features of ISC categorized according to the open coding analysis. Citations from the data obtained through the interviews will be presented in this section, too. Under the terms of the interviews, names of companies cannot be published.

4.1 IS awareness

A feature of ISC very apparent within the data concerned the interviewees' attitude of ISC, which often is seen as *IS awareness* [26]. Both for international cooperation and for local business too. Based on the data collected we can see that internal information security is much more essential for some companies than it is for some others. However, all the companies understand how important corporate information security is for a successful business.

"Undoubtedly, information security is important not only for our business, it is important for any business."

Another concept in the category is awareness of governmental initiatives. Our data analysis revealed that companies show little interest in public support on this matter. On the other hand, they do follow new legislative initiatives that concern information security on a regular basis.

"Well, I did not happen to hear about any. No, probably, there are no."

"Unfortunately not as much as we want. The state, they have not yet realized how important it is."

4.2 IS required in partnership

The category of *IS required in partnership* was created on the basis of two concepts: IS required by partners and IS required from partners. Most companies are required to provide a high degree of information security. This requirement can be both formal (a non-disclosure agreement) and informal (oral communication). Some partners not only demand IS, but also control how the companies meet the demand.

"They demand and check. I am speaking of real checks and audits."

The interviewed companies seem to have similar requirements to their partners. In some cases, the companies can assess information security in a prospect partner company and make further decisions based on their assessments.

“We do not put up any requirements. We look at that from the side and decide how we are prepared to communicate.”

It is noteworthy that the companies that cooperate with international organizations, domestic public sector companies or major private companies give a higher value to IS in business than the companies that do business with small and medium-sized companies in the first place. Clearly, this issue needs further exploration.

4.3 Allocating funds for IS

The category of *allocating funds for IS* was generated from two concepts: budgeting of IS and funds allocated for IS. When analyzing the data, we found out that not all the companies have a clear understanding of what tools there are to provide IS. It is believed that IS can be achieved with technical means only. It is for that reason that major corporate IS costs are software and hardware costs. When required, funds can be made available to buy software or hardware.

“Well, yes, to purchase equipment.”

Financing of IS costs is irregular. Company representatives also thought that IS expenses should be regarded as part of IT expenses or among miscellaneous.

“In small company security costs should be somewhere among miscellaneous.”

4.4 Existing IS policy

The category of *existing IS policy* was created from two concepts: security plan adopted and security plan implemented. The question about any IS plan available was somewhat difficult for the respondents to answer. It turned out that not everyone realizes what an IS plan is about. However information security rules do not exist or are at their inception stage in most of interviewed companies.

“Eh, we do have one. I could not reproduce it by heart, of course, but it contains some basic things.”

It is also common to believe that an IS plan is some kind of a non-disclosure agreement. When we asked them about availability of a IS plan, respondents mentioned that the company has IS rules documented, but basically understood by this term a non-disclosure agreement.

“We have a special addendum to every personal contract.”

Our findings also imply that availability of IS plan in a company is no guarantee an observance of IS rules. Reference to the rules occurs after a disclosure incident only.

“They apply only if something extraordinary happens, an event of information loss.”

4.5 Personnel training in IS

The category of *personnel training in IS* was created based on respondents' answers related to the training of personnel to work properly with important company information. The companies do realize that a threat to their corporate IS may come not only from the outside, but can be generated by a company's employee. However, they see this internal threat as something that can be done by the employee on purpose, not because of incompetence. Proceeding from that, the companies tend to search for professionals with proper personal qualities (honesty, good moral, etc).

If the employee is not going to have access to sensitive data, then simultaneously with signing the contract and the non-disclosure agreement, he/she is briefed, orally in most cases.

“It is done at the very beginning informally – in most cases.”

In case when job implies dealing with sensitive data, then, apart from signing the contract, the non-disclosure agreement and the briefing, he/she gets training, mostly in the process of work.

“I should say this gets communicated to those employees who deal with important information directly, to all managers, project managers and all developers, coders.”

“Not when hiring people. Discussions start in the process of work.”

4.6 IS violations

The category of *IS violation* – was based on how company employees pursue IS in their everyday activities. Lack of a clear information security policy results in no clear punishment for breaking IS rules. Any penalties allowed by the law can serve as punishment for breaching IS. In case of minor violations a disciplinary penalty may be used. In case of really bad incidents that may result in financial losses, a tougher response should apply such as a cash penalty or a dismissal.

“Well, we had some people dismissed before.”

Due to lack of a clear system of violations and penalties to them, a penalty is chosen on a case-by-case basis each time. Penalties do not always match the damage involved. No penalty can apply at all if the company finds out, for example, that an information leakage was not let on purpose. In such a case a communication of correct behavior may follow.

“I cannot answer this question generally. My question is what the reasoning was behind.”

An employee breaking the rules in order to achieve a financial advantage to the company may also avoid any punishment.

5 Discussion

The aim of this paper is to present categories arising from the open coding phase of a GT analysis of interview data for further theoretical sampling. In addition, the categories are informative in terms of state-of-the-art regarding ISC in North West Russian ICT SMEs. First, further theoretical sampling in this study concerns more data collection regarding the issues categorized within the data. Second, the categories suggest lack of attention to IS in Russian SMEs. Similar results were obtained by researchers from Australia [12]. They also found that Australian SMEs are not aware of the risks associated with information leakage and measures to prevent it. However, in contrast to Australian SME Russian SMEs managers understand the importance of IS for business, especially for business development in international direction.

The similar situation is with allocation funds for IS development in companies. Due to the lack of threat and security awareness by SMEs managers, companies do not allocate enough funds to IS needs. Owners and top managers of SMEs consider information security costs not as an investment to development of the company but as compelled costs which can always be reduced to minimum if necessary (for example, during the financial crisis). Commercial organizations cannot perform such functions since they lack confidence from SME owners, who see behind their actions only a wish to sell their security products and make money but not to assist in development of small businesses.

Summarizing all described above, we can say that it seems that the main reason of poor development of IS in SMEs is due to a lack of risk awareness associated with information loss and measures to prevent the information leakage. Lack of awareness results in lack of attention to IS of owners and as a consequence of ordinary employees.

Probably, to improve the situation in IS field in SMEs, state non-profit organizations must take initiatives to inform companies of possible risks associated with information loss. Perhaps by organizing workshops to assist companies in risk assessment associated with information leakage. Such workshops will help SME owners to understand that costs related to information security are not financial loss but an

investment in successful development of their enterprise. It is important to show by visual demonstration that information leakage will lead to big financial losses. This is only way to motivate business owners to develop company's IS.

Like often in scientific work, this study has limitations. It is important to take into account that the study took place in the context of Russia. Findings in other countries may differ due to possible cultural and national differences. In addition, the companies participated in the study represent one of the two largest cities of Russia - St. Petersburg – so-called cultural capital of Russia. It is also important to realize that our study is focused on ICT companies only. It is widely known that staff of such companies are very familiar with information and communication technologies, and they are already aware of some potential threats to companies IS and measures to prevent it.

6 Conclusions

Special relevance of a research on ISC in SMEs is explained by the fact that it is lack of attention to IS culture that appears to be number one challenge when trying to achieve a high level of corporate information security.

The purpose of our research was to study the level of corporate ISC in SMEs. Small and medium-sized companies engaged in information technologies business were the object of our research. Companies from ICT area that operate in the North-Western Russia took part in the research. In our study we used GT methodology in order to collect, process and analyze the data.

Although our research work is still in progress, certain peculiarities of ISC within Russian SME sector can be distinguished already now. The process of ISC development in Russia can be characterized as rather slow first of all due to low IS awareness of corporate managers. It seems like the situation is further escalated by the fact that companies' management typically perceives IS-related investments as just one more expense item rather than as a strategic investment in development of own business. We suppose that in general, the problems and trends of ISC development are very similar amongst different regions of Europe and the whole developed world, which leads to a conclusion that methods cultivating corporate ISC, both existing and being currently under development, can be applied in virtually any context where the aforementioned problems appear, including e.g. Russian SMEs.

Based on the data collected the results of the first analytic stage of GT method are obtained. Categories developed on the open coding stage are presented to demonstrate the further delineation for theoretical sampling. Based on the open coding phase further theoretical sampling will concentrate on clarifying the issues of IS awareness, IS required in partnership, allocating funds for IS, existing IS policy, personnel training in IS, and IS violations.

References

1. von Solms, B. : Information Security – The Third Wave? *Computers & Security*, 19, 615-620 (2000)
2. Leach, J.: Improving User Security behaviour. *Computers & Security* 22(8), 685–692 (2003)
3. Furnell, S.: End-user Security Culture: A Lesson that Will Never be Learnt? *Computer Fraud & Security* 4, 6–8 (2008)
4. Mazhelis, O., Isomäki, H.: Information Security Culture: A survey. Proceedings of the Eighth International Network Conference. Heidelberg, Germany, July 6-8, 153-158 (2010)
5. Martins, A., Eloff, J.H.P.: Assessing Information Security Culture. ISSA 2002, Muldersdrift, South Africa, July, 10-12 (2002a)
6. Martins, A., Eloff, J.H.P.: Information Security Culture, in Proceedings of the IFIP Tc11 17th International Conference on Information Security: Visions and Perspectives, May (2002b)
7. Schein, E.: *Organisational Culture and Leadership*, second edition. San Francisco: Jossey-Bass (1992)
8. Ruighaver, A.B., Maynard, S.B., Chang, S.: Organisational Security Culture: Extending the End-user Perspective. *Computers & Security*, 26, 56-62 (2007)
9. Schlienger, T., Teufel, S.: Analyzing Information Security Culture: Increased Trust by an Appropriate Information Security Culture, in Proceedings of the 14th International Workshop on Database and Expert Systems Applications. September, DEXA, IEEE Computer Society, Washington, DC, 405 (2003)

10. Khripunov, I.: Testimony of Dr. Igor Khripunov, Testimony to the House Committee on Homeland Security Subcommittee on Prevention of Nuclear and Biological Attack: "New Opportunities for Reducing Nuclear and Biological Threats at the Source" (2006)
11. Helokunnas, T., Kuusisto, R.: Information Security Culture in a Value Net. Proc. of the. 2003 IEEE International Engineering Management Conference, USA, 190-194 (2003)
12. Dojkovski, S., Lichtenstein, S., Warren, M.: Fostering information security culture in small and medium size enterprises: An interpretive study in Australia. In Proc. of the 15th European Conference on Information Systems, 1560-1571 (2007)
13. Glaser, B.G., Strauss, A.L.: The discovery of grounded theory: Strategies for qualitative research. (1967)
14. Strauss, A., Corbin, J.: Basics of Qualitative Research: Grounded Theory Procedures and Techniques. SAGE Publications, Inc., Newbury park, London, New Delhi (1990)
15. Karahanna, E., Evaristo, R., Srite, M.: Methodological Issues in MIS Cross-Cultural Research. In Whitman, M., Woszczynski, A. (Eds.) The Handbook of Information Systems Research. Idea Group Publishing: Hershey, PA (2004)
16. Van Niekerk, J.F., Von Solms, R.: Information security culture: A management perspective. Computers & Security 29, 476-486 (2010)
17. Van Niekerk, J.F., Von Solms, R.: Organizational learning models for information security. In Proceedings of Information Security South Africa (ISSA), Johannesburg, South Africa (2004)
18. Schlienger, T., Teufel, S.: Analyzing Information Security Culture: Increased Trust by an Appropriate Information Security Culture. In Proc. of the 14th Int. Workshop on Database and Expert Systems Applications (DEXA). IEEE Computer Society (2003)
19. Van Niekerk, J.F., Von Solms, R.: Understanding Information Security Culture: A Conceptual Framework, In Proc. of the ISSA 2006 from Insight to Foresight Conference, 5-7 July 2006, Balalaika Hotel, Sandton, South Africa. ISSA, Pretoria, South Africa (2006)
20. Johnsen, S. O.: Measurement and improvement of information security culture. Measurement and control, 39 (2), 52-56 (2006)
21. Vroom, C., Von Solms, R.: Towards information security behavioural compliance, Computers & Security 23, 191-198 (2004)
22. Woodhouse, S.: An ISMS (Im)-Maturity Capability Model. In Proceedings of IEEE 8th International Conference on Computer and Information Technology Workshops, 242-247 (2008)
23. Nonaka, I.: A dynamic theory of organizational knowledge creation. Organization Science 5 (1), 14-37 (1994)
24. Thomson, K.-L., Von Solms, R., Louw, L.: Cultivating an organizational information security culture. Computer Fraud & Security, October (2006)
25. Thomson, K.-L., Von Solms, R.: Towards an Information Security Competence Maturity Model. Computer Fraud & Security, May, 11-15 (2006)
26. Siponen M.T.: A conceptual foundation for organizational information security awareness. Information Management & Computer Security 8/1, 31-41 (2000)
27. Charmaz K.: Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis. SAGE Publications, London, Thousand Oaks, New Delhi (2006)

Appendix: Interview framework

<u>1. Ethical, national and organizational culture</u>	
- Do you consider information security of utmost importance for companies in your field of business?	<i>Считаете ли Вы информационную безопасность исключительно важной для компаний в Вашей сфере бизнеса?</i>
- Are there any governmental initiatives to support information security in companies such as yours?	<i>Есть ли государственные инициативы, направленные на поддержку/ улучшение информационной безопасности в таких компаниях, как Ваша?</i>
- Are good information security practices in your company regarded important by your business partners?	<i>Считают ли Ваши партнеры по бизнесу важными хорошие навыки в области информационной безопасности в Вашей компании?</i>
- Do you demand good information security practices from your partners?	<i>Насколько важно для Вашей компании то, на каком уровне находится информационная безопасность в компаниях-партнерах?</i>
<u>2. Managerial issues</u>	
- How common it is to have a written information security plan in companies such as yours?	<i>Насколько распространено в компаниях в Вашей сфере бизнеса иметь (в письменном виде) правила информационной безопасности?</i>
- If written plans are available, are the procedures implemented in line with the information security plan?	<i>Если наличие правил информационной безопасности является распространенным, соответствуют ли процедуры информационной безопасности установленным правилам?</i>
- Is information security seen as important by the management?	<i>Воспринимается ли информационная безопасность как важная (для бизнеса) руководством компаний?</i>
- Is it common for the management to communicate information security information to all job levels, e.g. when hiring a new person?	<i>Является ли распространенной практикой для руководства компании доводить сведения об информационной безопасности до сотрудников на всех должностных уровнях (например, в процессе приема на работу)?</i>
- Are money put by the management for information security costs?	<i>Выделяются ли руководством средства на расходы, связанные с информационной безопасностью?</i>
<u>3. Learning</u>	
- Is it common to train the personnel to use the information security functions in their daily operations?	<i>Насколько распространено обучение сотрудников использованию функций информационной безопасности в их каждодневной деятельности?</i>

- What do you think about sharing information and learn with your colleagues?	<i>Как Вы относитесь к обмену информацией (и к учебе) с Вашими коллегами?</i>
- Do you think that e-learning is a safe way to share information?	<i>Считаете ли Вы e-learning (обучение с помощью электронных/ компьютерных средств) безопасным способом обмена информацией?</i>
- Do you think that it is important that the company develops good information security practices throughout the whole company?	<i>Важно ли, с Вашей точки зрения, чтобы развитие навыков хорошей информационной безопасности происходило на уровне всей компании?</i>
<u>4. Behavioral issues</u>	
- Is it worth following good information security practices while working, even if they inhibit achieving business goals?	<i>Стоит ли следовать правилам информационной безопасности во время работы, даже если они мешают выполнению поставленных задач?</i>
- Is it important to budget money for security costs annually?	<i>Важно ли закладывать в годовой бюджет средства на расходы, связанные с информационной безопасностью?</i>
- To what extent do you consider the relations among staff member trustworthy to a company such as yours?	<i>Насколько доверительными Вы считаете между сотрудниками отношения в таких компаниях, как Ваша?</i>
- Do you think people should be considered accountable for their actions if they do not adhere to information security plan / good information security practices?	<i>Согласны ли Вы с тем, что на сотрудников должна возлагаться ответственность за их действия в случае, если они не следуют правилам информационной безопасности?</i>
<u>5. Open questions:</u>	
What else do you think is important concerning information security in your field of business? Your company?	<i>Что еще, по Вашему мнению, является важным в отношении информационной безопасности в Вашей сфере бизнеса? В Вашей компании?</i>
Do you think that information security is important in international business? Does information security support business?	<i>Считаете ли Вы, что информационная безопасность важна в международном бизнесе? Насколько внимание к вопросам информационной безопасности содействует ведению бизнеса?</i>
- Do you think it is justified to demand good information security practices from all employees?	<i>Считаете ли Вы оправданным требовать от всех сотрудников следования правилам хорошей информационной безопасности?</i>

Commons Based Peer Production of Mobile Phone Software: An Exploratory Framework for Analyzing Success Factors

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Abstract

The past decade has evidenced the rapid growth in the usage of mobile phones around the world. The mobile phone will be first Internet access device for a large part of the world's population. The increase in mobile phone usage has led to the development of various mobile phone software applications and a subset of these is developed through a Common Based Peer Production (CBPP) model [1]. One such mobile phone software that is growing rapidly is Google's Android operating system. The purpose of this paper is to propose a framework for analyzing the success of CBPP based mobile phone software projects and demonstrate the use of the framework by analyzing the Android operating system.

Keywords: open source success models, CBPP, mobile open source software, ecosystems, digital convergence, copy left licensing, Google Android, open source communities.

1. Introduction

Commons based peer production has been widely used in the development of software over the past few decades. Open source mobile software a manifestation of CBPP in the mobile software industry is a comparatively new phenomenon that is growing in significance. There has been a plethora of research that measures the success and failure of open source software projects but most of this research is centered on software that run on traditional computing devices such as Personal Computers and hence there has been limited research so far that is focused on measuring the success of open source software for mobile phones.

Due to factors such as Moore's law [10] and economies of scale; processors in mobile phones have become as fast as the ones in PC's and are contributing to intelligent mobile devices that are also getting cheaper by the day. Uther describes that in a mobile context limiting user data input, display of limited but relevant information that fits the screen size and use of context as key differences between mobile applications and applications for traditional computing devices such as the PC [2]. The key difference between the devices is in the nature of use, because mobiles are smaller in form factor, they are primarily used as a communication and information access device than as a frequent data input and processing device. The design of smart phone applications today is also influenced by factors such as digital convergence: that is the ability of applications to be accessed across devices such as netbooks, laptops, tablets, PC's and other digital devices.

In traditional computing devices, there is a loose coupling between the software and hardware, that is the end user could install any operating system and applications for the device while in a mobile context there is a tight coupling of the hardware and the software and the hence proliferation of the applications dictate the success of the device and vice versa. There has been abundant research in the field of open source software measurements and success factors but most of the existing research is limited to either exogenous or endogenous factors.

The significant differences between the mobile and the PC and the gaps in the existing research warrant a specialized study of the success factors of mobile CBPP based software products.

Section 2 of this paper will look into the existing research in the field of open source software success models and discuss the key points and their limitations. Section 3 will discuss the theoretical framework; this research will build upon the DeLone and McLean's model for Information systems success [3] and adapt it to fit the mobile open source software context.

Section 4 will describe the research method and the data sources used in this study; this section will also delve into the details of the Google Android operating system for mobile devices and the reasons for choosing the software for this case study. Section 5 will apply the framework to the case study and discuss the relevance of the framework by analyzing the case in detail. Section 6 will provide future directions for this research and discuss the conclusions.

From the collected data and building upon existing theories, this research aspires to create a comprehensive model to explain mobile open source software success and test the model by applying it to the Google Android case study. This research is a part of a longitudinal study of mobile open source software and is exploratory in nature. The results of this research will contribute to the existing literature on frameworks used in analyzing open source software success and to the emerging literature on the structure and evolution of the Google Android operating system for mobile devices.

2. Related Literature

Over the past decade there has been abundant research on Commons based peer production [1] of software; in specific research that describe ways to analyze the success or failure of open source projects. Rank et al argue [4] that the relative success of a FLOSS project can depend on factors such as the chosen forge and distribution. Lehman et al describe that the success of an open source project will depend on the software system undergoing continuous change, that is it must evolve [5]. Some of the well known open source projects such as Linux, Apache, MySQL and PHP have achieved high evolvability due to the active contribution of a large developer community and its need for change. Subramaniam et al describe that the nature of open source licensing has an impact on the success or failure of an open source project [6].

In their research findings Subramaniam et al describe that the restrictive OSS licenses have a negative impact on a project's outcome as the restrictive-ness of the license inversely impacts the developer interest; Subramaniam et al also demonstrate that the licensing influences participation in the project and the project activity levels have a strong impact on the outcomes of the project's success measurement. Colazo et al reaffirm the findings of Subramaniam et al in their research paper. Colazo et al suggest that the choice of licensing impacts development activity and in turn the overall success of the project [14]. Colazo et al describe that copy-left licenses when compared with non copy-left licenses are associated with higher developer membership, greater coding activity, faster development speed and longer developer involvement in the project, which are key to the success of open source projects.

Crowston et al [7] describe a set of direct and indirect factors that contribute to the success of open source projects. Indirect factors such as developer reputation and community interest have been key drivers of open source projects. The interest of the community and end users are measured by the amount of visitors to the project website and the number of downloads of the end product or code. Other indirect factors such as Individual job opportunities and salary that the project will bring directly or indirectly to the involved community members, individual reputation and knowledge creation have been found to influence the success of open source projects.

In their findings Crowston et al also attribute factors such as pace of maturity from alpha to beta to stable, the project achieving identified goals, level of developer satisfaction, process maturity in the development environment, number of developers involved in the project, level of activity (which is measured by the developer and user contributions), number of releases, time between releases, time to close bugs or implement new features to the success or failure of open source projects.

Shoba et al analyze various source forge projects from a population ecology perspective and propose endogenous factors such as reliability, size of the project, age and niche focus of the project as contributors to the success of these projects [8].

Schweik et al describe a framework for analyzing the success of open source projects in various stages of its evolution [9]. Success in the Initiation stage is determined by the developers producing a first release of the software or at least one release of the software in the first year of registration of the project in a forge such as sourceforge.net. Success in the growth stage is determined by the project achieving three meaningful releases after the first release and the product performs a useful computing task for at least a few users (the usefulness of the product is measured by the number of downloads of the product by the end users). A project is classified as indeterminate in the initiation Stage when it has not had an initial public release but demonstrates credible development activity. A project is considered indeterminate in the growth stage if it has not produced three releases but demonstrated considerable development activity.

Most of the existing research in the field of open source software success models use either exogenous or endogenous factors to describe the fate of the projects and do not provide a comprehensive framework that combine both endogenous and exogenous factors to explain the success or failure of these projects. The existing research is also limited to open source projects that run on computers and not on mobile phones.

3. Theoretical Framework

The DeLone & McLean's model for Information systems success (1992) combines both external and internal factors to provide a theoretical framework for analysis of the success of information systems [3]. The DeLone and McLean's model evaluates an information system based on six key factors. These factors directly or indirectly influence each other, the six factors are 1) system quality, 2) information quality, 3) use, 4) user satisfaction, 5) individual impact and 6) organizational impact.

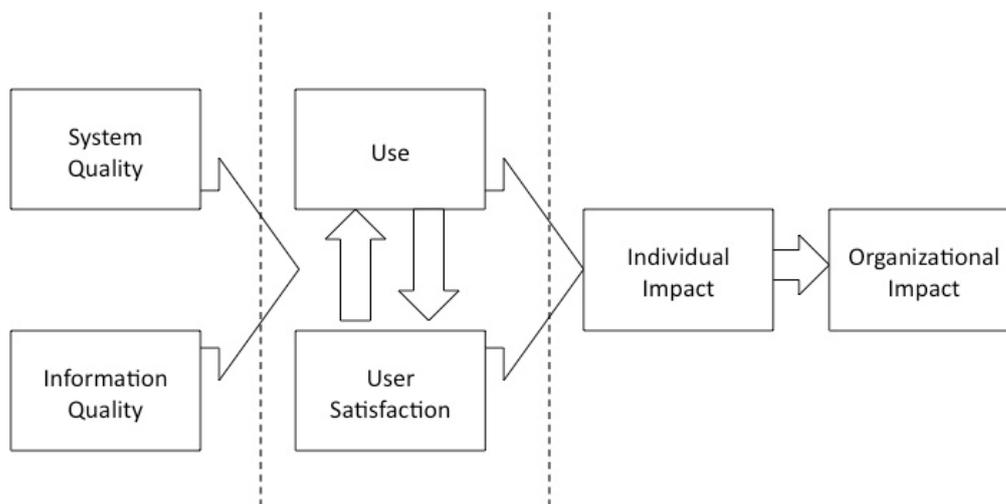


Figure 1: Information Systems Success Model (DeLone & McLean 1992) [3]

The arrows in the model describe the interdependence of the various factors. The model suggests that the success of an information system will depend on the overall impact it has on the organization.

The impact that a system has on an organization is influenced by factors such as the quality of the information and the quality of the system, which in turn drive the use of the system and end user's satisfaction in the organization. Satisfied users make use of the system across the organization making the information system successful.

Considered a comprehensive model to explain IS success of the 90's, the DeLone and McLean model falls short on various fronts to explain the success of present day Open source software. Open source software is primarily community driven and hence the community activity, response time, friendliness of the community, cycle time for bug fixes and number of active community volunteers contribute to the success of open source projects. The concept of community, which is the quintessence of open source software projects, is ignored in the updated DeLone & McLean model [13].

The concept of information quality in the DeLone & McLean model is irrelevant for measuring the success of open source mobile software projects as the quality of the information depends on the quality of the input data and the ability of the software to process the data (software quality).

The model postulated by Gupta et al for open source software success overcomes various short falls in the DeLone and McLean model [12] but ignores some of the key factors that are at the heart of the open source success story. An empirical analysis of the relationship between choice of license, nature of the application and proliferation on sourceforge projects demonstrates that projects with unrestricted licenses attract more contributors [15]. Hence the choice of licensing is a key factor in determining the success of open source projects, which is ignored in both DeLone & McLean model and Gupta et al's model. Both the models of DeLone & McLean and Gupta view the software as a stand-alone application, the concept of ecosystem, which is gaining predominance [22], is ignored in both the models.

The significant differences in the nature of use between the mobile phone and traditional computing devices and the emergence of new factors such as ecosystems, convergence, community and licensing warrant the postulation of a comprehensive model to explain the success of open source mobile software.

3.1 The MOSS Model

The Mobile Open-source Software Success model (MOSS) in figure 2 captures both exogenous and endogenous factors that influence the success of mobile open source software projects. This model uses some of the elements of the of DeLone & McLean model such as software quality, use, net benefits and adds some salient factors that are relevant to mobile open source software success. The MOSS model gives special consideration to the differences between the usage of mobiles and PC's by including factors such as convergence of mobile applications and the evolution of long tail mobile application ecosystems that are driven by the heterogeneous needs of end users [16].

Bosch identifies some of the key benefits of the *ecosystem* approach [23] as improvement in the value of the core offering to existing users, greater attractiveness for new users, improved "stickiness" factor of the end user to the application platform (stickiness refers to the users desire to stick on to the platform and not change it), accelerated innovation through open innovation with the help of ecosystem partners and reduced cost by sharing the R&D cost with other ecosystem partners. Hence the concept of ecosystems is used in the MOSS model

Companies such as Google and Yahoo offer an entire stack of online cloud based software services that replicate most of the functionality of traditional stand-alone PC software. Digital convergence the ability to access applications and information across devices is enabled through cloud computing platforms and is a key driver of the mobile information systems revolution. Hence *convergence* is key part of the MOSS model.

Mobile Open-source Software Success Model (MOSS)

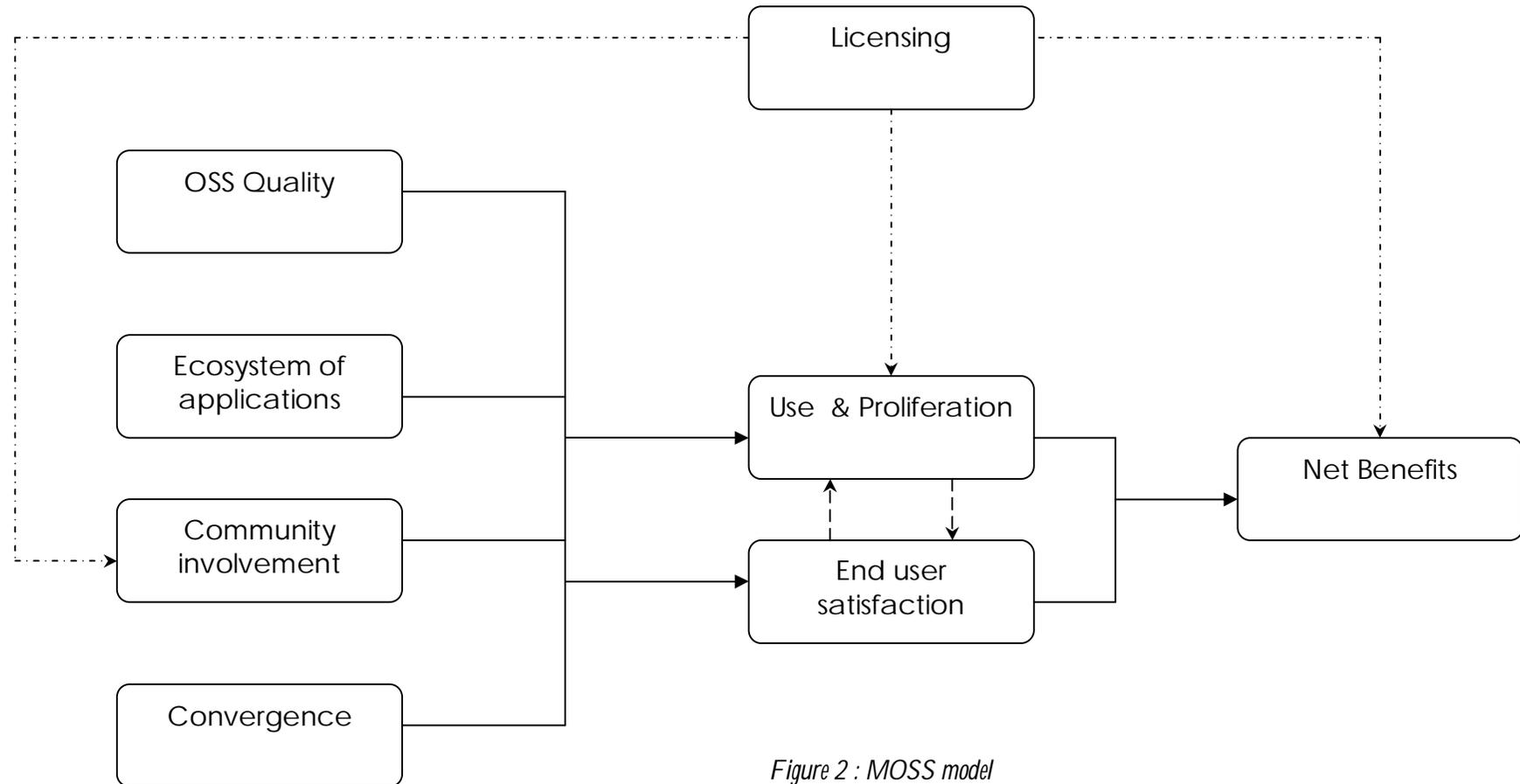


Figure 2 : MOSS model

DeLone & McLean base the *use* of the applications as a factor of analysis, use in a proprietary software context is measured by the number of downloads of an application or licenses sold to end customers. The PC environment allows for the loose coupling of the hardware and software, so the selection of a specific software among many choices in the category demonstrates success of the product, but in the case of mobiles a tight coupling between the hardware and software exists and hence use will not only entail the download and use of a mobile software but also account for the proliferation of the software through the bundling by the hardware vendors along with the devices and other derivative works of the product.

Use and proliferation depends not only on the availability of key applications such as productivity tools but also on the availability of a plethora of miscellaneous applications such as maps, mobile games and others that meets the long tail demands of the consumer. The use and proliferation of open source mobile software is directly linked to factors such as high quality of the software or a constant improvement in the quality of the software over a period of time.

As demonstrated by Crowston et al, Use and proliferation are also linked to high community activity. In the mobile software domain the role of the community goes beyond fixing bugs and answering end user queries. The community's role in the creation of derivatives via forking and contributions to the extension of the ecosystem play a vital role in the success of mobile open source software projects. Hence *community involvement* is used as a factor in the MOSS model.

Licensing plays a key role both in use and proliferation, as mobile software such as mobile operating systems and browsers are often tightly coupled with the hardware, a flexible copy left licensing helps the hardware vendors gain control of the product and plays a key role in the vendor's decision-making process. Hence Licensing is used as a factor for analysis in the MOSS model.

End user satisfaction in mobile open source software is influenced by the quality of the mobile software, the availability of a wide range of applications in the application ecosystem; a strong community of developers, end users and application developers and the ability to access and share information such as email, news, calendar and other key applications across devices. Use and proliferation is directly related to user satisfaction, an example of this is the growth of Linux on laptops, end user demand drove companies to bundle desktop Linux distributions over the past few years and this has led to the growth of desktop Linux distributions such as Ubuntu. Hence *end user satisfaction* forms a key part of the MOSS model.

For a developer in the community the open source application could help improve their coding skills and enhance a developers over all knowledge of the application, from an end user perspective the application can improve the productivity or enhance the quality of a task performed by the end user, from a hardware vendors stand point a killer application can help differentiate the mobile device from the competition and reduce cost of the mobile phone as the software is free and open source. Hence the MOSS model uses the concept *net benefits* to coalesce all the actors that benefit directly or indirectly from the application.

Thus the MOSS model takes into account mobile specific characteristics and encapsulates both exogenous and endogenous factors that influence open source software success to provide a holistic understanding of the success of open source mobile software. In the following sections a case analysis of the Google Android mobile operating system is considered to demonstrate the application of the MOSS model.

4. Research Method

This research is based on a detailed case study of the Google Android operating system. The qualitative case study method with an interpretive stance is used in this research. According to Yin (2003) the methodology employed in this research is an empirical inquiry that examines a contemporary phenomenon within a real life context [25]. The interpretive method was pursued in this research as it facilitates the understanding of a phenomenon under study through the semantics that people assign to the phenomenon within a specific situated context [26].

As described by Walsham (1995) various generalizations can be created from case studies [26]. The contributions from this case study are the generation of a theoretical model to explain mobile open source software success, rich descriptions of the Google Android case and drawing of some key implications from the case study.

4.1 Data Collection & Analysis Methods

For the construction of the MOSS model and applying it to analyze the Android case; the case study method of Yin (2003) and Romano et al's (2003) methodology for analyzing web based qualitative data were used [27]. Romano et al describe a three-step approach to data collection and analysis of Internet-based qualitative data namely: elicitation, reduction and visualization.

The data since the initial release of the Android software to the present day was systemically gathered. As described by Yin (2003) data for the case study method can come from six sources namely documents, archival records, interviews, direct observations, participant observations and physical artifacts. Multiple data sources help in analyzing a situation from a holistic perspective and contributes to improving data quality [20] [21].

Rich data from heterogeneous sources were used in this research. Various interviews by the people associated with the Android project were analyzed; this includes a 72-minute discussion on Android by Google CEO Eric Schmidt at the GSMA mobile world congress 2010. Official press releases from Google related to Android from 2007 till date that were relevant to this research were analyzed, relevant messages from the official Android developer mailing list were analyzed, online articles relevant to this research from major news sites and magazines such as PCWorld, CNET, The New York Times, CNN, BBC, Information Week were collected. Existing research on open source success factors and android were collected and a gap analysis was performed.

In the first step of elicitation, the data was captured using the Evernote data management tool and unstructured data in the form of whole web pages, emails and documents were identified and stored in the tool. This data was then sorted depending on the nature of the articles and were assigned meaningful metadata with the help of tags for easy search and retrieval.

A manual analysis was then performed on the sorted data, which was then reduced with help of the parameters from the theoretical framework. Various knowledge patterns and their associations were identified, which were then used in the deduction of various useful conclusions and the further analysis of the Android case.

4.2 Case Description

Google launched the first phone running the Android operating system in October 2008 and today the Android OS is among the fastest growing mobile operating systems in the planet. Google along with the members of the Open Handset Alliance are jointly responsible for the evolution of the Android operating system. Large developer communities that write useful applications make Android based devices competitive in the marketplace.

There are over 200,000 applications that are available for the Android as of today, which are available through the Android Market an application store for Android applications. The Android is a software stack for mobile devices, the core of the Android OS is based on a stripped down version of the Linux kernel. On top of the kernel are three key layers namely the library layer that contains essential libraries for multimedia, security and other key functionalities, the Android runtime, which contains the dalvik virtual machine that translate java applications (Applications written for the Android are in Java) and the Android application framework layer, which is used to implement a standard structure for applications that runs on the Android OS.

The Android architecture is considered a developer friendly architecture due to the ease at which third party applications are developed on the platform. The top most layer is the application layer, which contains the software components and extensions for the Android OS. These components are fully reusable due to the flexible application architecture that Android provides for its developers. The Android comes with an emulator, which can be used to test applications. The emulator contains various core applications such as a browser, phonebook and a map application.

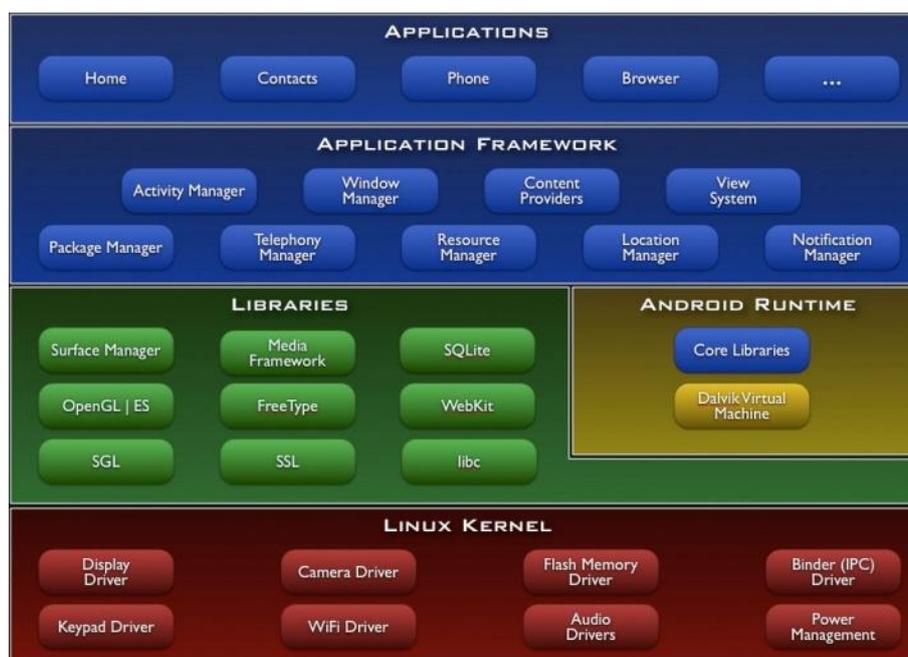


Figure 3: The Android Architecture [33]

Android is open source and fast growing in market share; in the last quarter of 2010 the Android operating system became the planets best-selling smart phone operating system and over took Nokia's Symbian from the leading position, which it held for ten years. Due to economies of scale [11], Android based devices have become cheaper and affordable, leading to its growth and proliferation in both developed and developing markets.

Android has been ported to a number of devices, it offers digital convergence by supporting access to applications and information across devices, provides a rich ecosystem of applications, it is supported by a large community of companies and volunteers that are active in the development and evolution of the operating system making Android suitable for this case study.

5. Case Analysis & Discussion

The MOSS model was used as a theoretical lens for analyzing the rich extensive data on Android. The Android project was analyzed based on various factors such as quality, ecosystem, community, convergence, licensing, use & proliferation, end user satisfaction and net benefits. The interplay between the factors also formed a key part of the analysis. There has been various performance benchmarks conducted by end users and organizations, these tests describe a constant improvement in the *quality* of the operating system over many releases [17]. Android's quality and performance has been constantly improving, which has led to its use and proliferation.

Android has the fastest growing *ecosystems* among its competitors [28]. Android OS offers a flexible architecture and developer friendly tools such as the app builder, which has led to the development of over 200,000 applications in the Android Market (a place to host and download android applications). Google promotes the development of killer apps through the Android developer challenge an event held every year, where the most innovative applications developed on the Android OS are rewarded. A rich ecosystem drives the use and proliferation of mobile software. The growth of the Android ecosystem has led to greater adoption and proliferation of the Android OS.

Unlike conventional open source communities that are non-hierarchical, the Android *community* is a double-layered hierarchy. On the top layer the Open Handset Alliance, a community of mobile phone manufacturers, mobile operators, software companies and semiconductor companies works on standardizing the software and on the second layer the Android developer community for end users develop applications, report bugs and submit feature requests [18]. The level of power and control in the hierarchy is minimal but important for managing the quality of the end product. Google controls key decisions when it comes to the release of the core of the Android platform. A technical team that is headed by Google controls the setting up of new projects and decides if the new project will become a part of the core platform.

The limits of control and the design of the community structure has attracted companies and end users to actively contribute to the project, this has led to eight major releases in under three years of its first release. Members of the Open Handset Alliance contribute to new projects by sharing code with Google and the alliance members. A volunteer can participate by reporting bugs, writing apps for the Android and contribute to the source code of the core OS via the Android Open-Source Project website, all volunteer contributions are submitted through a web-based system called Gerrit, which helps manage source code contributions.

The Android developer community has a few thousand users, an active mailing list, a bug tracker with short turn around times on bug fixes and has had eight official stable releases and various beta releases in just over two years of its launch. This makes it one of the most active open source communities today. Active communities help in creating better quality applications and contribute to the success of the project.

Google's core strategy has been to create digital services around the cloud; this is reflected in the design of the Android OS. Cloud services enable digital *convergence*, some of the key productivity and communication applications such as email, calendaring, maps, Google talk and others have been made accessible across devices such as mobile phones, PC's, tablets and even on televisions that run Android [29]. Android's ability to allow for applications and information to be created and synchronized across devices has led to greater end user satisfaction and proliferation of Android based devices.

The rapid growth of Android has been attributed to its flexible *licensing* scheme [19]. The core of the Android is the Linux kernel, which is licensed under General Public License version 2, but most of the user-space software is licensed under Apache Software License (ASL) version 2. The ASL is designed to promote commercial development and proprietary redistribution of the source in the same time ASL allows for the integration of the source code into proprietary products and allows for the redistribution of the same.

Companies that choose to make proprietary commercial products around Android can do so because of the flexible licensing scheme. Companies can use these proprietary killer apps or enhancements as a competitive advantage against other players using Android or other operating systems in the market. ASL applies only to the Android architecture; third party applications that run on top of the Android architecture can be distributed under their own licenses. Android's flexible apache licensing scheme has attracted developers to the community and has led to its use in hundreds of different types of devices ranging from cell phones to television sets.

The Android operating system, supported by a vibrant community, large ecosystem, flexible licensing scheme has found its way in over a hundred devices, which include Smartphone's, tablet computers, E-reader devices, televisions and mp3 players.

The list of these devices is increasing with the number of companies joining the open handset alliance and with an increase in unofficial ports across various devices. *Use* can be measured through the sales and adoption by end users; research on Android suggests that it is the fastest growing mobile OS and it recently overtook Symbian the market leader in quarterly sales [30].

Use & Proliferation not only entails downloads and bundling of Android operating system on various devices but also on derivative works that are based on the Android. Unofficial Android custom ROM's provide rich-features otherwise not found in official Android releases. The popular customized ROM's for Android are the CyanogenMod, Bugless Beast and Liquid Smooth [32]. The flexible Apache licensing scheme allows for the various customizations of the Android OS. As evident from the use & proliferation of Linux and Android, the number of derivative works of a software is directly proportional to its use and the wide spread use of a software leads to its success.

End user satisfaction is typically measured using user satisfaction surveys. A survey of 4068 Android consumer's shows that the Android operating system is gaining in user satisfaction and ranks second among all the smart phones in end user satisfaction [31].

Android through its licensing scheme, community design, software quality and the app store has created incentives for all actors involved to contribute to the growth of the software. Google gains by the dominance of the Android through which it sells search marketing and cloud based services, application developers' profit by selling apps on the Google market place.

Phone companies gain by reduced costs of manufacturing as they do not have to develop the entire operating system for the phones or pay a license fee for a third party proprietary operating system, the community volunteers who are often end users gain by high quality but cheaper phones as there is no license fee for the software and gain in personal reputation through their community contributions.

Android allows for all the associated actors to *benefit* leading to the proliferation of the Android operating systems in the market place. The various factors and their relationship in the MOSS model provide a comprehensive overview on the reasons leading to the success of mobile open source software projects such as the Android.

6. Conclusion & Future work

This research has demonstrated the need for a comprehensive theoretical framework to explain the success of open source mobile software, this was done by identifying the short falls in the existing literature on open source software success in specific open source software in the mobile segment.

The MOSS model postulated in this paper encapsulates both exogenous and endogenous factors and also brings to light the unique challenges of developing successful open source mobile software. The Android case analyzed through the theoretical lens of the MOSS model highlights the fact that individual factors cannot comprehensively explain the success of open source mobile projects and hence the various factors must be studied together.

While the model postulated in this research tries to bring together various factors to explain the success of mobile open source software it does not describe the relative significance of one factor over the other, this will be a part of the future research agenda of an ongoing longitudinal study. This research is exploratory in nature, the future objectives of this research will be to test the model on various open source mobile software projects and build a better understanding of the factors and the interplay between various factors in the MOSS model.

7. References

- [1] Benkler (2007), *The Wealth of Networks: How Social Production Transforms Markets and Freedom*, Yochai Benkler, 2007.
- [2] Uther (2002) , "Mobile Internet usability: what can 'mobile learning' learn from the past?," *Wireless and Mobile Technologies in Education*, 2002. Proceedings. IEEE International Workshop on , vol., no., pp. 174- 176, 2002, URL: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1039247&isnumber=22273>
- [3] DeLone & McLean (1992), *Information systems success: the quest for the dependent variable*, DeLone WH, McLean ER, *Information Systems Research* 1992;3(1):60–95.
- [4] Rank (2008), *Evolutionary success of Open Source Software: an investigation into exogenous drivers*, Karl Beecher, Cornelia Boldyreff, Andrea Capiluppi and Stephen Rank (2008), *Electronic communications of the EASST*, 8 . ISSN 1863-2122
- [5] Lehman (1997), *Metrics and Laws of Software Evolution—The Nineties View*. In El Eman and Madhavji (eds.), *Elements of Software Process Assessment and Improvement*, M. M. Lehman, J. F. Ramil, P. D. Wernick, D. E. Perry, W. M. Turski. Pp. 20–32. IEEE CS Press, Albuquerque, New Mexico, 5–7 Nov. 1997
- [6] Subramaniam (2009), *Determinants of open source software project success: A longitudinal study*, Chandrasekar Subramaniam, Ravi Sen, and Matthew L. Nelson (2009) . *Decis. Support Syst.* 46, 2 (January 2009), <http://dx.doi.org/10.1016/j.dss.2008.10.005>
- [7] Crowston (2003), *Defining open source software project success*, K. Crowston, H. Annabi, J. Howison (2003), *Proceedings of the 24th International Conference on Information Systems*, Seattle, WA, 2003.
- [8] Shobha (2003) , *Survival of open-source projects: A population ecology perspective* by: Shobha C. Smith, Anna Sidorova, *Proceedings of International Conference on Information Systems* 2003.
- [9] Schweik (2007), "Identifying Success and Tragedy of FLOSS Commons: A Preliminary Classification of Sourceforge.net Projects," *floss*, pp.11, Robert English, Charles M. Schweik, *First International Workshop on Emerging Trends in FLOSS Research and Development*, 2007.
- [10] What Is Moore's Law? <http://www.intel.com/about/companyinfo/museum/exhibits/moore.htm>
- [11] Economies of Scale <http://www.investopedia.com/terms/e/economiesofscale.asp>
- [12] Gupta (2009), *Measuring open source software success*, Sumeet Gupta, Sang-Yong T. Lee, Hee-Woong Kim, *Omega*, 2009, vol. 37, issue 2, pages 426-438
- [13] DeLone & McLean, *The DeLone and McLean model of information systems success: a ten-year update*, DeLone WH, McLean ER. *Journal of Management Information Systems* 2003;19(4):9–30.
- [14] Colazo (2009). *Impact of license choice on Open Source Software development activity*, Jorge Colazo and Yulin Fang, *J. Am. Soc. Inf. Sci. Technol.* 60, 5 (May 2009), 997-1011. DOI=10.1002/asi.v60:5 <http://dx.doi.org/10.1002/asi.v60:5>
- [15] Lerner (2005), *The scope of open source licensing*, Lerner J, Tirole J, *Journal of Law, Economics, and Organization* 2005.

- [16] Hannu Verkasalo: Open Mobile Platforms: Modeling the Long-Tail of Application Usage. ICIW 2009: 112-118
- [17] High-end Android phones benchmarked with Quadrant, Taylor Wimberly
<http://androidandme.com/2010/05/news/high-end-android-phones-benchmarked-with-quadrant/>
- [18] Why Google's Open Handset Alliance Has Been A Disappointment? , Leslie Grandy
<http://moconews.net/article/419-the-reasons-why-googles-open-handset-alliance-has-been-a-disappointment/>
- [19] Why Google chose the Apache Software License over GPLv2 for Android
<http://arstechnica.com/old/content/2007/11/why-google-chose-the-apache-software-license-over-gplv2.ars>
- [20] Creswell (2007), Qualitative inquiry and research design: Choosing among five traditions (2nd Ed), Creswell, J. W. (2007). Thousand Oaks, CA: Sage.
- [21] Soy (1996), The case study as a research method, Soy, S. K. (1996).
<http://www.gslis.utexas.edu/~ssoy/usesusers/1319d1b.htm>
- [22] Tiwana (2010), Research Commentary---Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics, Amrit Tiwana, Benn Konsynski, and Ashley A. Bush. 2010 Information Systems Research archive, Volume 21 Issue 4.
- [23] Bosch (2009), From software product lines to software ecosystems, In Proceedings of the 13th International Software Product Line Conference (SPLC '09). 111-119.
- [24] Mueller (1999), "Digital Convergence and its Consequences, Milton Mueller," Javnost/The Public 6, 3, 11-28 (1999).
- [25] Yin (2003), Case Study Research: Design and Methods, Yin, R.K. (2003), Sage, London.
- [26] Walsham (1995), "Interpretive case studies in IS research: nature and method", Walsham, G. (1995), European Journal of Information Systems 4: 7.
- [27] Romano (2003) "A methodology for analyzing web-based qualitative data," Romano, N. C., Donovan, C., Chen, H., & Nunamaker, J. F, Journal of Management Information Systems, (19:4), 2003, pp. 213-246.
- [28] Android Market YoY Growth Hits 861%, iPhone App Store Still Tops URL:
<http://www.intomobile.com/2011/02/23/android-market-growth-hits-861-iphone-app-store-still-tops/>
- [29] Android, Chrome OS to converge, says Google's Eric Schmidt. URL:
<http://www.silicon.com/technology/software/2011/02/16/android-chrome-os-to-converge-says-googles-eric-schmidt-39746988/>
- [30] Google's Android overtakes Nokia's Symbian.
<http://www.ft.com/cms/s/0/17433c60-2d31-11e0-9b0f-00144feab49a.html#axzz1HpzRXMZE>
- [31] New Survey Shows Android OS Roiling the Smart Phone Market.
http://www.changewaveresearch.com/articles/2010/01/smart_phone_20100104.html
- [32] Geek 101: Demystifying Custom Android ROMs (Part II)
http://www.pcworld.com/article/219034/geek_101_demystifying_custom_android_roms_part_ii.html
- [33] Android Architecture – What is Android ?
<http://developer.android.com/guide/basics/what-is-android.html>

Global Software Development: The complexities in communicating about the requirement specification across culture and geography

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Abstract. Investigating global software development practices, we in this paper, present empirical data on how developers experience the difficulties in communicating system specifications across culture, geography, and languages. Based on a grounded theory-inspired analysis of 14 interviews in one large global software development company of Danish orient, we explain how the developers experience miscommunication concerning the requirement specifications. Miscommunications are related to translation of domain specific knowledge, translation between languages, and the continuously negotiation of the interpretation of the requirements.

Keywords: Global software development, requirement specification, miscommunication.

1 Introduction

Global software development (GSD) is an important area for Information System research, since developing IT systems across geographical, cultural, and language discontinuities involved both concerns for system development practices, socio-technical perspectives, and collaborative practices. One of the visions for GSD is in any given project to be able to achieve a shared understanding of the system requirements across the various local sites, which are part of the project [1]. The system requirements pose a key artifact for the collaborative practices in all types of software development, and it is used to guide, negotiate, coordinate, and communicate about the shared task across the developers. Nevertheless, reports from empirical studies of GSD show that misunderstandings and misinterpretations of the system requirements often cause problems and in some cases delay projects or even reduce the quality of the final product [2, 3]. Communication about the requirement specification is basically about creating shared knowledge across participants, in such a way that all parties share knowledge, and knows that they share knowledge and in this way have common ground [4]. Previous research has pointed to that collaborating across geography and culture is prone to conflicts and communication problems [5, 6] due to the lack of shared context and social capital [3]. We wanted to investigate the challenges as experienced by developers engaged in GSD related to this process of communicating about the requirement specifications across culture and geography, so

we initiated an empirical study in a global organization GSD Company in November 2010. The study is still ongoing and comprises a larger ethnographic study of the collaborative practices between Danish and Philippine developers in GSD Company. In this paper we report from one part of this study, namely the interview investigation of how the Danish employees experience the challenges of collaborating with the Philippine developers in relation to communicating about the system specifications. We find that the miscommunications are related mainly to three aspects: Translation of domain specific knowledge, translation between languages, and the continuously negotiation of the interpretation of the requirements. These findings point to that if we want to reach the vision of providing the participants in GSD projects with the best possible conditions for achieving a shared understanding of the system specification, we should try to develop new socio-technical solutions supporting negotiation practices of domain specific knowledge. Our studies questions whether this is simply about creating more detailed and better textual specifications, and instead point to that the ongoing interpretation and negotiation practices comprise essential practices for GSD, which we must consider as key part of the articulation work involved in this type of collaborative practice.

The paper starts with an introduction of our methods for data collection and analysis, as well as a presentation of the empirical case. In the analysis we extract key interview quotes illustrating how the developers experienced the problems of communicating about the system requirements. Then we relate the empirical observations to existing literature, and finally we conclude.

2 Method

Investigating global software development we initiated a larger empirical study GSD Company in November 2010 and the study is still ongoing. In total we conducted 18 audio-recorded interviews: 16 in Denmark and 2 in the Philippines, out of these 14 has been transcribed. We also conducted two workshops, both in Denmark, as well as collected various documents, and observed two video meeting sessions. In this paper we focus on the 14 interviews with Danish participants. We decided to focus on the Danish site, because they had experienced with both national and global software development, and could as such compare the two types of work practices. Moreover, we quickly realized that the system specifications was not simply used to communicate about the technical parts of the future systems, but it was also used to negotiate many other aspects of GSD, including the economic relationship between the Philippines and the Danish site. As such we wanted to include the managerial aspects and since most the managers are at the Danish site, this became our focus.

The 14 interviews, which is the focus in this paper, were with employees at many different levels (see Table 1), and as such we had the opportunity to compare the cooperative vice president perceptions with the IT-developers perspectives. Analyzing the data material we coded and categorized the interview material from a grounded theory perspective to create a systematic overview of the data.

We applied an inductive and explorative approach to identify useful relationship between data and our theoretical ideas and concepts. This approach gives an iterative

process of data collection and analysis, where the initial theories may be rejected during the coding phase [7].

Table 1. Data Sources.

Job function	Number of Interviews
Cooperate Vice President	1
Vice President	1
Director	1
Manager	3
Team Leader	2
Advanced Project Manager	1
Senior Project Manager	2
Project Manager	1
It-architect	1
Developer	1

3 Analysis

Investigating the data from the GSD Company it became clear that one of the key challenges experienced by the developers was connected to the specifications for the IT-product; what the system was actually supposed to look like. Here specifications cover all descriptions used to communicate the requirements and specifications for the new IT-system such as mock-ups, requirement specifications, uses cases etc. The challenge related to the system specifications experienced by the developers concerns the complexities in actually being able to communicate and exchange information about the proposed IT-system. Being located in different geographical locations, the developers' experience that it is difficult to communicate about the systems specification with developers from the other locations, having different cultural backgrounds. In particular it was evident that it is difficult to communicate about systems designed for a particular societal context, which is not shared among the developers. We label this challenge, the complexity in exchanging and creating common ground about the requirement specifications. In the following analysis, we will illustrate how the developers articulate this challenge, as well as explain why the complexity increases when negotiating requirements across distances.

The clients of GSD Company are all located in Denmark – and as such it is the responsibility of the Danish developers to have the close relationship with the client. This means that it is the Danish employees who visit the client and is the key actors in the process of negotiating and defining the requirements for the system. The responsibility to specify the requirement specification sufficiently before sending the specifications to the Philippines is thus placed in Denmark. The Philippine employees have, because of the geographical distance, not the same opportunity to meet with the client to clarify task-specific questions. Their role in the

interaction with the client is therefore very limited and in all cases, we know about, only the Danes have direct contact with the client. Still one of the key issues for the Danes in this process is that specifying the requirements in such details that it makes sense for the remote developers requires extra time and efforts. As a Danish manager explains:

"[The process of the requirement specification] is something that we spend a lot of time on just to play the ball forward and back, then it's very limited what the Philippines' employees can do. (...) [They cannot] be present onsite. They cannot come and sit with the customer and draw on the blackboard and make those things. " (Manager)

When working remotely in GSD the amount of articulation work increases – here described as extra work of going back and forth. From the Philippines perspectives the specification miss much information, and when the main link between their understanding of the system and the client is based on these documents they have to rely on these documents alone, which make the lack of information problematic. This is a well know aspect in GSD Company as a manager explains:

"The PH developers often ask: Why are you only describing part of the requirement? Why are the DK not specifying the requirements in a proper way? If it should be green, then you should write it – instead of leaving out the information." (Manager)

Working remotely an increased demand for the quality of the requirement specifications arise. This causes in increased demands for the Danish employees to the levels of details in the requirements, which affect how the Danes typically write specifications. This challenge is not unproblematic, as a Danish developer explains:

"If you must make the descriptions so exact, that you actually are writing pseudo-code, it would be easier to simply write the code and finish it. " (Developer)

This quote illustrates the complexity of knowledge sharing, because there always is a balancing in the degree of detail of the requirement specification. This developer explains that writing a requirement specification is an act of balancing, because the Philippine employees request a high level of detail in the specification that the Danish developers would spend much time writing, which might take the same time as if the Dane created the code himself. Reversely if the specification level is too low the Philippine employees will rightfully not understand the content of the task and are therefore required to ask the Danish employees, which is both time consuming and costly. The developer perceives the problem to be the excessive demands on the requirements specification made by the Philippine employees. The consequence of this mismatch between the level of details made by the Danes and the level of details required by the Philippines is that the deliverables from the Philippines are not living up to the high quality expected within the organization. As the Corporate Vice President explains:

"PH make the code based on their instructions and the requirement specifications are not exact enough. The deliverables are not good enough, and it is a consequence of what was sent from

DK in the beginning. The quality of the requirement specifications is not good enough. (Corporate Vice President)

Misinterpretation of the system specifications is a key challenge for the GSD Company. However, investigating the data from this study, we found that it is not simply about creating better and more detailed system specifications. Instead this is linked to the collaborative tasks of creating common ground [4] around their joint project. All textual system descriptions can be interpreted in different ways based on different perspectives, and key challenges is when collaborative partners are not aware that this have different interpretations of the same text. Different interpretations are also related to the system specifications, as a manager explains:

”Off cause it takes time to negotiate and discuss the concept and agree to these. PH does not ask questions about the key concepts and explain that they are not sure that they understand the concepts in the right way. Because they experience that they do understand the concepts 100%. It is just not the same 100% as we understand.” (Manager)

Interpretation of system requirement includes negotiations of the concepts described in the system specification documents, and the issue is not that the Danes and Philippines refuse to enter a negotiation process and discuss these concepts. Rather, it is about that they are not aware that they understand key concept differently, and therefore misunderstandings are not detected early on, but instead not until the delivery of the source code. Identifying possible misunderstandings early on is also further complicated due to the language translation back and forth between English and Danish.

“When we work with governmental clients, then all communication, specification, and requirements are written in Danish. We cannot blame the Philippines that they do not understand Danish. But it means that we have to translate. So they translate to English, and when they return it to us we translate it back to Danish. We loose much information due to theses translations.” (Advanced project manager)

The fact that the clients of GSD Company typical form Danish governmental institution, it means that system requirements must be created in Danish. When the information is transferred to the Philippines it will be translated to English, and upon return to Denmark the documents are translated again. This continuously translation practices further increases the complexities of creating common ground concerning the key concepts and the system specifications. One finally complexity related to the negotiation and interpretation of the system specifications concerns the use situations of the system. Since the clients typically are governmental institutions the Danish societal context are highly embedded within many of the system specifications. E.g. the Danish healthcare structures are embedded within healthcare systems specifications. This societal link in the system specifications we refer to as domain specific knowledge. Communicating domain specific knowledge across societal and culture setting as difficult, and this is part of the everyday collaboration between the developers in GSD Company.

5. Conclusion

We investigated how IT developers experience the communication problems concerning the system specifications, and found three key challenges. The risks for miscommunications are related to translation of domain specific knowledge, translation between languages, and the continuously negotiation of the interpretation of the requirements. These findings are related to what previous research refer to eliciting and communication system specifications [1], and this point to that if we want to improve the conditions for GSD, we should investigate the role and use of the system specifications and find new ways to approach the negotiation practices required for transferring knowledge across cultures and geographical sites.

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References

- 1 Herbsleb, J.: 'Global software engineering: The future of socio-technical coordination'. Proc. Future of Software Engineering (FOSE), Washington, DC, USA2007 pp. Pages
- 2 Herbsleb, J., Paulish, D., and Bass, M.: 'Global software development at Siemens: Experience from nine projects', in Editor (Ed.)^(Eds.): 'Book Global software development at Siemens: Experience from nine projects' (ACM, IEEE Xplore, 2005, edn.), pp. 524-533
- 3 Boden, A., Nett, B., and Wulf, V.: 'Trust and social capital: Revisiting an offshoring failure story of a small German software company'. Proc. European Conference Computer Supported Cooperative Work (ECSCW'09), Vienna, Austria, September 7-11 2009 pp. Pages
- 4 Olson, G.M., and Olson, J.S.: 'Distance Matters', Human-Computer Interaction, 2000, 15, pp. 139-178
- 5 Hinds, P., and Mortensen, M.: 'Understanding Conflict in Geographical Distributed Teams: The Moderating Effects of Shared Identity, Shared Context, and Spontaneous Communication', Organization Science, 2005, 16, (3), pp. 290-307
- 6 Bjørn, P., and Ngwenyama, O.: 'Virtual Team Collaboration: Building Shared Meaning, Resolving Breakdowns and Creating Translucence', Information Systems Journal, 2009, 19, (3), pp. 227-253
- 7 Walsham, G.: 'Interpretive Case Studies in IS Research: Nature and Method', European Journal of Information Systems, 1995, 4, pp. 74-81

Designing the CloudBoard: an innovative tool for collaborative e-learning environments using HTML5

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Abstract. This paper aims to summarize the concepts of e-learning, LMS/VLE and cloud-based computing and present how the use of these technologies trends towards collaboration and interactive multimedia. Another purpose is to define and explain this trend in e-learning environments and technologies by presenting research grounded in constructivist learning theory. Subsequently, this paper summarizes the current situation of online whiteboard tools and the new HTML5 standard and key attributes. Next, this paper outlines how an open HTML5 solution for a collaborative, cloud-based, online whiteboard can improve accessibility, performance, collaboration, and security plus offer enhanced multimedia opportunities. Finally, this paper concludes with a presentation of an early prototype of an open, cloud-based online whiteboard, an e-learning cloudboard, which utilizes the advancements found in HTML5 and modern JavaScript libraries such as JQuery.

Keywords: LMS, HTML5, Distance Learning, E-Learning, Cloud Collaboration, Online Whiteboard, Educational Technologies

1 Introduction

Rapid technological advances in web technologies is something we have become accustomed to over the years, as the WWW has evolved and matured into what it is today. However, the changes in how the WWW is built can be argued to constitute an advancement of a greater magnitude with the introduction of HTML5, the new markup language from W3C (www.w3.org). HTML5 enables designers to create innovative ways of interaction between users and between users and systems not possible before. Furthermore, the new open standard combined with powerful

¹ Please note that the LNCS Editorial assumes that all authors have used the western naming convention, with given names preceding surnames. This determines the structure of the names in the running heads and the author index.

JavaScript libraries also gives designers a platform to develop user interfaces not possible until now.

This paper will operate in the intersection between technology and education, exploring HTML5 and how it can support development of educational technology. More specifically, we will create a prototype of a collaborative e-learning tool using HTML5 and various JavaScript libraries demonstrating the possibilities of the new technology.

The following section will begin by elaborating on research on educational technologies and follow with a background into the constructivist view on learning as a social construction, implying the need for educational technologies to incorporate rich, sound support for interaction between users. Finally, the paper gives an overview of existing collaborative tools, describes the relevant attributes of HTML5 in detail and concludes with a description of the prototype called the CloudBoard.

2 E-learning, cloud computing and content

El-Bakry and Mastorakis state that LMS (Learning Management System) /VLE (Virtual Learning Environment) are the primary tools used to implement e-learning [1]. Furthermore, according to El-Bakry and Mastorakis [1] LMS/VLE are different acronyms for the same concept. LMS/VLE are variations of CMS (Content Management Systems) where the focus is on learning. E-learning can be defined in a variety of ways, but in this paper the focus is on e-learning using the broad definition found in previous research. Zhang and Nunamaker define e-learning as “any type of learning situation when instructional content is delivered electronically via the Internet when and where people need it” [2] and Welsh provides a similar definition stating that “E-learning can be defined as the use of computer network technology, primarily over an intranet or through the Internet, to deliver information and instruction to individuals” [3]. Finally Koohang and Harmon [4] reinforce this definition stating that “e-learning is the delivery of education (all activities relevant to instructing, teaching, and learning) through various electronic media.” In other words, e-learning is where learning activities take place online and use technology. In summary, e-learning is then a broad term defining the digital consumption of learning content over the Internet in some form of LMS/VLE.

E-learning has grown and changed substantially since the advent of the Internet and the World Wide Web and is one of the fastest growing trends involving technology and education, especially in higher education [5][6][7]. Taylor’s conceptual framework that describes the evolutionary development of distance education [8] describes how e-learning has grown through different phases into his final 5th stage that emphasizes key aspects such as computer mediated communication and online interactive multimedia. Furthermore, in recent years, e-learning has been shown to consist of collaborative communication and interactive multimedia just as predicted by Taylor [6][9]. In addition, Zhang et al. [10] finds that it is not only sufficient to involve video in e-learning environments to achieve favorable learning outcomes. Positive learning outcomes are contingent on video

interactivity. Furthermore, the trend is toward interactive multimedia content and collaboration.

Cloud computing and cloud collaboration are two other concepts that can be integrated into a modern interpretation of e-learning and the use of LMS/VLE. Hayes defines cloud computing as a software where the major components reside on unseen computers scattered about the Internet. He names popular software such as Google Docs as examples but even states that “for most applications, the entire user interface resides inside a single window in a Web browser” [11]. Erickson further narrows the concept of cloud computing to that of cloud-based collaboration [12]. He states that cloud-collaboration is on the rise and that there is a shift from applications to solutions in the cloud where collaboration and content are in focus. Correspondingly, he states that cloud collaboration will take place in the web browser using a rich interface for multimedia rich content. These ideas correspond to the current delivery mode of e-learning which is via the Internet and World Wide Web and subsequently primarily web browser based.

3 Constructivism and Instructional Design

Given that e-learning uses LMS/VLE, which are based in the cloud and contain multimedia content, how do we then maximize the instructional design of a collaborative cloud-based tool? As defined by Willis [13] “instructional design is the technology for the development of learning experiences and environments which promote the acquisition of specific knowledge and skill by students”. Instructional design in e-learning then deals with the design of the e-learning environment to promote learning. The next step is to base this instructional design on some form of existing learning theory. Fortunately, a great deal of previous research already exists that discusses this very topic. A variety of researchers in the disciplines of e-learning and constructivism emphasize the importance of and point out the beneficial aspects of using constructivism to design e-learning artifacts and environments [14][4][5][15][16][17][9]. Additionally, the constructivist learning model is the most commonly adopted in e-learning [9]. The basic tenet in existing research is that Vygotsky’s fundamental theories regarding social constructivism can be utilized for the instructional design of e-learning environments and content in order to maximize learning outcomes. Tam [17] reinforces this concept by stating that “Vygotsky’s theory of social constructivism, as opposed to Piaget’s individualistic approach to constructivism, emphasizes the interaction of learners with others in cognitive development”. Tam [17] elaborates on how constructivist principles are key in a technology-driven collaborative environment, especially for e-learning situations by stating that “Constructivist principles provide a set of guiding principles to help designers and instructors create learner-centred, technology-supported collaborative environments that support reflective and experiential processes. When applied to the distance learning context, there is no doubt that constructivism and the use of new technologies will help transform significantly the way distance education should be conducted”. Finally Snyder [16] concisely summarizes constructivism and e-learning

environments by stating that “constructivism supports learner-centered environments that are authentic, collaborative, constructive, and active”.

A key recurring theme in the research regarding e-learning, instructional design and constructivism is that the environment as well as the content must be interactive. Beldarrain [14] states that instructional design must be adapted for a focus on interaction saying “Instructional design frameworks must be adapted to purposely integrate student interaction using technology tools”. Tam [17] emphasizes the importance of social interaction when she states that “The constructivist perspective supports that learners learn through interaction with others. Learners work together as peers, applying their combined knowledge to the solution of the problem.” Furthermore, Moore [15] defines three types of interaction in learning: learner–instructor, learner–learner, and learner–content. Moore [15] explains that all three forms are important, but that learner-learner is especially important and easier to realize in a multimedia e-learning environment than in large face-to-face groups. Zhang [9] succinctly summarize the importance of social interaction stating “Learner-learner interaction fosters collaborative learning”. The need for interaction even extends outside of the intrapersonal interaction to interaction with the instructional content. Zhang et al. [10] reinforce this idea when they conclude in a study of interactive video in e-learning that interactive video and individual control over the content can improve learning outcomes. Finally, Beldarrain [14] mentions how emerging technologies not only allow content to be customized but even customizable interaction where the learner can determine how and when interaction takes place.

4 Current online collaborative tools

The need for an online collaborative environment has not gone unnoticed. There are a variety of products available for purchase or free use. The existing products vary in capabilities, price and implementation technologies. The common name for these products seems to be Online WhiteBoards [18]. The table in Table 1 presents a list of popular products within this field and the list is in no way exhaustive or ranked in anyway. The list is simply intended to provide a glimpse into certain characteristics of current products.

Table 1 - Overview of online whiteboards

Product Name	Website	Open Source	Support for all media types	Technique used
Twiddla	www.twiddla.com	No	No	HTML, ASP.NET JavaScript
Scriblink	www.scriblink.com	No	No	Java
Dabbleboard	www.dabbleboard.com	No	No	Flash
Groupboard	www.groupboard.com	No	No	Java
Skrbl	www.skrbl.com	No	No	N/A
Scribblar	www.scribblar.com	No	No	Flash
CoSketch	www.cosketch.com	No	No	N/A
ImaginationCubed	www.imaginationcubed.com	No	No	Flash

The Online WhiteBoards products in Table 1 share a number of characteristics. All of the products are proprietary in some manner meaning that the source code is unavailable. Most offer a free version or trial version with limited functionality and the full versions typically require paying a license fee. Furthermore, the majority uses plug-ins in the web browser, i.e. Java and Adobe Flash. Despite the fact that different web browsers deal with plugins differently, the use of plug-ins is a large security risk for browsers because security holes in plugins can create a situation where interaction with the host operating system becomes possible [19]. A recent study by the security company Qualys shows that out of date plugins for Java, Adobe Reader and Adobe Flash provide a high percentage of exploits [20]. Also, the products typically focus on drawing and image uploads. Some products contain some form of chat solution. None of the products support video or interaction with video and none of the products explicitly focus on learning. The typical focus of the products is on drawing, conferencing and sharing and collaborative creation of simple content.

5 An E-Learning CloudBoard with HTML5

If the aforementioned principles of instructional design, constructivism and e-learning are to be utilized then an E-Learning CloudBoard should contain certain characteristics. The proposed CloudBoard should be open, secure, responsive and interactive. The next step is to use the appropriate technologies to achieve these

design goals. Fortunately, the new, open standard HTML5 from W3C contains the capabilities to create a new innovative E-Learning CloudBoard.

5.1 New tools for online collaboration

HTML5 is the impending official standard from W3C (www.w3.org), which is the official, non-profit organization that creates and maintains various web standards. The W3C establishes the various web standards through vote and discussion by the member organizations that include the majority of leading IT organizations <http://www.w3.org/Consortium/Member/List> HTML5 is currently a W3C Editor's Draft. This means that HTML5 is currently not a W3C recommendation and therefore not an official web standard yet, however, this standard makes revolutionary changes in how HTML can be implemented in the web browser. Though full compliance for HTML5 does not currently exist and compliance in legacy browsers is more or less non-existent, support by the leading web browser manufacturers such as Microsoft, Apple, Mozilla, Google, Opera, etc. in their respective browsers is considerable and increasing with each new version [21]. The working draft was originally planned to become an official W3C recommendation by the fall of 2010, but the date has since been adjusted to 2012 [22]. HTML5 along with the new JavaScript APIs (Application Programming Interfaces) offer web developers new native tools to create safe, interactive, responsive and collaborative online environments. These web tools quite simply represent a technical revolution in web development.

The following list provides insights into how specific attributes of HTML5 and the new JavaScript APIs can provide the tools needed to create a collaborative e-learning CloudBoard [23].

5.2 Interaction and Multimedia

- Audio and Video tags - HTML5 provides native support for audio and video. These new HTML5 tags allow for audio and video to be directly played by the web browser without a need for any form of third party plug-in.
- Canvas – HTML5 implements a new canvas tag that allows for web applications to draw 2D graphics. With the canvas tag areas of a web page or even an entire web page can be drawn. Even video can be presented as a canvas and manipulated as desired.
- WebGL – Is a standard for programming in 3D when using the web browser as a platform. WebGL is an interface between JavaScript and OpenGL, which allows for hardware accelerated 3D rendering using the HTML5 canvas tag.
- HTML5 is natively user editable – HTML5 has the attributes `designMode` and `contentEditable`. These attributes allow for native editing of the associated objects directly by the user in the web browser.

5.3 Communication

- Web Sockets and SSE – Web sockets is a portion of the HTML5 standard that represents the next evolution in web communication. Web sockets resemble the Web 2.0 techniques of AJAX and Comet in that direct communication that is bi-directional (full duplex) between the client web browser and the server are possible thus avoiding the need to update an entire web page via an HTTP request. In other words, when data changes on the web server, the web server can send a request to the client, eliminating the need for polling and providing a true, real-time exchange of information from the server to the client web browser
- Cross Document Messaging – HTML5 allows web browser frames, tabs and windows from different origins to communicate securely and directly with one another [24]
- Geolocation - By using the new JavaScript Geolocation API, web applications can reveal a client's physical location as well as show where other users currently are. This process can only be done with the user's permission

5.4 Performance

- Web Workers – Web workers allows JavaScript code to be executed in parallel without affecting the user interface. This implementation allows web applications to perform multiple tasks simultaneously therewith improving the performance and responsiveness of HTML5 web applications. In other words, web applications can now support parallel processing and more calculation intensive implementations.

HTML5 can utilize the aforementioned attributes to create a collaborative e-learning environment that is accessible, responsive, secure, collaborative, multimedia-rich and interactive. Furthermore, as previously stated, HTML5 provides the tools to implement the aforementioned instructional design characteristics and constructivist principles needed for a collaborative, interactive environment.

6 Presenting the CloudBoard

The CloudBoard builds on the concept of a whiteboard (see Fig. 1). The whiteboard takes up most of the space in the browser window and is the part of the system where all interaction between participants is taking place as well as all the different types of objects such as text, links, different types of media and Twitter feeds. The whiteboard itself is dynamically resizeable facilitating both small and large projects as well as big or small screens. The “Control Panel” is located on top of the whiteboard space. The control panel is always on top and always accessible for the user, no matter what part of the whiteboard the user is viewing and features functions such as login/logout and a time slider elaborated on later in this text.

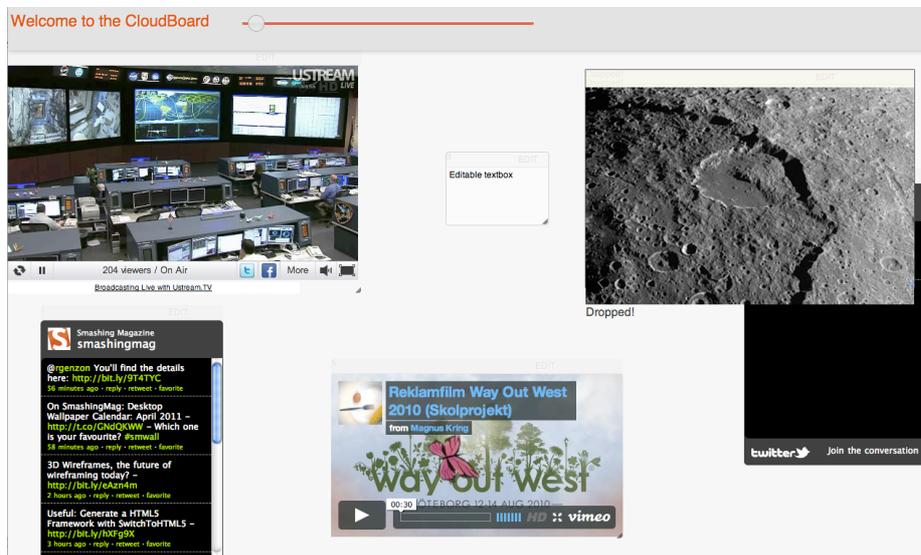


Fig. 1. The CloudBoard prototype

The whiteboard view is shared between the users of the system, and what you see is exactly the same as everyone else sees. Further, all users have the same privileges, and everyone can edit and delete any object in the CloudBoard.

These features of the CloudBoard will now be elaborated on following the themes outlined in the previous section, i.e. “accessibility”, “responsiveness”, “security”, “collaboration”, “interaction” and “multimedia”.

6.1 Accessibility

The characteristic of accessibility refers to the idea that the entire environment is open and accessible for everyone. Furthermore, this concept focuses on the openness of the actual technology. In the case of HTML5 the standard and all associated technologies such as JavaScript and CSS3 are open. Therefore, by building an E-Learning CloudBoard exclusively with HTML5 the codebase will be free from proprietary interests. Furthermore, the actual code can even be made open source to further expand upon the concept of accessibility and openness in education and e-learning.

By not relying on third-party plugins and proprietary code, we also ensure that the CloudBoard can be used on computers in environments where the installation of software is prohibited.

6.2 Responsiveness

The attribute of responsiveness refers to the idea that the web application that hosts an E-Learning CloudBoard must be responsive. In line with aforementioned research, a collaborative e-learning should be online, cloud-based and be leveraged as a web application in a web browser. The performance of web applications in the web browsers can be a source of frustration for users as simply waiting on webpages to download causes user dissatisfaction [25] and the constant focus on web page rendering and JavaScript rendering performance by the major web browser vendors attests to the need for web applications that are as responsive as desktop applications. The Web Worker attribute in HTML5 addresses this issue directly. By designing an e-learning cloudboard with web workers, the CloudBoard can be multi-threaded just like a desktop application. In that way the user interface will not freeze while performing simultaneous requests from the user. Moreover, the user can perform tasks asynchronously and thereby maximize interactivity with other users and the content. Web Sockets can even improve responsiveness by making chat functions and other forms of communication in a collaborative environment even more responsive due to the ability to send data full-duplex in real-time between the web browser and the client.

6.3 Security

Security is an important characteristic of any computer application but it is especially important for a web application where anyone with a web browser can access the application. By building an e-learning cloudboard entirely with HTML5 without the use of 3rd party plug-ins security can then be managed by the web browser. The web browser is then solely responsible for the rendering of the HTML tags and JavaScript. Updates to the web browser will keep a web application secure as possible and there is no reliance on updates for plug-ins.

6.4 Collaboration

In the area of collaboration, HTML5 offers a variety of new tags and functionality that provide the necessary tools to create a truly collaborative and innovative environment. By utilizing Web Sockets and SSE (Server Sent Events) an e-learning cloudboard can be a truly collaborative environment. Web Sockets and SSE can provide a full-duplex connection between the web browser and the server, so that the exchange of for example text, images, audio and video can take place quickly, efficiently and synchronously across browser windows. Cross Document Messaging makes it both safe and easy to move objects and information between portions of the user interface as well as between the underlying iframes or even between domains. Also, Geolocation offers exciting possibilities to easily integrate mapping technology into the collaborative environment and even make possible collaboration in the physical world by being able to easily show the location of each user, given the user's permission of course.

All users of the CloudBoard have the same privileges to add, edit or delete objects on the CloudBoard. Since this enables anyone to “sabotage” the information on the CloudBoard, all events is logged and visible to all, thus making individual actions transparent to other users. To minimize the consequences of an accidental edit or deletion of an object, the CloudBoard also incorporates a dimension of time. The time slider in the control panel enables users to view an historical representation of the CloudBoard by dragging the slider control. It also enables users to go back in time and re-activate a deleted object, making it available to everyone again.

6.5 Interaction

As previously stated, the central principles of constructivism, as the name implies, deal with the concepts of constructing knowledge through interaction with the content and other users. HTML5 delivers a variety of new technologies that enable the construction of a truly interactive e-learning environment. The canvas tag is the most important new aspect of the HTML5 standard. The canvas tag gives the user the ability to manipulate a 2D drawing surface natively in the web browser without using any 3rd party plug-ins. Users can create any form of 2D object such as drawings, text or images and even freely interact with them by using JavaScript. Additionally, HTML5 supports drag and drop natively so that users can use a web application just as they would use a desktop application. In the CloudBoard, users can drag and drop for example documents, images, audio and video directly into the collaborative environment. Further, objects can be re-arranged and resized, grouped, merged and connected together.

Finally, the attributes of contentEditable and designMode in HTML5 make it possible for the user to directly interact with the collaborative environment itself (within developer constraints). This gives the users greater learning flexibility by providing the possibility to interact with the environment itself and alter it according to individual preferences. This ability further reinforces the ideals of constructivism.

6.6 Multimedia

A key aspect that separates the possibilities of HTML5 from the other Online WhiteBoard solutions is the ability to natively support and implement multimedia in an a collaborative e-learning environment. The audio and video tags in HTML5 give the user the ability to directly import and manipulate audio and video files. Another exciting and interesting possibility in HTML5 is WebGL. WebGL offers the ability to present and manipulate 3D objects and even entire virtual environments natively within the web browser. These capabilities are entirely inline with aforementioned research in that multimedia such as video is both interactive and collaborative. Furthermore, users can construct their own meaning and knowledge by manipulating the various multimedia objects as desired.

Being a cloud-based system, a large number of third-party APIs is also utilized enabling users to easily access for example a Vimeo video or a Twitter feed.

7 Conclusion

The true potential of using HTML5 to create an e-learning collaborative environment that fulfills all the aforementioned characteristics of accessibility, responsiveness, security, collaboration, multimedia-rich and interaction lies in the ability to combine the various attributes. A combination of web workers, web sockets, canvas and native multimedia provides the user with powerful and innovative tools to achieve new levels of collaboration and interaction. This statement is reinforced by Snyder [16] who calls for further research asking for exploratory research into what type of web tools should be used for collaborative learning online. This paper acts on this call for further research by presenting an early version of an e-learning CloudBoard prototype implemented with the entirely open and native techniques of HTML5 and JavaScript libraries such as JQuery.

The next step in this research is to deploy the CloudBoard in an educational setting. We will conduct a series of interviews as well as an observational study to reveal how well the CloudBoard supports collaboration in a learning setting.

References

1. El-Bakry, H. M., & Mastorakis, N. (2009). E-learning and management information systems for E-universities. Paper presented at the Proceedings of the WSEAES 13th international conference on Computers.
2. Zhang, D., & Nunamaker, J. F. (2003). Powering E-Learning In the New Millennium: An Overview of E-Learning and Enabling Technology. *Information Systems Frontiers*, 5(2), 207-218.
3. Welsh, E. T., Wanberg, C. R., Brown, K. G., & Simmering, M. J. (2003). E-learning: emerging uses, empirical results and future directions. *International Journal of Training & Development*, 7(4), 245-258.
4. Koohang, A., & Harman, K. (2005). Open Source: A Metaphor for E-Learning. *Informing Science: The International Journal of an Emerging Transdiscipline*, 8.
5. Koohang, A., Riley, L., Smith, T., & Schreurs, J. (2009). E-learning and Constructivism: From Theory to Application. *Interdisciplinary Journal of E-Learning and Learning Objects*, 5.
6. Evaluation of evidence-based practices in online learning [electronic resource] : a meta-analysis and review of online learning studies / prepared by Barbara Means ... [et al.]. (2009). Washington, D.C. : U.S. Dept. of Education, Office of Planning, Evaluation and Policy Development, Policy and Program Studies Service.
7. Orellana, A., Hudgins, T. L., & Simonson, M. (2009). *The perfect online course: best practices for designing and teaching*: Information Age Publishing.
8. Taylor, J. (1999). *Fifth Generation Distance Education*. American Journal of Distance Education.
9. Zhang, D. (2005). Interactive multimedia-based e-learning: A study of effectiveness. *The American Journal of Distance Education*, 19(3), 149-162.
10. Zhang, D., Zhou, L., Briggs, R. O., & Jay F. Nunamaker, J. (2006). Instructional video in e-learning: assessing the impact of interactive video on learning effectiveness. *Inf. Manage.*, 43(1), 15-27.
11. Hayes, B. (2008). Cloud computing. *Commun. ACM*, 51(7), 9-11.
12. Erickson, J. (2009). Content-Centered Collaboration Spaces in the Cloud, 13, 34-42.

13. Willis, J. (2009). *Constructivist Instructional Design (C-ID) Foundations, Models, and Examples*: Information Age Publishing.
14. Beldarrain, Y. (2006). Distance education trends: Integrating new technologies to foster student interaction and collaboration. *Distance Education*, 27(2), 139-153.
15. Moore, M. (1989). Editorial: Three types of interaction. *American Journal of Distance Education*, 3(2), 1-7.
16. Snyder, M. M. (2009). Instructional-Design Theory to Guide the Creation of Online Learning Communities for Adults. *TechTrends: Linking Research & Practice to Improve Learning*, 53(1), 48-56.
17. Tam, M. (2000). Constructivism, Instructional Design, and Technology: Implications for Transforming Distance Learning. *Educational Technology & Society*, 3(2).
18. Lloyd, D. M., Coates, A., Knopp, J., Oram, S., & Rowbotham, S. (2009). Don't stand so close to me: the effect of auditory input on interpersonal space. *Perception*, 38(4), 617-620.
19. Wang, H. J., Grier, C., Moshchuk, A., King, S. T., Choudhury, P., & Venter, H. (2009). The multi-principal OS construction of the gazelle web browser. Paper presented at the Proceedings of the 18th conference on USENIX security symposium.
20. Dunn, J. E. (2011). Many browsers run insecure plug-ins, analysis finds. Retrieved 2011-05-25, 2011, from <http://www.csoonline.com/article/682524/many-browsers-run-insecure-plug-ins-analysis-finds>
21. Wikipedia. (2010). Comparison of layout engines (HTML5). Retrieved October 17th, 2010, from [http://en.wikipedia.org/wiki/Comparison_of_layout_engines_\(HTML5\)](http://en.wikipedia.org/wiki/Comparison_of_layout_engines_(HTML5))
22. WHATWG, W. (2010). WHATWG FAQ - When will HTML5 be finished? Retrieved October 17th, 2010, from http://wiki.whatwg.org/wiki/FAQ#When_will_HTML5_be_finished.3F
23. Jobe, W. (2011). HIVE (Hypermedia Interactive Virtual Environment) – Utilizing HTML5 and instructional design to improve online learning. Paper presented at the Society for Information Technology & Teacher Education International Conference 2011. Retrieved from <http://www.editlib.org/p/36820>
24. Lubbers, P., Albers, B., Smith, R., & Salim, F. (2010). *Pro HTML5 Programming: Powerful APIs for Richer Internet Application Development*: Apress.
25. Nah, F. F.-H. (2004). A study on tolerable waiting time: how long are Web users willing to wait? *Behaviour & Information Technology*, 23(3), 153 - 163.

Dynamics in an innovation boundary context: exploring a living lab process from a community of practice perspective

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Abstract *This paper is based on studies of a living lab process, which is an open, user-centric, innovation approach, where several actors from industry, user groups and academia are involved. We aim to describe and analyze the dynamics in an innovation boundary context based on a living lab process. An action-oriented research approach was applied and the empirical results are from The Find Project (TFP), with the aim of customizing an ICT product based on the needs of a user group. The findings are analyzed from a community of practice perspective where the three different communities i) researchers from Halmstad Living Lab (HLL), ii) ICT developers (ICTD), and iii) next of kin's to demented elderly persons (NOKD) represented the units of analysis. The analysis identified several boundary situations that played a vital role for the innovation process. The contribution of our research to innovation theory is a process model describing the dynamics in an innovation boundary context with regard to boundary objects-in-use as well as to brokering. The research highlights two different levels of brokering: i) product/service brokering; and ii) process brokering.*

Keywords: Innovation, learning, boundary context, brokering situations, communities of practice

1 Introduction

The research interest in this paper relates to innovation and learning and the intertwining of these during an innovation process. Generally, innovation activities could be understood as all scientific, technological, organizational, financial and commercial steps which actually lead to, or are intended to, the implementation of innovations [1]. The last ten years, researchers has focused on other innovation approaches than the one performed within one particular firm or within one specific R&D department. Open innovation [2], user driven innovation [3] and living labs [4] are all examples where co-creation between a multiplicity of actors and stakeholders are in focus during an innovation process. Furthermore, innovation and structural change are often alleged to result from information brought into the organization by external representatives [5]. This leads to an interesting challenge of crossing sectors of such kind and to understand different forms of activities and interaction taking place at the interface between different groups of stakeholders across those sectors. Hence, one way to approach the intertwining of innovation and learning is to understand boundaries and the bridging of boundaries. While such a multiplicity of stakeholders and boundaries increases there is a need to develop approaches for integrating and leveraging for such a context, i.e. a boundary context.

In this paper we apply a community of practice perspective on a living lab process, which is a user-centric innovation process, where several actors from industry, user groups and academia are involved. We will present findings from an ICT innovation process where an organization (the ICT developers) collaborate with a user group consisting of people not belonging to an organization, but driven by an interest: caretaking of a demented person, such as wife, husband, father or mother (the next of kins), and researchers from Halmstad Living Lab. From a community of practice perspective, we can see how different community groups engage in a heterogeneous interaction where a mix of different world views is to be handled [6]. We pay particular attention to boundaries, boundary objects and brokering as we take the existence of boundaries as given in the situations occurring in a boundary context of a living lab.

The research question in the paper is: *How can a boundary context, such as a living lab process, be understood and facilitated from a community of practice perspective?* The empirical findings result from a project called The Find Project (TFP). The aim of the TFP was to customize an ICT product based on the needs of a user group. The ICT product that should be customized consisted of a sender and a receiver that worked together in a mission to find missing objects. There were about fifteen people involved in TFP: three researchers from Halmstad Living Lab (HLL); three ICT developers (ICTD) and the group of eight next of kin's to demented elderly persons (NOKD).

The contribution of our research to innovation theory is a process model describing several implications for how dynamic activities in an innovation boundary context (such as a living lab process) can be understood as well as facilitated by different support mechanisms. From our findings we have found that essential mechanisms of the boundary context are vital important for facilitating interaction and learning

in a living lab process. For that reason we have distinguished several boundary objects-in-use and two different levels of brokering.

2 Living lab: communities of practice in an innovation boundary context

Learning and working are interrelated, compatible, intertwined and connected to innovating [15]. The innovation process in TFP was inspired by user-centric innovation and the living lab approach [4]. One of the underlying ideas in the living lab approach is that people's ideas, experiences and their daily needs of support from products, services, or applications, should be the starting point in innovation [11]. The living lab approach also relates to co-creation in collaborative, multi-contextual real-world settings [11]. During the last years five key principles has emerged for the living lab approach [12]:

- Continuity: Cross-boundary collaboration that builds on trust.
- Openness: As many perspectives as possible in the innovation process.
- Realism: Involvement of real users, co-creators, in real-life situations.
- Empowerment of users: The innovation process should be based on human needs and desires.
- Spontaneity: The ability to detect, aggregate, and analyse spontaneous users' reactions and ideas over time.

In a Living Lab process, based on the five key principles, the innovation process takes place in a more social context, where relations and connections of several people and activities crosses various types of boundaries in a multi-contextual environment.

One of the main motives behind the approach is that during the TFP process we wanted the NOKD to be active in the process not only as a reference group but more as co-producers. In the TFP we started with a product with an intention to customize it according to criteria's from the NOKD. This approach is also in line with the living lab approach, where for instance [4] argues that there is no standard user, which leads to a focus on customization. The living lab activities are intended to improve a product with regards to the needs of a new customer group which will change the everyday practice of that group [1].

2.1 A communities of practice perspective

A community of practice (COP) is a group of people that share a concern (or a set of problems) and deepens their knowledge by interacting on an on-going basis [14]. Learning is described as an ability to negotiate new meanings within a COP, to create engagement in COP and to deal with boundaries between COP's [8], which means a form of inter-community learning process [13]. The inter-community process is important [16] because it helps to overcome some of the problems the community may create for itself [15].

Some critics about the inter-community process has been raised: the dynamics of inter-community knowledge sharing processes has been neglected in much COP-literature [13] and that COP is limited in addressing the power dynamics in the inter-community process [10]. Yoo, Lyytinen et al [18] discusses an innovation process from complementary social translation, which is identified as combining two previously unconnected communities [18]. Hislop (2004) states that the dynamics of knowledge sharing within and between COPs are likely to be qualitatively different, the sharing of knowledge between communities being typically more complex and more difficult. However, Boland & Tenkasi [17] argue that the beauty with COPs is that they are not limited to specific contexts and organizations but transcend boundaries. In order to understand this complex inter-community process of learning they develop the concepts of perspective making and perspective taking [17]. Perspective making represent the first step, in which knowledge creation is built and re-built for shared understanding and communication within a community of practice [17].

In the presented research we regard the different stakeholders (NOKD, ICTD and HLL) as three different communities of practice [8, 14]. NOKD's practice is caretaking, ICTD's practice is development of ICT products and HLL's practice is research.

2.2 Forms of boundaries and brokering

There are attempts to use the theory of brokering and boundary objects in innovation settings [13, 19, 20, 21] but they all discusses the lack of dealing with the dynamics. According to Levina and Vaast [10] boundary spanning could be described as a sharing of expertise between boundaries. They describe a kind of role of a change agent, boundary spanners-in-practice, who produce and uses artefacts, boundary objects-in-use. During such boundary spanning the boundary spanner uses several artefacts such as

scenarios, physical prototypes, design drawings and other types of documents in order to communicate and collaborate organisationally. Similarly, Bolan and Tenkasi [17] say that in order to have an inter-community interaction different forms of objects (boundary objects) or subjects (brokers) are needed. These can serve the boundary spanners when to support meaning creation and bringing in new perspectives in a brokering processes, between communities of practice. Thus, boundary relations are described as a duality: i) boundary objects; and ii) brokering (activities and situations).

Boundary objects, serve to coordinate and communicate perspectives for some purpose [9]. Boundary objects play extremely important roles as shortcuts to communication, as well as playgrounds for knowledge sharing among different communities of practice [15, 16]. Brokering is the second part of the duality, made by people who introduce elements of practices from one COP into another COP [8]. Boundary objects can be used by a broker in a brokering situation. In [10] the community of practice perspective is disregarded due to limitations in addressing power dynamics. Levina and Vaast [10] and Lindgren, Andersson et al (2008) address boundary objects from boundary spanning, but not from communities of practice perspective. Within communities of practice boundary bridging is described as boundary relation which consist of two intertwined parts: boundary objects (artefacts) and brokering (activities and situations) [8, 14]

Based on the above concepts of living lab, communities of practice, innovation and boundaries we consider a boundary context as a multi-faceted arena, or place, where several co-existing actors or communities of practices play out their organisation and interaction for a common goal, for instance such as a living lab project.

3 Research approach

Our underlying methodology was in accordance with an action oriented research. In action oriented research, there is always a balancing between involving in the change process (the problem solving) and the research process [22] which is further inspired from the clinical perspective [23, 24]. Herein, Schein argues that the process should be client driven, i.e. the needs of the client is more important than the needs of the researcher. So, the focus should be on client's issues rather than involving the client in the researcher's issues. This was particular appropriate for us in a living lab approach.

The main idea in TFP was to learn more about the needs of the kin's in order to customize (in this paper customization is interpreted as significant improvements to an existing product) the ICT product based on the needs. The ICT product that should be customized consisted of a sender (Grey in Fig 1) and a receiver (white in Fig 1) that worked together in a mission to find missing objects (in the TFP a missing person) according the ICT developers (ICTD). When the ICTD developed their product they had a broad perspective on a missing object, it could be almost anything: a stolen car, a missing container of goods or a demented person.

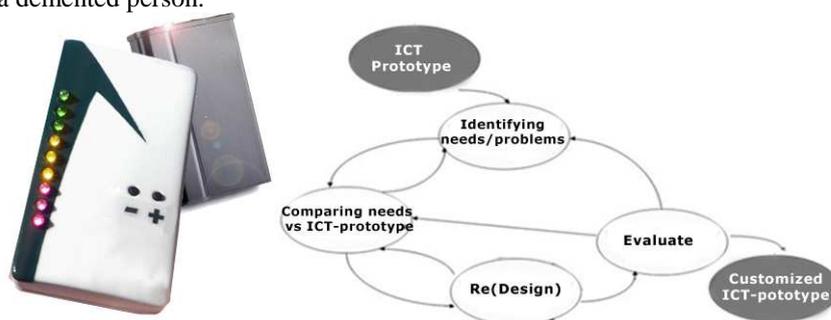


Figure 1: Left: Sender and receiver, Right: The TFP process

In the TFP, several workshops were held in an apartment that has been a meeting place for next of kin's to demented and also demented people. The apartment is an example of real-life context which is addressed in the Living Lab key principle realism.

The TFP innovation process (Fig 1) was inspired by principles from user-centred design [25] and user-centric innovation [26]. The first phase in TFP, *Identifying needs and problems* (Fig 1), consisted of three main activities: planning; workshop and a follow up meeting. The workshop consisted of presentations, demonstration of the ICT product, creating scenarios in groups and follow up discussions. The main reason behind the scenario inspired technique was to get a rich description of the life-situation and caretaking among the NOKD.

The second phase in TFP, *comparing needs vs ICT prototype* (Fig 1), followed the same structure as the first phase. At the planning meeting a comparison between the needs of the next of kin's, presented in

mind map [27], and the ICT product was done which resulted in a list of statements and questions were it seemed to be a difference between the functionality and design of the ICT product and the actual needs of the next of kin's. When the list of statements and questions was adjusted and approved by the next of kin's we started the second part of the workshop, individually prioritize the most important statements and question on the list

The third phase in TFP, *(Re)Design* (Fig 1), followed the same structure as the first two phases. The workshop started with a presentation of the design activity, followed by the actual group-work and ended with a presentation of the group prototypes.

Analysis of the empirical data from the TFP was made in a continuous manner during the process and also after the innovation process. We integrate the set of facts and physical conditions or circumstances that surround a situation, which might help to determine interpretation of a given interaction. The *brokering situations in a boundary context* is described as the intertwining of: boundary spanning-in-practice [10] and, brokering [8] inspired by perspective making and perspective taking and the use of boundary objects [9]. From the findings we identified situations that affected the innovation process in a greater extent in terms of brokering situations and its consequences for further actions and learning in the project. A process model was developed, in order to conceptualize the various forms of interactions.

4 Brokering situations in a boundary context

We have distinguished features within the embedded practices of a Living Lab and we have pointed out four brokering situations where different forms of brokering took place. The first sub section (4.1) is a description of the boundary context where we undertook many of the research activities. The first brokering situation (4.2) took place at the first workshop in the *Identifying needs and problems phase*. The second (4.3) and third (4.3) brokering situations took place at the workshop when we were *comparing needs vs ICT prototype* and the fourth (4.5) situation took place *at the (re)Design* workshop.

4.1 The brokering context – the apartment

The workshops in the TFP were held in an apartment that has been a meeting place for next of kin's to demented and also demented people. The apartment is equipped with tools and artefacts especially designed for demented elderly people. The apartment also serves the purpose as a kind of test laboratory for NOKD were they can try, test and also borrow (for a shorter period) different tools and artefacts.



Figure 2: The apartment

The apartment is also designed according to principles based on helping elderly demented people; each room is painted in special colour, green room, red room, etc. The colours are chosen to be in a strong contrast to what's on the wall for instance a light switch, to the left in figure 2.

Before the first workshop started the HLL and ICTD got a guided tour around the apartment by the NOKD. It was obvious during the guided tour that the NOKD gained in confidence in the relation with the HLL and ICTD, for many of them this was the first time they have met researchers and ICT-engineers. In a sense we were very close to the real-life context situation of the NOKD's, which is crucial in the living lab approach [12]. We will refer to the apartment as a boundary context where brokering situations took place during the workshops. Yoo, Lyytinen et al [18] describes a social context where actors from different communities negotiate and mutually adjust to other's perspectives which influences the innovation process as a "trading zone". The trading zone and the boundary context has much in common but there is one difference, the empowerment of the users which is addressed in [12]. The guided

tour in the apartment could be understood as an empowerment activity, relating to the forthcoming brokering situations.

4.2 The scenario brokering situation

At the first workshop the researchers from HLL had introduced *scenarios* as a technique for capturing ideas and needs for the ICT product and the ICTD demonstrated their product. The brokering situation took place when the NOKD were working with the scenarios. They discussed quite loud and wrote down a question (Fig 3a): “If a demented person disappear, were will I start to look?” They also wrote down a note (Fig 3a): “Direction indication! Use the internet to get an indication where the person is.” They also underlined some of the statements that they had written on the paper.



Figure 3a and 3b A scenario note and a brokering situation (notes in Swedish)

After the NOKD had written down the notes and the questions they asked for one of the ICTD representatives and several more additional questions arise, such as: “Is it hard to get an indication of the direction?”, “Is it possible to connect the sender/receiver to Internet and get a position on a map?” The representative for the ICTD answered the questions but also started a dialogue asking follow up questions (Fig 3b): “How do you mean?”, “What do you mean by location of direction?”. During the dialogue the ICTD placed himself in the sofa and took part in the following work with the scenarios, at several times he stated “this is really interesting and useful input”.

The workshop where the scenario brokering situation took place is regarded as user-centric innovation activity [28] in a living lab innovation process, but also a brokering situation relating to both the ICTD’s role as boundary spanner [10] in the inter-community learning process [13]. The three different groups: NOKD; ICTD and HLL are interpreted as three different communities of practice. Each one of the COP’s share a set of problems, a mutual concern and within the COP they interact on an on-going basis [8, 14]. In the inter-community learning process HLL act as a broker (the workshop) [8] when introducing a boundary object (the scenario-technique), the ICTD act also as a broker or boundary spanner-in-practice [10] (when presenting the product and taking part in dialogue) and their product as a boundary object-in-use. It is interesting to notice that the brokering and boundary objects presented by HLL were used in the inter-community relation during the innovation activity between the NOKD and the ICTD. HLL acted as a brokering for brokering situations.

4.3 The newspaper-clip brokering situation

The second brokering situation was initiated by Lars (a member of the NOKD) when he presented a clip from a newspaper (Table 1). HLL had started the workshop and presented a mind map as a summary of the last workshop. Lars raised his voice and said he wanted show us something, Lars showed the newspaper clip (Table 1) and described what has happened to him and his wife, rather recently.

<p>...länge sen som han gick fri från ett fängelsestraff.</p> <p>Kvinna hittades välbehållen</p> <p>VARBERG. Den 73-åriga dementa kvinnan lämnade sin bostad i Varberg klockan 21.40 i måndagskväll. När hon inte hade kommit hem 22.15 larmade hennes man polisen.</p> <p>Polisen startade upp sökandet och påträffade kvinnan några timmar senare. Kvinnan var utom fara, förutom att hon var lite nedkyld.</p>	<p>Female found in good condition (12/2-2009)</p> <p>The 73 year old demented female left her apartment in Varberg at 21.40 on Monday. When she did not return at 22.15 her husband (Lars) called the police.</p> <p>The police started searching for the female and found her a couple of hours later. The female suffered from a light hypothermia and her life is not in danger.</p>
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Table 1: Newspaper clip (in Swedish) and brief summary

He also explained that similar accidents have happened afterwards. Lars had a two-folded purpose by showing the newspaper clip. Firstly, he wanted us (HLL and ICTD) to get a deeper understanding of the life situation of a NOKD. Secondly, one essential need, according to Lars, was to point out that most situations when demented persons get separated from the NOKD is close to their homes or, when the NOKD is rather near the demented but cannot find her or him. He described two other occasions. The first one was when they were at an airport and just before they were boarding the airplane she suddenly disappeared. The second occasion was at Gothenburg Opera and in the break between the acts, she was also missing. These two situations were extremely stressful for both Lars and his wife.

One of the representatives from ICTD started to ask follow up questions like: “How far away did your wife go?”, “What is the maximum reach of the sender and receiver?” During the discussion the NOKD supported his ideas and recognized them-selves in the description from Lars. The NOKD claimed that the maximum reach of the sender and receiver should be 500 meters, longer reach is not necessary. After the brokering situation the ICTD started a discussion and their opinion was that this input from Lars was really important. “Maybe this is the first time we really understand the life situation of a NOKD”. I asked Lars why he did as he did and the answer was: “Because the ICTD and HLL listen to our opinion and to some extent are engaged in our wellbeing.”

From a COP perspective Lars acted as a broker [8] using a boundary object (the newspaper clip) [10]. The effects of the brokering and boundary object was twofolded: i) a deeper understanding of the life situation (ICTD) and, ii) a design guideline (a reach of 500 meters and near the home range). Lars presented the newspaper clip at a group meeting, attended by three different COP's, which lead to a process of perspective making and perspective taking [17] involving all three COP's. The dynamics in the brokering situation involved many people from three COPs, many ideas and some boundary objects, this is not that well described in the literature [13]. At the end of the brokering situation, the ICTD could answer questions like: “Why their product is important?”, “Where their product should work?”, “What it should do?”, “And to some extent how it should work?” The discussion had an impact on ICTD and the continued development of the ICTD product. When Lars described why he did as he did, he described that the brokering situation is dependent on earlier brokering situation, that a kind of trust has been established during the engagement in the scenario brokering situation.

4.4 The questionnaire brokering situation

The third brokering situation took place when the NOKD was asked to fill out a questionnaire. In the questionnaire there were seventeen statements and The NOKD should rank the statement from the most important “1” to the least important “6”. They were not allowed to rank all statements - they had to choose six out of the seventeen. After the NOKD had filled out the questionnaire the HLL made a quick summary and presented the result (based on the score) to ICTD and NOKD (Table 3).

The result started a rather loud discussion between members of the NOKD and also between NOKD and ICTD. One of the most frequent comments between members of the NOKD was: “Did you choose that statement?”, “I didn't, but I think that it is important.” Most of the questions from the NOKD to ICTD included: “Is it possible to have that function?”, “Does it cost any extra?”, “How exactly will you do this?”. The NOKD was very curious about how the ICTD should develop the new improved prototype. After the discussion I talked to the ICTD and asked: “What did they think about the result?” The answer was: “we take the result seriously; mostly dependent on that we had been involved in the process. If we had not been involved there is a chance that the result could end up in the bottom of my desk drawer.”

The next of kin should be able to control the geographical position of the demented.	1
It is important that the sender and receiver should be simple and easy to use, with few functions.	2
Indication of the battery status.	3
The receiver should indicate direction.	4

Table 3: Ranking from the questionnaire

In the above described brokering situation there were boundary objects-in-use [10]: the questionnaire and the result of the questionnaire. Notable is that the boundary objects were related to each other in the brokering situation, i.e. what happened in one situation affects the other situation. Both the ICTD and NOKD were in a sense brokers by actually ranking statements and discussing the statements. Trust appeared to be really important and trust was built by taking part and being engaged in the process of perspective making and perspective taking. The ICTD was involved in the making of the questionnaire and they had also been involved when Lars was telling his story, and participated in an open dialogue with the NOKD. A trust that was established in the process affects the trustworthiness of an object that

could be a boundary object-in-use. Notable is that the 500m limitation of the sender was not among the high ranked statements, which indicates a need of a follow-up process on relation between brokering situations.

4.5 The prototype brokering situation

The fourth and last brokering situation had the main objective to build and design a low-fi prototype (Fig 3). At the workshop the NOKD had to their help: paper, pencils with different colours, flower foam bricks, scissors, sticky tape, post-it notes and scalpels. The instructions was just: “lets get creative in the designing of a low-fi prototype”. Before the workshop HLL and ICTD had a discussion about “How will the workshop go?”, “How will the NOKD react to this workshop?”, “Will they be engaged?”. Most of the NOKD’s members were over 65 years. When the workshop started they really started to work, there was absolutely no reason for our earlier concerns. They discussed different solutions, draw sketches and used the scalpel in cutting the flower foam brick and laughed a lot. After about 90 minutes they presented their low-fi prototypes of the sender and receiver. A loud discussion started during the presentation of their different ideas and the ICTD had a lot of questions. One of the groups presented a receiver inspired from a compass which should show the indication of direction (Fig 3). The sender would be inside a piece of jewellery and there were mainly two reasons behind this solution: the demented should want to wear the sender and for a demented person routines are important and it is easier to learn a new routine if the demented wants’ to wear the sender.



Fig 3. Left: a paper prototype of the receiver and the sender as inside a piece of jewellery. Middle the sender with a nametag and a button. Right a receiver made of paper, flower foam brick and flower sticks.

The other group presented a low-fi prototype of the receiver (to the right in fig 3) that should be easy to grip, light-emitting diodes in the top indicating the direction and to the left indicating the distance. The prototype also contained a speaker that responded when a person pushed the button on the sender. The sender should have a nametag (middle fig 3), the main reasons behind this are that a demented person can forget their name and the space on the sender was unused.

After the workshop the ICTD was surprised by the engagement, the quality of the prototypes, the ideas and that the process has worked out so well. This was the first time that they had really worked together with users (creating artefacts and taking part in group discussion) during a longer process. In other innovation processes they had used the users as a control group of ideas.

In the above described brokering situation all of the low-fi prototypes were boundary objects-in-use (Fig 3). The discussion in the groups between NOKD and ICTD is an example of brokering, were it was rather unclear who the broker was. If we compare the prototypes with the result from the questionnaire and the newspaper-clip it became clear that there were contradictions, but also consistencies in the process. The first contradiction was that in the questionnaire “simplicity”, “easy to use”, “few functions” were very high ranked. But the actual prototype was complex with new functions (speaker) and many light-emitting diodes. The second contradiction was that geographical position (visualized on a map by mobile or web), was mentioned in the scenario as well as high ranked in the questionnaire but, was not mentioned in the presentation of the prototypes, neither by the ICTD nor the NOKD. The prototype was consistent with the earlier results: indication of direction and intended to be used 500 m within home range.

5 Product/service and process brokering in an innovation boundary context

The TFP innovation process has been described as interaction between three communities of practice [8, 14]. Therefore the analysis is to a great extent influenced by the dynamics in brokering situations in an innovation boundary context, including brokering and boundary objects. We will highlight the following

three considerations and implications for understanding and facilitating an innovation boundary context in a living lab process:

1. Boundary context for establishing trust and engagement

The research indicates that innovation activities in a boundary context are about feeling comfortable with the actual environment. We saw how the NOKD actually felt comfortable in the apartment where their demented family members and next of kin's usually met. The physical layout and facilities in the functional areas within the factual room space played a vital role for establishing a familiar environment for the brokering situation. By making the environmental prerequisites and conditions highly visible and present as a boundary context in the living lab process have led to that the NOKD feel their interests were accommodated more effectively. Also, it was in this room, or apartment, where the NOKD had all their meetings and performed much of their daily activities together. By being in their space might empower the NOKD group and makes them more accountable for important input (perspective making) in the living lab process.

In order to meet a user group's need for more convenience in a brokering situations, we argue for consider the importance of the boundary context when dealing with trust and engagement during innovation activities in a living lab process. In the literature about inter-community interaction, trust and engagement (and the underlying dynamics) needs to be explored further [13]. However, the knowledge and competence of the NOKD was truly important for the product/service brokering in the innovation process (Fig 4). It was necessary to bridge the gap between their problems and needs of the ICT product as well as their related use of it in the later run.

2. Product/service and process brokering in the boundary context

Herein, brokering is about alignment and creating meaning [13, 19, 20] on two different levels: *product/service and process level* (Fig 4). The product/service brokering situations could be described as a process of perspective making, perspective taking [17] between NOKD and ICTD where boundary objects was used. One example of *product/service brokering* is when Lars shows the newspaper-clip and talks about his wife. In a sense it was more of perspective making and less perspective taking from NOKD and the opposite from ICTD (Fig 4). The underlying reason why he did it, he described as trust "the developers listened" and that he had become engaged in the process.

The *process brokering* aims to facilitate that constant iteration, feedback and reflections are undertaken as an interactive dialogue during and between group activities, which is considered important for innovation from a more process-oriented view. Herein the *process brokering* is an iterative process which aim's to facilitate reflections and creations of perspective taking and engagement activities. For this purpose we have identified the need and necessity of an emergent boundary spanning competence. The appearance of a new role took place [10]. The role can be regarded as an expert on process brokering for product/service brokering situations. We could see several situations where the role was undertaken by the HLL community members, by their engagement in developing a common viewpoint that adequately captured the dynamics of relations between the other communities of practice. This role was played out both spontaneously and intentionally by the HLL community members. The aim of this role-taking was primarily to break boundaries in order to reach to mutual understanding between the various communities of practice. The process broker can help maintain the legitimacy of the organization by providing information to important client groups, stakeholder groups or communities.

3. The role of boundary-objects-in-use

The workshops in the TFP innovation process were built around activities and artifacts' [10]. In many *product/service brokering situations* the activities, such as creating scenarios, were intertwined with the artefacts used, boundary-objects-in-use, for instance, a discussion between COP's, during a group activity. The idea's of boundary spanners-in-practice and boundary objects-in-use [10] are supported by the empirical data.

Several boundary objects were used, produced and re-produced with the particular focus on innovation of the product. For instance, one such boundary objects-in-us negotiated in the living lab process was the scenario that was related to the mind-map, which in turn was related to the questionnaire and the prototype. This is an example when *process brokering* is about handling and preparing boundary-objects-in-use. Another example was about the consistency and contradictions between the boundary objects-in-use, which then were needed to be handled in the *process brokering*, including negotiating boundary objects-in-use.

In this section we have presented three implications for understanding and facilitating an innovation boundary context in a living lab process. These three implications indicate that facilitating could be understood as process brokering for product/service brokering situations in a boundary context with

regard to trust and engagement. The process and product/service brokering is visualized together with the perspective making and taking process in the process model (Fig 4).

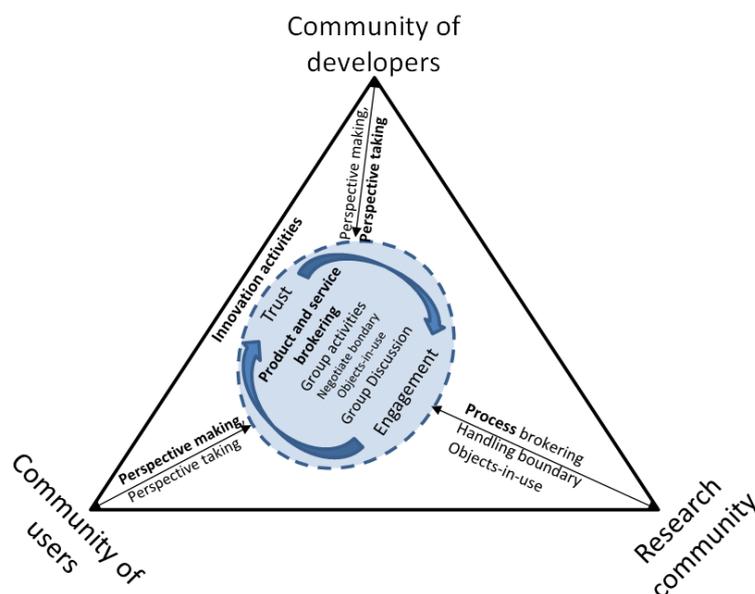


Figure 4: The process model of an innovation boundary context

6 Concluding remarks

Our results clearly indicate that a boundary context has impact on the innovation process. First of all, these activities led to actions and consequences that were important to the subsequent phase in the innovation process, i.e. learning from iterations and actions. The emergent properties of distinguished actions undertaken by the different community members formed a good basis for interaction and learning across community boundaries. Members from the three communities combined and transformed different views as well as objects of concern for the innovation process, such as problem motivation, scenario descriptions, prototypes etc, things and views that someone thought of as being important for motivating the project, for reaching the goal, for taking the “right” action.

The research provided us with insights from the dynamics of the interactions that occurred between the various types of stakeholders in a living lab innovation process. The dynamic interactions are described in a process model (Fig 4), which consists of a number of essential activities and functions that were considered important in order to facilitate both process brokering and product/service brokering situations for a dynamic innovation boundary context. The boundary context, within which the activities occurred, played a vital role for the overall concern of boundary interaction and learning. Herein, boundary objects-in-use, product/service and process brokering was connected with other issues such as empowerment and trust in an intertwined process. Thus, we consider the process model (Fig 4) to be a conceptual description of an innovation process, consisting of intertwined product/service and process brokering situations. We direct this process model as our contribution to innovation theory as we conceptualize the dynamics in an innovation (living lab) process from a community of practice perspective in that model. The innovation process context for our research is the innovation process with three different COP’s. This differs from the innovation process context in the article by Levina and Vaast (2005), where the context is between two firms or between two departments within a firm.

References

1. OECD, *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data*. 3rd ed, ed. N. Tanaka, M. Glaude, and Fred Gault 2005: OECD Publishing.
2. Chesbrough, H., *The Era of Open innovation*, in *Managing innovation and change*, D. Mayle, Editor 2006, Sage.
3. Hippel, E.v., *Democratizing innovation* 2005: MIT Press.
4. Eriksson, M., V.-P. Niitamo, and S. Kulkki *State-of-the-art in utilizing Living Labs approach to user-centric ICT innovation - a European approach*. 2005.

5. Ancona, D.G. and D.F. Caldwell, *Bridging the boundary: External activity and performance in organizational teams*. *Administrative Science Quarterly*, 1992. **37**(4): p. 634-665.
6. Aldrich, H. and D. Herker, *Boundary Spanning Roles and Organizational Structure*. *Academy of Management Review*, 1977(2): p. 217-230.
7. Cohen, W.M. and D.A. Levinthal, *Absorptive Capacity: A new perspective on learning and innovation*. *Administrative Science Quarterly*, 1990. **35**(1): p. 128-152.
8. Wenger, E., *Communities of practice: learning, meaning, and identity* 1999, Cambridge: Cambridge University Press.
9. Star, S., *The structure of ill-structured solutions: boundary objects and heterogeneous distributed problem solving*. *Distributed artificial intelligence*, 1990. **2**.
10. Levina, N. and E. Vaast, *THE EMERGENCE OF BOUNDARY SPANNING COMPETENCE IN PRACTICE: IMPLICATIONS FOR IMPLEMENTATION AND USE OF INFORMATION SYSTEMS*. *MIS Quarterly*, 2005. **29**(2): p. 29.
11. Bergvall-Kåreborn, B., M. Holst, and A. Ståhlbröst. *Concept Design with a Living Lab Approach*. in *Proceedings of the 42nd Hawaii International Conference on System Sciences - 2009*. 2009.
12. Ståhlbröst, A., *Forming Future IT - The Living Lab Way of User Involvement*, in *Department of Business Administration and Social Sciences* 2008, Luleå University of Technology: Luleå.
13. Hislop, D., *The Paradox of Communities of practice: Knowledge sharing between communities*, in *Knowledge Networks: Innovation through Communities of practice*, P.M. Hildreth and C. Kimble, Editors. 2004, Idea group: London.
14. Wenger, E., R. Mcdermott, and W.M. Snyder, *Cultivating communities of practice* 2002, Boston: Harvard Business School Press.
15. Brown, J.S. and P. Duguid, *Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation* *Organization Science*, 1991. **2**(1): p. 40-57.
16. Cook, S.D.N. and J.S. Brown, *Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing*. *Organization Science*, 1999. **10**(4): p. 381-400.
17. Boland, R. and R. Tenkasi, *Perspective Making and Perspective Taking in Communities of Knowing* *Organization Science*, 1995. **6**(6): p. 350-372.
18. Yoo, Y., K. Lyytinen, and R.J. Boland. *Distributed Innovation in Classes of Networks*. in *Proceedings of the 41st Hawaii International Conference on System Sciences*. 2008.
19. Lundkvist, A., *User networks as sources of innovation*, in *Knowledge Networks: Innovation through Communities of practice*, P.M. Hildreth and C. Kimble, Editors. 2004, Idea group: London.
20. Manville, B., *Building customer communities of practice for business value: Success factors from Saba Software and other case studies*, in *Knowledge Networks: Innovation through Communities of practice*, P.M. Hildreth and C. Kimble, Editors. 2004, Idea group: London.
21. Lave, J. and E. Wenger, *Situated learning: legitimate peripheral participation* 1991, Cambridge: Cambridge University Press.
22. McKay, J. and P. Marshall, *The dual imperatives of action research IT and People*, 2001. **14**(1): p. 46-59.
23. Schein, E.H., *The Clinical perspective in fieldwork*. *Qualitative research methods serie* 1987.
24. Schein, E.H., *Process consultation, action research and clinical inquiry: are they the same?* *Journal of Managerial Psychology*, 1995. **10**(6): p. 14-19.
25. Preece, J., Y. Rogers, and H. Sharp, *Interaction Design: Beyond Human-Computer Interaction* 2002: Wiley.
26. Svensson, J. and C.I. Eriksson. *Challenges with User involvement in a Living Lab context*. in *eChallenges 2009*. 2009. Istanbul.
27. Buzan, T., *The MindMap book* 1995, London: BBC Books.
28. Bergvall-Kåreborn, B., et al. *A Milieu for Innovation – Defining Living Labs*. in *ISPIM 2009*. 2009. New York.

On results of scientific research

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Abstract.

The most guide books on research work concern one type of research only. Therefore different types of research results had scattered into different outlets, and they are difficult to find. In this paper our aim is to collect various types of research results. We shall also show that our collection is best this far, and we shall shortly evaluate which kinds of results are most desirable.

Keywords: Research result, finding, output.

1 Introduction

The motivation for this paper comes from my experiences on guiding some dissertations and diploma works. Students clearly have difficulties to perceive what their results are. One reason might be that we nowadays have a multitude of acceptable research approach. Earlier physics with theoretical and empirical physics played a leading role in science. The laws of nature were then derived. Such a theory presented as a certain law of nature predicted and explained a particular phenomenon of nature. The ideal of scientific research in physics was thereafter followed in behavioral sciences, too, and the laws of nature were later applied to design research. These enlargements brought some new conceptualizations and methods with. The multitude of scientific terminology increased to such an extent that it was difficult to master. The purpose of this paper is to collect different research results, to classify them and shortly evaluate their value. The rest of this paper is structured into analysis of different results types, their comparison with the best classification this far and a tentative evaluation of the value of research results in general.

2 Different Types of Results in Information Systems Research

We shall organize this section according to the chapters in our book “On research methods” (Järvinen 2004), although the method is not necessarily the most important factor to characterize potential results. The titles of chapters are: Conceptual-

analytical research, theory-testing research, qualitative, interpretive and new theories creating research, design-science research and mathematical research.

Conceptual-analytical research

The citation from the book (Järvinen 2004, p. 10): “In conceptual-analytical studies basic assumptions behind constructs are first analyzed; theories, models and frameworks used in previous empirical studies are identified, and logical reasoning is thereafter applied; finally a new tentative theory, model or framework describing a certain part of reality is developed.” The object of the conceptual-analytical study is a reality or a part of reality, but there is no empirical contact with reality.

There are two bases of this type of study: 1) the earlier studies and 2) the assumptions of reality. A researcher derives her constructs, frameworks, models, theories or methods from those two bases by analytical reasoning. A certain construct can be composed of one or more concept. Concepts or concretely said terms refer to different concrete and abstract objects and entities.

Gregor (2002, p. 15) describes the most important results of scientific research, a *theory* as follows: “It answers a human need to make sense of the world and to accumulate a body of knowledge that will aid in understanding, explaining, and predicting the things we see around us, as well as providing a basis for action in the real world”. Weber (2003) states that a *theory* in information systems contains constructs, relationships, and lawful state and event spaces. From the latter we receive a *relationship* as new type of the research result, and it is presented as $A \rightarrow B$, where A and B are two variables. The theoretical *framework* and *model* are close to theory and contain many concepts and between them many relationships. A framework and/or a model is a tentative theory with no or few empirical evidence this far.

Gregor (2002, 2006) also developed the categorization of theory with 5 types. The categorization of theory depends on the primary purpose that the theory under consideration is to serve. She describes five different types of theory that are seen as relevant. These five different categories of theory are not regarded as mutually exclusive, but are inter-related.

The Gregor’s five types of theories

Type I: Theory for Analyzing and Describing

Descriptive theory says “what is”. Descriptive theories are the most basic type of theory. They describe or classify specific dimensions or characteristics of individuals, groups, situations, or events by summarizing the commonalities found in discrete observations.

There are two categories of descriptive theory – naming and classification. A *naming theory* is a *description of the dimensions or characteristics of some phenomenon*. A classification theory is more elaborate in that it states that the dimensions or characteristics of a given phenomena are structurally interrelated. The dimensions may be mutually exclusive, overlapping, hierarchical, or sequential.

Classification theories are frequently referred to as typologies, taxonomies or frameworks.

Research approaches for building descriptive theory include analysis of existing evidence or data, philosophical and historic enquiry and empirical observation.

Type II: Theory for Understanding

This type of theory explains “how” and “why” something occurred. It is not formulated in such a way, however, that predictions about the future are made so that they can be tested.

At least two types of work may be distinguished here. In the first, theory is used as a “sensitizing device” to view the world in a certain way, often called as *meta-theories*. The point of theory, in this view, is not to generalize, because many generalizations are widely known and rather dull. Instead, theory is a ‘surprise machine’ .., a set of categories and domain assumptions aimed at clearing away conventional notions to make room for artful and exciting insights. - Examples of theory used in this way in information systems are structuration theory and actor-network theory.

In a second type of theory for understanding, “*conjectures*” are drawn from a study of how and why things happened in some particular real world situation. These conjectures could form the basis of subsequent theory development, or be used to inform practice.

Research approaches that can be used to develop this type of theory include case studies, surveys, ethnographic, phenomenological and hermeneutic approaches and interpretive field studies.

Type III: Theory for Predicting

Theories aiming at prediction say “what will be”. These theories are able to predict outcomes from a set of explanatory factors, without necessarily understanding or explaining the causal connections between the dependent and independent variables.

Associated research approaches include statistical techniques such as correlational or regression analysis. Correlational work can be longitudinal, that is, we can show how Y varies with a number of independent variables (X_1, X_2, \dots) over a time period. Correlation studies can also be multi-directional, that is we can say larger values of X are related to larger values of Y, and also larger values of Y are related to larger values of X (as in height and weight of the population).

Type IV: Theory for Explaining and Predicting

This type of theory says “what is”, “how”, “why” and “what will be”. To many it is the real view of theory (the traditional view).

A theory is a set of interrelated constructs (concepts), definitions, and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena. This is the *classical* view on theory.

This theory type implies both prediction and understanding of underlying causes, as well as good description of theoretical constructs. Authorities can be found for the dimensions and specification of theories of this type.

In the social sciences the predictions made are not expected to take the form of universal or covering laws, but rather to be probabilistic-type propositions.

Almost all research methods can be used to investigate aspects of theory of this type, including case studies, surveys, experiments, statistical analysis, field studies, and also interpretive methods if they are used to build theory with predictive power. The grounded theory approach can be used to develop theory, which is at some point capable of prediction, and thus being tested.

Type V: Theory for Design and Action

Theory for Design and Action says “how to do something”.

This type of theory has two aspects. First, it can concern the methodologies and tools used in the development of information systems. Second, it can be about “design principles”, which are design decisions and design knowledge that are intended to be manifested or encapsulated in an artifact, method, process or system. In both cases it must be possible to articulate the principles instantiated in the method, tool, process, or design. It is this articulation, whether in natural language, diagrams or similar, that constitutes the design theory.

Some clarifications

We use *concepts* or concretely said terms referring to different concrete and abstract objects and entities. A construct can be a concept or a composite one. Phrases *composite constructs* and *formative constructs* are used when they are referring to constructs made up of formative measures. *Latent variable*, on the other hand, is a term that has sometimes been associated in the literature with reflective measures. *Reflective constructs* are used throughout the information systems literature for concepts such as perceived ease of use, perceived usefulness, and satisfaction. Such reflective constructs have observed measures that are affected by an underlying latent, unobservable construct. Changes in the underlying construct are hypothesized to cause changes in the indicators, meaning that respondent variations in the latent construct of perceived ease of use, for example, will cause *all* of its measures to reflect this change. By way of contrast, formative constructs are a composite of multiple measures. Unlike reflective measures where a change in the construct affects the underlying measures, *formative constructs* work differently: changes in the formative measures cause changes in the underlying construct. One example of a formative construct could be organizational performance operationalized using three measures: productivity, profitability, and market share. Each measure captures differing aspects of organizational performance, and as a result, this operationalization of the construct is formative. (cf. Petter et al. 2007, p. 624)

We pay also attention to term ‘method’. It can have two stances, descriptive and normative ones. The descriptive *method* describes how transformations happened; the normative method describes how actions should happen, when the purpose to transform a system from the initial state to the target state.

Theory-testing research

In the theory-testing study we shall answer to the question: Does a particular theory, model or framework well describe a certain part of reality? In a more detail, do our experiments, field or case studies confirm or falsify our theory, model or framework? The final outcome from this type of studies is either confirmation or falsification. The theory-testing studies concern Gregor's Type III and IV theories.

Qualitative, interpretive and new theories creating research

In the theory-creating study we shall answer to the question: Which kind of theory, model or framework best describes or explains a part of reality? In a more detail, as which kind of theories, models or frameworks can we describe and explain our observations? The theory-creating studies concern Gregor's Type I and II theories.

In general, researchers are interested in finding what is a part of reality, i.e., to find out the truth, but phenomenography (Marton, 1982) is intended to describe, analyze and understand conceptions: the aim is to describe the qualitative different ways in which various aspects of reality are seen and conceptualized and to search for logical relations between the categories of description arrived at.

Design-science research

In the design research we shall answer to the questions: Can we build a certain innovation and how useful is a particular innovation? We can also ask, which kind a certain innovation ought to be, and how ought we to build a particular innovation? In *building* a new innovation utility aspects are striven and a particular (information systems) development method is applied. In *evaluation* of the innovation, e.g. an information system, the realized final state is compared with the desired goal state, and maybe some criteria are used and some measurements performed. The measurement instrument for evaluation of the goodness of an innovation is called the *goal function* under which all kinds of different interests can be collected (cf. Järvinen 2007). The design research studies concern Gregor's Type V.

Both the theory-testing and theory-creating studies emphasize the descriptive nature of the study and finding out the truth. It could be called descriptive research, how things are. But design research brings values into consideration. The old unsatisfactory state is wanted to be transformed into the new desired state. Design research is therefore called prescriptive research how things ought to be. One type of results produced by design research is prescriptions: The logic of a prescription is 'if you want to achieve Y in situation Z, then perform action X'.

According to March and Smith (1995, pp. 257-260) design science products are of four types, constructs, models, methods, and instantiations. We use their definitions. *Constructs* or concepts form the vocabulary or language of a domain. A *model* is a set of propositions or statements expressing relationships among constructs. A *method* is a set of steps (an algorithm or guideline) used to perform a task. An *instantiation* is the realization of an artifact in its environment. Hevner et al. (2004) use the same classification for results of design research. We (Järvinen 2004) enlarged design

research results from the technical innovation to the social and informational ones, too.

Mathematical research

Mathematical methods concern formal languages, algebraic units etc., in other words, symbol systems having no direct reference to objects in reality. In *mathematical* studies some invariances are considered, i.e., a certain theorem, lemma or assertion is proved to be true (cf. Aulin 1989).

3 Discussion

In this section we first collect the results from our consideration above into the following table and thereafter compare our results with the Hevner et al. (2004, p. 75).

Table 1. Different result types

Concept Construct (formative, reflective)
Relationship
Framework Model Theory (descriptive, meta-theories / conjectures, predictive, explanatory, desired state)
Method (descriptive, prescriptive/normative)
Instantiation (technological, social and informational innovation)

Hevner et al. (2004) combined “two paradigms characterizing much of the research in the Information Systems discipline: behavioral science and design science. The behavioral-science paradigm seeks to develop and verify theories that explain or predict human or organizational behavior. The design-science paradigm seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artifacts. Both paradigms are foundational to the IS discipline, positioned as it is at the confluence of people, organizations, and technology.” To our mind, Hevner et al. presented the widest list of scientific results in Information systems that far.

Table 1 above will be compared with knowledge base (foundations and methodologies) presented by Hevner et al. (2004). They write that (p. 80) “knowledge base provides the raw materials from and through which IS research is accomplished. The knowledge base is composed of foundations and methodologies. Prior IS research and results from reference disciplines provide foundational theories, frameworks, instruments, constructs, models, methods, and instantiations used in the develop/build phase of a research study. Methodologies provide guidelines used in justify/evaluate phase.” The following items are classified under title Foundations: Theories,

frameworks, instruments, constructs, models, methods, instantiations, and under title Methodologies: Data analysis techniques, formalisms, measures and validation criteria. In our table there seem to be all other foundations than ‘instruments’, but an instrument is used to measure a certain latent variable, and we call it construct. Hence all the foundations are in our table. From the items mentioned under title Methodologies ‘data analysis technique’ is a method in our terminology, ‘formalism’ is a result from mathematical studies, ‘measure’ is a construct and ‘validation criterion’ is a concept. We can conclude that our result types in Table 1 at least cover the same items that exist in the knowledge base presented by Hevner et al. (2004). Actually our set of results is tighter than that presented by Hevner et al. because differentiated constructs into reflective and formative ones, theories into 5 classes and instantiations into 3 classes.

Results compared with the earlier literature

Our results can be novel, supporting the earlier findings and contrasting with the earlier findings. The novel results are very much valued but the value of the studies that support the earlier results is controversial. We shall first consider result types with *novel* results and thereafter two others.

On the novel results

New *concept* can be found in a theory-creating study. Deetz (1996) focuses on the origin of concepts and problem statements as part of the constitutive process in research. Differences among research orientations can be shown by contrasting “local/emergent” research conceptions with “elite/ a priori” ones. - The key questions this dimension addresses are where and how do research concepts arise. In the two extremes, either concepts are developed in relation with organizational members and transformed in the research process or they are brought to the research by the researcher and held static through the research process – concepts can be developed *with* or applied *to* the organizational members being studied.

A researcher develops new *constructs* (reflective and formative) (cf. Petter et al. 2007) for theory-testing studies and the suggested constructs are pretested in many ways before the acceptable use. (cf. Boudreau et al. 2001).

A new *relationship* can be found in many ways. In the theory-testing study a researcher can include a new relationship into the theoretical framework, model or theory to be tested. The empirical support is needed for the new relationship. A researcher can find a new relationship in her theory-creating study, for example, by applying the grounded theory method to the collected raw data. A researcher can also find a new relationship in design research when she is testing her new prototype of the desired artifact.

A new theoretical *framework, model or theory* can be found in two ways, based on theoretical-analytical approach or on empirical theory-creating approach.

A new descriptive *method* can be found in connection with the theory-creating study and a new prescriptive method in connection with action research and design research.

A new *artifact* can be built in design research.

On the results supporting or contrasting

Such results that *support* the earlier findings or *contrast* with the earlier findings can be considered together. A chance where supporting (or contrasting) is usually possible is the theory-testing study. If the hypotheses derived from the theory tested will receive an empirical support from the observations made we say the theory is supported. If the observations do not have any evidence for the hypotheses then the theory tested will be falsified. Another study type where supporting (or contrasting) is possible is design research. The idea to achieve the desired state can in a particular design project be based on a certain relationship between two variables, and this relationship had been found in natural or behavioral studies. If the desired state is really achieved, then the relationship will receive support, in the opposite case, the relationship will be falsified. The third study type, the theory-creating study can also support (or contrast) a certain theory or relationship. The new tentative theory synthesized from raw data can be similar (or dissimilar in the contrasting case) as some found in the earlier literature or the new theory can contain a similar (or dissimilar) relationship found earlier.

The design project and the theory-creating study differ from the theory-testing study. The purpose of the latter is the repetition of a certain earlier study but the purpose of the formers is not. The repetitive studies are recommended and criticized. Colquitt and Zapata-Phelan (2007) analyzed the section "Information for Contributors" the editors (in Academy of Management Journal) wrote. During the period 1999-2004 they cited that "Manuscripts that offer an original theoretical and empirical contribution, but one that is small in scope, may be published as research notes ... Replications of previously published work and very incremental research rarely offer enough of a contribution to warrant publication." (p. 1303). Berthon et al (2002, p. 416) have an opposite view when they writ that "replications are an important component of scientific method in that they convert tentative belief to accepted knowledge".

References

Aulin A.: Foundations of Mathematical System Dynamics: The Fundamental Theory of Causal Recursion and its Application to Social Science and Economics. Pergamon Press, Oxford (1989)

Berthon P., Pitt, L., Ewing M., Carr C.L.: Potential Research Space in MIS: A Framework for Envisioning and Evaluating Research Replication, Extension, and Generation. *Information Systems Research* 13, No 4, 416 -- 427 (2002)

Boudreau M.-C., Gefen D., Straub D.W.: Validation in Information Systems Research: A State-of-the-Art Assessment. *MIS Quarterly* 25, No 1, 1 -- 16 (2001)

Colquitt J.A., and Zapata-Phelan C. P.: Trends in Theory Building and Theory Testing: A Five-Decade Study of the Academy of Management Journal. *Academy of Management Journal* 50, No 6, 1281 -- 1303 (2007)

Deetz S.: Describing Differences in Approaches to Organization Science: Rethinking Burrell and Morgan and their Legacy. *Organization Science* 7, No 2, 191 - 207 (1996)

Gregor S.: DesignTheory in Information Systems. *Australian Journal of Information Systems*, Special Issue, 14 -- 22 (2002)

Gregor S.: The Nature of Theory in Information Systems. *MIS Quarterly* 30, No 3, 611 -- 642 (2006)

Hevner A.R., March, S.T., Park J., Ram S.: Design Science in Information Systems Research. *MIS Quarterly* 28, No 1, 75 -- 105 (2004)

Järvinen P.: On research methods. *Opinajan kirja*, Tampere (2004)

Järvinen P.: On reviewing results of design research. <http://www.cs.uta.fi/reports/sarjad.html>

Petter S., Straub D., Rai A.: Specifying Formative Constructs in Information Systems Research. *MIS Quarterly* 31, No 4, 623 -- 656 (2007)

Weber R.: Theoretically Speaking. *MIS Quarterly* 27, No 3, pp. iii -- xii (2003)

Studying Users and Virtual Prototyping in Machine Design

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Abstract. Our current research interest relates to the conceptual design phase of mobile work machines. In this context virtual environments offer an effective way to present prototypes of machines and provide means to study the drivers' work tasks. Our aim is to approach this research area from users' perspective. We understand that it can be done through alternative theoretical frames in which the focus varies. In this paper we identify and evaluate three of the possible frames: technology, work situation and user experience. The result highlights that all of the frames are useful in different situations and contexts. However, the researchers should be able to understand other theoretical frames than their own ones and this paper helps the researchers to get a picture of alternative perspectives.

Keywords: User-centered system design, Virtual prototyping, Virtual environments, Machine design, Presence studies, Activity theory, User experience studies.

1 Introduction

A concept of the user is a starting point for the research and practice of information systems design, development, and evaluation [1]. User-centered system design studies face a challenge when traditional computing has changed to new forms. In traditional computing the use requires interpretation of basic symbolic representations such as numbers, 2D graphics, or texts [2]. Today computing can be connected for example to ubiquitous computing performing everyday activities such as driving a car or listening music or to immersive 3D virtual worlds where user can feel mediated experiences.

Therefore, we understand that the "culture of information and communication technology (ICT)" has changed. From the users' perspective, Yoo [2] define that users' needs are much broader than informational needs for task performance in organizations. Instead, such changes challenge traditional assumptions underpinning IS research, which often puts computers (in traditional organizational use) at the center of our discourse [3, 4].

As IRIS 2011 conference theme highlights this transformation will also affect to our own IS profession. ICT is not created in a vacuum or designed somewhere outside

our society. Either the researchers are not outside of “culture of ICT”. We approach this theme by focusing on a certain situation, namely virtual prototyping in machine design. We illustrate thought which theoretical frames the researchers aim to understand the “culture of ICT” in this situation: studying users and virtual work machines in immersive virtual environments (VEs). The theoretical frames also reflect researchers’ culture to study previous issues.

We decided to use this example from the practical motivation view-point. In most products of mechanical engineering the time-to-market and an understanding customer needs are today major factors in product success [5]. These goals can be achieved applying various tools of information technology for digital product process. Especially computer simulation has taken a major role in the entire product process. Conceptual design phase has generally acknowledged the most important part of the design process [6]. However, design tools for this purpose are immature and inadequate. Conceptual design phase is challenging because usually there is not enough time and information to employ detailed design models at this stage.

On the other words in the product design business, the human aspect and customers’ needs are one of the central issues. The customers’ needs can be identified with interviews, focus groups and observations of existing products [5]. However, the process of negotiation about customers’ needs is difficult, as it is multiprofessional cooperation, in which the participants have different assumptions about the result [7, 8].

This paper focuses on the use of VE as a tool in the conceptual design phase, especially to user-centered design. VE offers an effective way to study virtual prototypes and provides a means to study the drivers’ work tasks. This is provided by the fact that today’s design work is already performed using 3D CAD software. Virtual prototypes enables evaluation of several design alternatives at conceptual design phase between customers, engineers, industrial designers and other stakeholders giving fast feedback for next design cycle. Due to its high cost the virtual reality technology has mainly been used in large companies, especially in car and aerospace industry [9, 10]. However, there has been significant development in software and hardware available on market. As a result exploring 3D CAD models in VE can be accomplished with low cost PC devices. Applying this technology has already been subject of interest in many companies. However, when virtual prototyping has become technically and economically affordable, more emphasis needs to be paid on human experiments in VE and measuring of user experience (UX).

In this paper we outline that the focus on studying work machine related issues with using virtual prototypes depends on the theoretical frame. The research question is: *what kind of theoretical frames the researchers can use to study users and virtual mobile work machines?*

We understand that this question is multidisciplinary by its nature and so we seek the answer with a literature review of relevant journals. As a result we describe and evaluate alternative frames in which the focus varies. We illustrate the use of the frames by our practical example. Furthermore, the result helps the reader to evaluate and decide which kinds of frames are needed in special cases.

In the following we first describe the practical background of this study (virtual design of mobile work machines). Second we briefly open the literature review and

evaluation process. Our aim was not to evaluate frames so that we say that one of them is better than the others. Instead we focus on how theoretical frame and its assumptions influences to research process and results in the situation of virtual machine prototyping. Third we present the results (three frames and their evaluation) and discuss the results in the context of “culture of ICT”.

2 Practical Background

For this study the practical background is the control cabin of a moving work machine, examples in figures 1 and 2. In this paper, the role of the case is to illustrate the different focuses of the frames. Machine cabins are complex entities for highly specialized purposes in forest and mining machines. The machines are human-driven and produced in small series. Concurrent engineering is often needed because typically the machine and the control cabin have been designed by different engineering teams. To fit them together requires a number of trade-offs from both design teams.



Fig. 1. Virtual mobile work machine.



Fig. 2. Evaluation of virtual control cabin.

Designing a control cabin for a mobile machine is itself challenging because it necessitates numerous trade-offs between various design quantities, such as visibility, functionality, ergonomics, safety, and industrial design.

Driver’s *visibility* is an essential design quantity, and it is limited by the cabin construction and by the structure of the machine. Also the moving parts of the machine, booms for example, limit visibility. *Functionality* refers to the explicit man-machine interface through which the driver controls the position of booms. *Ergonomics* denotes the driver’s ergonomic work positions in the cabin. *Safety* refers to the solid construction which protects the driver in accidents such as falling of a tree on the cabin. *Industrial design* means esthetical quality both in the inside and outside of the cabin as well as the cabin's serviceability.

3 Literature Review and Evaluation Process

VEs offer an effective way to present prototypes of machines and provide means to study the drivers' work tasks. Our aim is to approach this research area from users' perspective. We understand that it can be done through alternative theoretical frames in which the focus varies.

For studying the possible frames, we first need to identify which of them have substances to closer look. We decided to find out frames that are used in this kind of contexts and are still apart from each other. Our aim was to focus first on the most common frame and also two alternatives. So we can see the diversity of this research field. To identify research frames we used a literature review of relevant journals such as *Presence: Teleoperators and Virtual Environments*, *Journal of Human-Computer Studies* and *Design Studies*. In the literature review we found that technology (presence studies) is the most common theoretical frame, and other different were work situation and UX.

Second we defined how to evaluate the selected theoretical frames. Our aim was not to evaluate frames so that we say that one of them is better than the others. Instead we focus on how used theoretical frame and its assumptions influences to research process and results in the situation of virtual machine prototyping.

4 Result: Evaluation of Frames

As an outcome of the literature review process we decided to focus on three alternative theoretical frames to study user, VE and virtual prototypes of working machines. The first one is the traditional frame in VE studies, which is the concept of presence. It focuses on the technological components, which are needed for providing a VE user the feeling of s/he is acting with a real product. The second frame focuses on the work task by using the extended version of activity theory. The third frame focuses on the individual user and her/his behavior and feelings within acting with the (virtual) product. However, this frame is based on the studies of UX especially those UX studies which focus on users' emotions. In the following we evaluate and illustrate these theoretical frames in context of virtual work machines.

4.1 Frame 1: Technological Environment for Users

The first frame for studying the work tasks in VE is presence, which is used in many virtual reality studies. The concept of presence is used to refer to a sense of realism in computer-generated environments. Such as vision and hearing which provide the user feels to be in a place other than their true location.

Walk-in VE offers 3D vision of the design and allows the user to move in respect to picture. This gives a very realistic feeling on moving inside a 3D picture. The human feeling of realism that is provided by VE is called presence which means human feeling of being there. One of the early interpretations [11] defines it as combination of interaction, immersion and autonomy, figure 3. However, the

concepts used in the VE field, are not yet established; for example, Zetzer uses the terms immersive and presence on the contrary [12] than presented in figure 3.

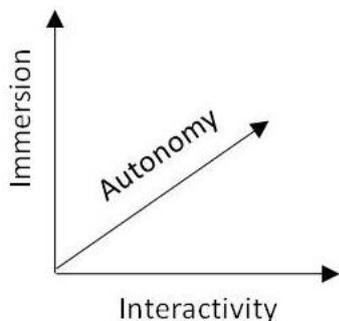


Fig. 3. Dimensions of presence in VE [12].

Fig. 4. Physical objects in VE.

Immersion means level of virtual reality facilities which supports users feeling of being in a synthetic environment giving sense perceptions such as vision, hearing. Most important factors are resolution and frame rate of the vision system. Also quality of the picture in virtual world such as number of polygons and texturing used are important. Important factors for hearing are quality of sound system as well as quality of sound source. *Interactivity* means level of user's possibility to interact with the virtual world. Usually this means locomotion but in the case of mobile machine it can be a possibility to drive the virtual machine. *Autonomy* means, for example, level of virtual objects to obey physical laws, such as gravitation, in virtual world. This increases credibility in more complex cases.

From Presence viewpoint the virtual test situation should be made as realistic as possible. However, available time and recourses for the task are limiting this. In visibility studies, for example, only the immersion is needed. Some *interactivity* is needed when functionalities of the machine such as movement of the boom structures, are tested in order to see their effect on visibility. *Autonomy* is needed in cases where more complicated work cases are studied for example to dropping of rocks (gravity effect) from bucket of the work machine.

Although VPs are considered to be virtual objects, they can't completely be virtual objects if good presence is sought. Driver is sitting in a control cabin and therefore VE need to have at least a bench. Also the most important man-machine-interfaces such as a driving wheel need to be real because they are touch by hands which includes is very sensitive human sense of touch [13], figure 4. If the immersion is incomplete, VE may also provide inconsistent feelings which easily disturbs the user and can even cause a simulator sickness. This problem can be emphasized if test users are first time in VE [14, 15].

In presence studies the goal is to make laboratory experiments where test situation is kept as constant as possible. In such experiments it is possible to measure quantities like time for the work task, number of errors made, etc. With eye-tracking devices it is possible to see which parts of the man-machine-interface the test driver actually saw. By using EEG-sensors it is even possible to measure mental load of the test driver.

4.2 Frame 2: Simulating Work Situation

As the first theoretical frame focused mainly in the technology, the second one opens as wide picture as possible: it focuses on the work tasks by using extended activity theory. The original activity theory focuses on an individual subject performing a task with an instrument - see the upper triangle in figure 5 [16]. In the case of cabin design, the subject corresponds on a driver, the instrument to the mobile machine and its cabin to the object comprising the task performed by the driver is doing.

Work tasks are not independent of other subjects; the tasks are done together or related to other works, customers or other stakeholders. Fundamental to modern activity theory is the idea that the development of thoughts and cognitive activity requires social interaction and exchange with a physical environment [11, 17, 18]. The social infrastructure is constituted by social rules, the community, and division of labour [11]. The factor of (social) rules refers to the explicit and implicit regulations, norm and conventions that constrain actions and interactions within the activity system [19]. People in an organization coordinate their actions towards a problem through the shared knowledge about rules and norms. The third factor of social infrastructure is the division of labour, or specialization, in the given organization.

As expanded activity theory (see figure 5) includes social interaction, it is a useful tool for analysing cooperative tasks, as product design. In the cabin case, the social interaction part includes community of designers and drivers who participates to the design process, their division of labour and the rules. The division of labour is the role which each designer has in the design process and drivers' role is to present how they act with the (virtual) machine and cabin. The behaviour norms in work cooperation include, for example, the respects of others' professionalism and the verbal presentation of the issues under design. However, the designers' and drivers' concepts differ from each others, so they hardly understand each other's word [20]. One way to overcome this problem, is to use an instrument (virtual prototype of cabin) which allows drivers to show their work practice (driving virtual mobile machine), instead of describing it with words.

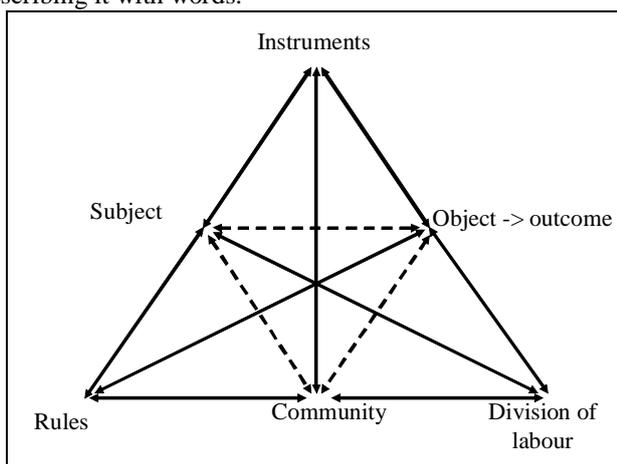


Fig. 5. Structure of organization activities [11].

This frame is not useful for laboratory tests, since the expanded activity theory included too many components for controlling. There are six elements and they all include several features (as subjects age, gender, education, work experience, ...); furthermore, the elements interact with each other.

When a study focuses on users' point of view with activity theory, then the main point is to make visible work practice and the needs for its development; as drivers' ways to act with mobile work machine and drivers' needs for improving the working situation. This approach may also indicate user's work practices which are against designed work practices such as misuse of machine.

4.3 Frame 3: Emotional User

The third theoretical frame to study users' work tasks in VE is taken from the studies of UX. In the literature UX is associated with a wide variety of meanings from traditional usability to experiential aspects of technology use [21]. Hassenzahl and Tractinsky [22] present three facets how UX can be studied in the HCI field and related areas (figure 6). In the following we illustrate first the facet in general and after that how the facet can be applied in the cabin design context.

The first facet deals with addressing human needs *beyond the instrumental*. The idea is to ensure the product's instrumental value. This means HCI research that focuses almost exclusively on the achievement of behavioral goals in work settings. [16] In the case of cabin design, it can mean measuring time: how fast user is able to do a specified task or how fast user learns a specific work task with machine.

UX studies of type of *beyond the instrument* are the traditional usability studies. There are similarities between them and the first frame *Technological environment for users* studies.

The second facet, *emotion and affect*, is mainly employed in the current UX research. It takes a human perspective by focusing on positive emotions, such as joy, fun and pride. These kinds of emotions are subjective, and humans and their feelings have to be taken into account. [22] This approach has many similarities with Kansei Engineering [23].

In the case of cabin design, this may mean issues such as users may find some parts of the virtual machine as gamelike; for example, they may enjoy driving the simulator. Furthermore, these kinds of studies may find some elements of the machine under design to be rewarding or boring, uncomfortable (to reach), disturbing or pleasing, for example.

The facet of *emotion and affect* shapes a new frame for studying users in VE. Instead of the first facet, now the users are seen subjective and emotional. As users are subjective, it means that they can be differences between test users. For VE test situation this means that it must be pondered what kinds of users are selected. Instead of viewing users mechanical, they are seen as emotional actors. This is towards more holistic view of human being, however, it makes VE test situation even harder: The users negative and positive emotions effect on their performance during VE test.

The third facet deals with the nature of experience. The *experiential* perspective on UX emphasizes two aspects of technology use: its situatedness and its temporality. In this view, UX is a broad concept that refers to a consequence of user's internal

state, characteristics of designed system, and the context within interaction occurs.

[22] In the case of cabin design, the elements are:

- user: the driver of the virtual machine,
- system: VE artifact and the virtual machine,
- context: virtual mine environment and the tasks there.

All of the elements are interrelated. The research may focus on how to interact and modify each other as a whole.

The *experiential* facet of UX studies is many ways similar than activity theory based Frame 2. Both of them view VE test situation as complex, situated and temporary. One difference between them is the context: using activity theory it is work context, but UX can also be connected to leisure time context. The other difference is the view of user: activity theory views users – or workers – belong to a work community, whereas the *experiential* facet of UX does not outline the essence of user.

Frame 1 focused on technology-oriented presence studies. However, there are more philosophical presence studies, as well, and their view of situation is close to the *experiential facet* of UX [24, 25].

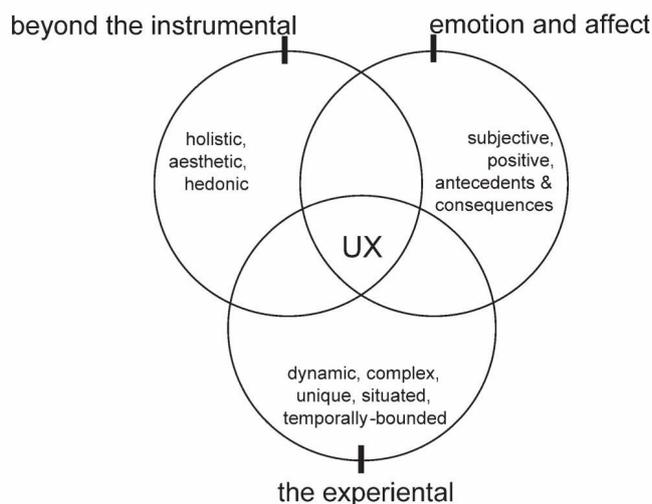


Fig. 6. Facets of UX [22].

5 Discussion

This paper presented the effect of a theoretical frame used on the research findings. We outlined three frames for studying VE users' actions with VPs. The frames' focuses varied, to make them useful in different situations. The summary of them is presented in Table 1.

The first frame focuses on creating a technological environment for users, as is often done in presence studies. In them, the underlying assumption is that more immersion gives a better presence for users. This frame is useful when some features, such as visibility, ergonomic and functionality, of a virtual product are evaluated in laboratory tests.

The second frame focuses on a work situation based on an extended activity theory, which includes a work community. In this frame the test users are workers (machine drivers) who belong to a work community which affects the workers' view of working rules and norms. This frame is useful when the virtual product must be seen in work practice – in our case this is how the cabin as a whole fits to all drivers' work tasks.

The third frame is the emotion and affect facet of UX studies. It is useful for targets similar to Frame 1, but when using Frame 3, the users are seen as emotional individuals whose evaluations of the product vary. So in this case the result of a user test gives different answers.

The three frames presented are not the only possible ones to use for studying users in VE. However, as they differ from each other in several aspects, they shape the manifold possibilities in using VE. Apart from the different theoretical frames, different research methods can be used in studying VE users. This creates plenty of opportunities in this field for qualified researchers.

Table 1. Summary of the frames.

FRAME	USER	TASK in VE	CABIN
Frame 1: Technological environment for users	- Mechanical view of human - No personal differences	- Controlled lab test - Measurable objective - Starting point: cabin features	- Visibility - Ergonomic - Functionality
Frame 2: Simulated work situation	- Member of work community - Situated acting	- Starting point: work practice - Description of work	- How cabin fits to work practice
Frame 3: UX (facet: emotion and affect)	- Subjectivity - Feelings, joy	- (Controlled) lab test - Measurable objective or users' own evaluation - Starting point: cabin features	- Subjective evaluation of cabin

5.1 Implications to “Culture of ICT”

Studying users and virtual prototyping is not itself a highly cultural issue. Instead the researchers are not outside of “culture of ICT” and so we understand researchers' work in relation to culture. First, users are studied using other than traditional computing (including numbers, 2D graphics, or texts) in organizational context. Our

focus is to study users when they evaluate virtual prototypes in 3D immersive VE. Second, in the context of “culture of ICT” the result challenges researchers to understand other view-points than they use and also multidisciplinary approaches. Disciplines in traditional social sciences are not well equipped to understand the transformative power of digital technology [2]. Science and engineering disciplines are not too concerned about the human experience. The IS researchers can take a major step towards this discussion. In the research efforts of virtual prototyping in machine design we see that we need different theoretical approaches related to research culture.

The IS discipline was born as a new discipline when digital artifacts (e.g., computers and communication technologies) were beginning to transform modern organizations [26]. Yoo [2] highlights that studying the new kind of users’ experiences allows us “to draw on a strong intellectual tradition in the IS discipline that examined the consequences of organizational work practices and structure through the use of information technology”. The IS researchers can employ these theoretical and methodological tools to study how users construct the world and thus shape their experiences. In the context of virtual prototyping in machine design there are plenty of new possible technologies available, but the problematic area seems to be how to fit users’ needs, technologies, and practice together. The IS research is needed in this changing “culture of ICT”.

5.2 Limitations and Future Research

Our paper includes also some limitations and implications for future studies. The presented three frames are not the only possible ones to use for studying users in VE. However, the frames show multidimensional picture of possibilities in using VE, as they differ from each other based on several aspects. There is a need to illustrate also use of other frames. Besides of the different theoretical frames, different research methods can be used in studying VE users. This makes even more possibilities for the researchers.

We used the practical example of virtual machine design. However, we decided not to use it as a case because this is a first attempt towards understanding alternative frames. The next step can be to demonstrate the use of the alternative frames with same case and experiments in it (through different theoretical frames). In addition, the use of the theoretical frames could be illustrated in different contexts. We assume that our result is possible to generalize to some similar situations when the researchers are interested in VE users, design and work tasks. Furthermore, in these situations our result helps the reader to evaluate and decide which kinds of frames are needed in special cases.

6 Conclusion

Researchers can use different theoretical frames when they study users, VEs and prototypes of working machines. We see theoretical frames as a cultural issue inside research work. In this paper, we evaluated three of possible frames: technology, work

situation and UX. Our aim was not to evaluate frames so that we say that one of them is better than the others. Instead the result of our study illustrates how used theoretical frame influences to research process and result. All of the frames are useful in different situations. This means that to understand the very fast developing "culture of ICT" researchers need to get a picture also from other perspectives and their underlying assumptions than researchers' own ones.

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References

1. Lamb, R., Kling, R.: Reconceptualizing Users as Social Actors in Information Systems Research. *MIS Quarterly* 27:2, 197--235 (2003)
2. Yoo, Y.: Computing in Everyday Life: A Call for Research on Experiential Computing. *MIS Quarterly* 34:2, 213--231 (2010)
3. Benbasat, I, Zmud, RW.: The identity crisis within the IS discipline: defining and communicating the discipline's core properties, *MIS Quarterly* 27:2, 183--194 (2003)
4. Orlikowski, W. J., Iacono, C. S.: Desperately Seeking the 'IT' in IT Research: A Call to Theorizing the IT Artifact. *Information Systems Research* 12:2, 121--134. 2001.
5. Ulrich, K.T, Eppinger, S.D.: *Product Design and Development*, McGraw-Hill, 3rd ed. (2003)
6. Pahl, G., Beitz, W.: *Engineering Design a Systematic approach*, Springer, 3rd ed. (2001)
7. Davidson, A.L., Schofield, J., Stock, J.: Professional Cultures and Collaborative Efforts: A Case Study of Technologists and Educators Working for Change. *The Information Society*, 17, 21--32 (2001)
8. Tiainen, T.: Bounded or Empowered by Technology? Information System Specialists' Views on People's Freedom within Technology, in Heiskanen, T. and Hearn, J. (Eds.), *Information Society and the Workplace: Spaces, Boundaries and Agency*, Routledge, London, UK, 29--46 (2004)
9. Seron, F.J., Gutierrez, D., Magallon, J.A., Sobreviela. E.A., Gutierrez, J.A.: A CAVE-like environment as a tool for full-size train design. *Virtual Reality*, 7:2, 82--93. (2004)
10. Schabacker, M., Sabeur, M., Vajna, S., 2006. INSIDES – A New Design and Simulation Platform for Virtual Prototyping in Automotive and Aerospace Industry. *Proceedings of ASME 2006 IDETC/CIE Conference*. Philadelphia. 8 p (2006)
11. Engeström, Y.: *Learning by expanding*. Orienta-konsultit, Helsinki, Finland (1987)
12. Zeltzer, D.: Autonomy, interaction, and presence. *Presence: Teleoperators and Virtual Environments* 1:1, 127--132 (1992)
13. Ellman, A., Laitinen, J., Tiainen, T.: Combination of Virtual and Physical Objects in User-centered Design of Mobile Work Machine Cabin. *Proceedings of IMECE2007, 2007 ASME International Congress and Exposition, November 11-15, 2007, Seattle, Washington, USA*, 6 p (2007)
14. Tiainen, T, Ellman, A, Katajamäki, T, and Kaapu, T.: Occasional Users' Experience on Visiting in a Virtual Environment. In E. Alba, S.J. Turner, D. Roberts, and S.J.E. Taylor (Eds.) *Proceedings of Tenth IEEE / ACM Int Symposium on Distributed Simulation and Real-Time Applications (2-4.10.2006, Torremolinos, Malaga, Spain)*, 63--69 (2006)

15. Tiainen, T., Ellman, A., Kaapu, T., Roberts, D.: Effect of Navigation Task on Recalling Content: The Case of Occasional Users in Restricted, Cave-like Virtual Environment. To be published in E. Alba, S.J. Turner, D. Roberts, and S.J.E. Taylor (Eds.) Proceedings of 11th IEEE / ACM International Symposium on Distributed Simulation and Real-Time Applications, 22-34.10.2007, Chania, Greece, 8 p (2007)
16. Vygotskij, L.S.: *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press (1978)
17. Engeström, Y.: *Activity Theory and Individual and Social Transformation*. *Activity Theory*, vol. 7, no. 8, 6--17 (1991)
18. Fjeld, M., Lauche, K., Bichsel, M., Voorhorst, F., Krueger, H., Rauterberg, M.: Physical and Virtual Tools: Activity Theory Applied to the Design of Groupware. *Computer Supported Cooperative Work* 11: 153--180 (2002)
19. Boer, N.-I., van Baalen, P.J., Kumar, K.: An Activity Theory Approach for Studying the Situatedness of Knowledge Sharing. Proceedings of HICSS 2002, Hawaii, January (2002)
20. Chamorro-Koc, M., Popovic, V., Emmison, M.: Using visual representation of concepts to explore users and designers' concepts of everyday products. *Design Studies* 29(2): 142--159 (2008)
21. Forlizzi, J., Battarbee K.: Understanding experience in interactive systems. In Proceedings of the 2004 conference on Designing Interactive Systems (DIS 04): processes, practices, methods, and techniques (New York: ACM) (2004)
22. Hassenzahl, M., Tractinsky N.: User experience—a research agenda, *Behaviour & Information Technology*, 25:2, 91--97, (2006)
23. Nagamachi, M.: *Kansei Engineering*. Tokyo: Kaibundo Publishing Co. Ltd (1989)
24. Steuer, J.: Defining Virtual Reality: Dimensions Determining Telepresence, *Journal of Communication*, 4:24, 73--93 (1992)
25. Herrera, G., Jordan, R., Vera, L.: Agency and Presence: A Common Dependence on Subjectivity? *Presence: Teleoperators and Virtual Environments*, 15 (5), 539--552 (2006)
26. Iacono, S., Kling, R.: Computerization Movements: The Rise of the Internet and Distant Forms of Work, in *Information Technology and Organizational Transformation: History, Rhetoric, and Practice*, J. Yates and J. Van Maanen (eds.), Thousand Oaks, CA: Sage Publications, 93--136 (2001)

The importance of an individual element – future mobile services

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Abstract. The purpose of this paper is to describe two different cases in the perspective of the individual consumer in the field of mobile services. Especially the purpose is to ventilate the limitations and gaps in the present knowledge and models, when making suggestions and interpretations of the individual consumers' adaptation of the mobile services. First some viewpoints in the field of mobile services are illustrated. Then a definition of the consumer is given and the connection between consumer, everyday life and mobile services is showed. After, the cases are introduced and the advantages and disadvantages of them are discussed. First, a banking system is described; the reasons and viewpoints of the so called failure story are discussed. Secondly, the case of Angry Birds, a successful mobile game, is explained and its key benefits are analyzed. The paper is ended by making some concluding remarks which indicate, that everyday life of the individual consumers of the mobile services should be taken into consideration in broader perspective.

Keywords: Individual consumer, mobile services, everyday life.

1 Introduction

It was recently estimated that there are over 5.1 billion mobile subscribers and 4.2 trillion mobile text messages sent. The amount of Internet users is around 1.6 billion. The penetration rate of mobile phones has passed 100% in several countries like Finland, Japan and South Korea. Moreover, it has been estimated that future growth of Internet users is expected from countries with large populations such as India, China, Russia and some African countries, which many of their citizens have the only access to Internet through mobile phone (budde. com 2010). On the one hand, it can be said that it is important to retain customers and understand consumers generally in such saturated global markets and on the other hand, there are several possibilities in mobile markets which are not fully exploited. There is no doubt that the next ten years will bring more new consumers to the mobile markets and they want to have

innovative services with value. Devices have evolved from simple talk-based services to multiple functions like downloading music, ring tones, multimedia messaging, not to mention locations based services and video calls.

This paper investigates consumer's everyday life with mobile services. For example the concept of consumer satisfaction with information systems has been discussed for more than thirty years. Several measurement instruments and scales are developed for various usage contexts (Doll et al., 2004; Bouwman et al., 2006). Moreover, the importance of physical, cognitive, security and economic factors have been investigated (Bouwman et al., 2006) as well as impact of the cultural characteristics when choosing and using the mobile services (Lee et al., 2003). According to Ministry of Transport and Communication Finland (2011) the technical quality of the services is important but at least as important are quality of the emotional and social services people imagine or feel to achieve. This is also confirmed by several researches which suggest that beliefs and values of the consumers have effect on their consuming habits in their everyday life (Grant et al., 2010, Babin et al., 2001, Dong-Mo 2005). Moreover, there are some researches which tell that the actual usage of the e/m-commerce could be higher (Hernandez et al. 2010) in other words; consumers could consume more using e/m-commerce.

2 Theory and method

Consumer is often used as a synonym of customer or even end-user. Here the consumer refers to an individual person who consumes something; products or services through mobile devices. In this paper the consumer does not refer to organizational consumers like companies or other institutions. (Schiffman et al. 2000, Turban et al. 2010) Moreover, a consumer is seen an individual who does the choices independently when using mobile services. That means that s/he decides, what to consume how to consume and where to consume. It may happen that different individual consumers consume the same mobile service, but for different reasons, and/or in the personal level, they find different ways of using it or even for different purposes it has been originally designed. This leads to think that an individual consumer belongs to a heterogeneous group of consumers (Legris et al. 2003; Salovaara et al., 2009; Bagozzi 2007), and therefore consumers are not passive absorbers of the technological products - in this case mobile services (Pedersen et al 2003; Salovaara et al. 2009).

According to Keen et al. (2007) in mobile commerce consumers define value of services, and when, where, and how they want it. Mobile services offer consumers freedom. Freedom itself is not value but *freedom becomes value when it changes the limits of the possible in the structures of everyday life*. That is called *Braudel Rule*.

Braudel Rule means that mobile services become valuable in case they change the daily routines of people and moreover people shall rely on that specific mobile service. If the mobile service would disappear people feel that their daily routines are disturbed. This is one base when evaluating the effectiveness and simplicity of mobile value services to the consumers (Bouwman et al., 2008; Bouwman et al., 2006). On the other hand, according to Silverstone (2003) the concept of everyday life refers to everything meaningful in individual's life such as social community like work but as well activities at home, often trivial, like cooking. The question here is how the consumers do their choices in the field of everyday life and the same applies to information technology; how the IT is made part of consumers' everyday life. (Lie et al., 1996)

The contribution of TAM –model (Technology Acceptance Model) when explaining the use behaviour in information technology implementation, is inevitable. In this case, though, the consumer is seen as an individual who make the choice of using the mobile services him/herself according to his or her daily life. Only a loose connection to TAM-model and an extension of TAM of Davis (1993) and Venkatesh et al. (2000 and 2003) can be seen.

This paper is more explorative than empirical research. The used method is literature review, where both scientific and professional articles are used.

3 Case description

There has been number of mobile services which kicked off but never reached their full potential. First case is the example of the failure of mobile services. Mobile banking systems have been coming to markets for years but today only 10% of banks have some form of mobile banking products in working. However, the 57% of the banks in the US say that they plan to add mobile services within the next 12-24 months and globally the percentage is 32%. Interesting is the replica of a bank vice-president who says that the mobile banking success and failure lies in its technology strategy and how banks treat customer, though the conclusion is that consumers themselves should be aware of services (telecom2.com).

Also, according to Telecom2, the results from the survey conducted in 2007 shows that 50% of the customers did not know if their bank was offering mobile services. In this light the lack of services but also the lack of knowledge among customers is one of the limitations in mobile banking. The third result was that consumers want to access financial services without time, locations or device restrictions, and they want the access to be easy and clear (Telecom2. com; Sybase.com/365)

The second case describes the very successful mobile game Angry Birds by a company called Rovio. Rovio is an entertainment Media Company located in Finland, and the creator of the Angry Birds franchise. Rovio was established in 2003 as a mobile game development studio but is now expanding its activities in broadcast media, merchandising, publishing and other services. Furthermore the company has developed several award-winning titles for various mobile platforms. Customers of Rovio are for example Apple, Nokia, Vivendi, Namco Bandai and Mr Goodliving/Real Networks etc. (<http://www.rovio.com> 2011).

The game Angry Birds was first released as a casual puzzle game for touch screen smart phones but is nowadays available on further platforms, too. The idea of Angry Birds is very simple: Green pigs stole the bird's eggs and birds try to get them back. Thus, the birds get angry and a player can use the unique destructive powers of the birds to destroy the pigs. The two main purpose of the player in the game is to protect the birds' eggs and to destroy the pigs. The game has 120 levels which each require different logic and skills to protect the eggs.

3 Analysis

This paper illustrates the consumer and his/her usage of mobile services in his/her everyday life. In mobile game case the features of the good mobile service are simplicity and ease of use. On the other hand reliability, in the sense of the strategy game play mechanics that are instantly recognizable to a consumer is something that decreases the perceived level of risk that consumer feels when downloading the game (Chang et al., 2009; Ojavainio et al., 2003). Good and clear graphics, ability to play against other people kind of the natural extension of the mobile phone's connectivity. Moreover, in order to understand the individual consumer's behavior and intentions to use mobile services in her/his daily life, here mobile games, is not explained totally by the fundamentals of TAM-model. Instead, it is needed to have a qualitative explanations or at least illustrations of the behavior of an individual consumer especially when trying to explaining the mobile services expanding in the new era such as mobile entertainment services.

In general, the situation is that by the year 2009, there would be 220 million mobile phone game fans in the world. Aside online games and static game devices like Play station, mobile games are the next most popular games. (Ha et al. 2007).The popularity has grown so fast that mobile operators are competing against each other by offering their subscribers loads of both free and paid games for their pleasure. Not only mobile operators, cell phone manufacturers are also pre-programming their phones with a variety of games. The growing interest in mobile gaming is producing a

lot of benefits for the mobile industry. The operators are deriving huge revenue from selling these games, software developers are regularly deriving royalties from phone manufacturers and the manufacturers themselves are cashing in heavily on revenue from subscribers (<http://www.mobileisgood.com>; <http://www.rovio.com>).

In the bank case the system complexity and uncomfortable usability from the perspective of a customer prevents the system to succeed. Consumers felt that entering to the system was time consuming and it was difficult to find the way in the system. (Pousttchi et al 2004; <http://www.telecom2.com>) Moreover, limited services in mobile banking but also lack of knowledge among consumers prevented the services to expand.

Clearly, the system usage was more organizational driven than a customer driven. In this case, the TAM-model and the extensional approaches and derived explanations from it, are functioning, when identifying the customers' choice making process as well as final choices (Salovaara et al. 2009).

4 Discussion

Recognizable trends in the area of the mobile services and emerging markets today are for example games, which are easy to upload and easy to use but also offer challenge to consumers but in a way consumers want it. That means that consumers decide what they play, when they play and how they play i.e. change the stage or change the game. In terms of Braudel Rule, - *freedom becomes value when it changes the limits of the possible in the structures of everyday life* - the mobile game Angry Birds, seems to provide value to consumers.

According to a failure case as banking systems in general, consumers cannot be forced to consume something which they consider to be difficult or not appropriate for their daily usage. New mobile services should be low in risk and even better when combined with ease of use. In this case the shortage of knowledge or unclear information from banks' side seemed to be the failure factors. On the other hand, the bank case awakes thoughts that organizational driven technology acceptance, which is forced to consumers, cannot work nowadays. In other words, the underlying assumptions of the technology acceptance do not reflect the actual reality of the daily life of the individual consumers. Customers must be taken to be a part of the development process of the services, also in traditional companies, if they want to implement information technology successfully. (Legris et al. 2003; Salovaara et al. 2009) Moreover, the banking case can be seen as an example of the classical adaptation system; a consumer can adapt to it or not.

When comparing the two cases, mobile Angry Bird and mobile banking system, which services have the same technology and tools but the result is totally different, the question arises, how we can explain and understand this. This paper suggests that there is an individual element in consumers' behavior which should be investigated more. Existing models do not explain the different result of services, one successful and the other unsuccessful.

So called Z-generation, born 1994-2004, who demands different perspective when handling them as consumers, should be considered (<http://sparxoo.com>, 23.2.2011). They say that they learn things e.g. languages and mathematics while playing mobile games. Zs are a more sophisticated generation who will use technology for their own purposes and not in the way corporations define it. For Zs innovations are not technology driven but they want to take advantage of it when, where, and how they want it (Sandberg et al. 2011; <http://www.news.com> 25.3.2011). Pedersen et al. (2003) argues e.g. that adoption models used now are not a solid background when the adaptation of the same service by young and other *end-users* are required.

Trend could be also so called *open source* not only referring to coding but more to everyday life actions of an individual including work habits, education ecosystem and living in general. That means that working and learning is not anymore bonded to a certain time and place but one can do it when, where, and how they want it through their mobile devices. Mobile services should be built in a way that their serve the daily actions of living in individual's life and the services should be easy to use and convenient for the purpose they are meant for.

5 Conclusions

This paper serves generally as an illustration of some ideas and discusses the possible limitations of present theoretical viewpoints in mobile services. Literature view and scientific papers clearly suggest that fresh and dynamic approaches beside TAM-model are needed. The cases show too, that some mobile services succeed and other failed although the services are not so far away from each other at least technically or in sense of importance and value.

However, there are limitations in this paper that suggest further research. Further research may consider a broader and deepened insight into an individual consumer's life concerning his/her decisions in the daily life according to mobile services. For example semi structured or structured interviews or/and observation can give data for further analysis. Additionally, traditional views when analyzing the individual customer's decisions on technology usage should be investigated properly

in order to move efficiently to a direction where both human and social change processes are taken into broader consideration.

References

1. Babin B., Babin L.: Seeking something different? A model of schema typicality, consumer affect, purchase intentions and perceived shopping value. *Journal of Business Research* 54, pp. 89-96 (2001).
2. Bagozzi R.: The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift. *Journal of the Association for Information Systems Article*, April 1 (2007).
3. Bouwman H., Carlsson C., Walden P., and Molina-Castillo F.J.: Trends in Mobile Services in Finland 2004-2006: From Ringtones to Mobile Internet, *INFO*, (10:2), March, pp. 75-93 (2008).
4. Bouwman H., Carlsson C., Molina-Castillo F.J., Walden P.: Barriers and drivers in the adaptation of current and future mobile services in Finland, *Telematics and Informatics* 24, pp. 145-160 (2007).
5. Bouwman H., Vos N., Haaker N.: *Mobile Service Innovation and Business Models*” Springer-Verlag Berlin Heidelberg (2008).
6. Bigne, C., Ruiz S., Sanz S.: The impact of internet user shopping patterns and demographics on consumer mobile buying behavior, *Journal of Electronic Commerce Research* 6 (3), pp. 193–210 (2005).
7. Chang H., Chen S.: Consumer perception of interface quality, security, and loyalty in electronic commerce. *Information and Management* 46, pp. 411-417 (2009).
8. Davis, F.: User acceptance of information technology: system characteristics, user perceptions, and behavioral impacts. *International Journal of Man Machine Studies* 38, pp. 319-340 (1993).
9. Doll, W., Deng, Z. Raghunathan, T.S., Torkzadeh, G. and Xia W.: The meaning and measurement of user satisfaction: A Multigroup invariance analysis of the end-user computing satisfaction instrument. *Journal of Management Information Systems*, 21, 1, 227-262 (2004).
10. Dong-Mo K.: The fundamental reasons of e-consumers `loyalty to an online store. *Electronic Commerce Research and Applications* 5, pp. 117-130 (2005).
11. Global – Key Telecoms, Mobile and Broadband Statistics: budde.com.au

(19.6.2011).

12. Grant R., Clarke R., Kyriazis E.: Research needs for assessing online value creation in complex consumer purchase process behavior. *Journal of Retailing and Consumer Services*. Volume 17, Issue 1 pp. 53-60 (2010).
13. Ha I., Yoon, Y., Choi M.: Determinants of adaptation of mobile games under mobile broadband wireless access environment. *Information and Management* 44, pp. 276-286 (2010).
14. Hernandez B., Jimenez J., Martin J.: Customer behavior in electronic commerce: The moderating effect of e-purchasing experience. *Journal of Business Research* 63, pp. 964-971 (2010).
15. Keen P. and Mackintosh R.: *The freedom Economy: Gaining the mCommerce Edge in the Era of Wireless Internet*, Osbourne/McGraw-Hill, and N.Y.(2007).
16. Legris P., Ingham J., Colletette P.: Why people use information technology? A Critical View of the Technology Acceptance Model. *Information and Management* 40 pp. 191-204 (2003).
17. Lee Y., Kozar K., Larsen K.: The technology acceptance model: Past, present, and future. *Communications of the Association for Information Systems*, 12, pp.752-780 (2003).
18. Lie M., Sorensen, K.: *Making the technology our own? Domesticating technology into everyday life*. Scandinavian University Press. Oslo, Norway (1996).
19. Ministry of Transport and Communication Finland: VAMOS – Liiketoiminnan mobiilit ratkaisut 2005 - 2010 (2011).
20. Mobile is good: <http://www.mobileisgood.com> (20.3.2011).
21. News: www.news.com (25.3.2011).
22. Ojavainio M-K, Tiainen T.: Consumer´s Trust in E-Commerce. Published in CD format, IRIS26 conference Finland (2003).
23. Pedersen P.; Ling R.: Modifying adaptation research for mobile Internet service adoption: Cross disciplinary interactions. *Proceedings of the 36th Hawaii International Conference on System Sciences* (2003).
24. Pousttchi, K.; Schurig, M.: Assessment of Today´s Mobile Banking Applications from the View of Customer Requirements. MPRA Paper No. 2913 (2004).
25. Rovio: <http://www.rovio.com> (18.3. 2011).

26. Sandberg J., Maris M., de Geus K.: Mobile English Learning: An evidence-based study with fifth graders. *Computers & Education* pp. 1334-1347 (2011).
27. Salovaara, A., Tamminen S.: Accept or appropriate? A Design-Oriented Critique on Technology Acceptance Models. *Future Interaction Design II*, pp. 157-173. London: Springer (2009).
28. Schiffman, L.G. & Kanuk L.: *Consumer Behavior*. Prentice Hall, Upper Saddle River, NJ (2000).
29. Silverstone, R. and Hirsch, E.: *Consuming technologies: Media and Information in Domestic Spaces*, Routleg London, UK (1992).
30. Sparxoo: <http://sparxoo.com> (23.3.2011).
31. Sybase: <http://www.Sybase.com/365> (23.3.2011).
32. Telecom: <http://www.telecom2.com> (23.3.2011).
33. Turban E., Lee J., King D., Liang T., Turban D.: *Electronic Commerce*. Prentice Hall (2010).
34. Venkatesh V., Davis, F.: A theoretical extension of the technology acceptance model. Four longitudinal field studies. *Management Science*, 46 pp. 98-118 (2000).
35. Venkatesh V. Morris M., Davis, G., Davis F.: User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27 pp. 425-478.
36. Z-generation: <http://www.news.com>. (25.3.2011).

Organizational Knowledge and Learning Culture in Academic and Business Worlds

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Abstract. Organizational knowledge and learning culture in this paper refers to an overall state of the most important knowledge and learning processes, i.e. organizational knowledge creation and organizational learning processes in organizations. We analyzed a large dataset describing organizational and learning culture in academia and companies. Relevant ontologies and online fuzzy logic platform were applied to collect this dataset over the past few years. According to the results the knowledge creation needs are perceived quite similarly in academia and in companies. The results for learning environment were somewhat different between academic and companies. The results give a clear indication what could be done to develop organizational and learning culture in academia and in companies. The results can be partly explained by the nature of the organizations.

Keywords: Knowledge creation, organizational learning, knowledge and learning culture, ontology, fuzzy logic

1 Introduction

Organizational success is one of the main goals in leadership and management. An organization's success highly depends on how well the leaders of the organization can manage that organization's intellectual capital [1]. Intellectual capital can be separated into human capital and structural capital, where customer capital and organizational capital are the most important outside human-dependent capital components, affecting the development and growth of an organization (ibid). The leaders and managers are responsible for the development and growth of these assets and must realize how these components can be affected. From the leadership and management point of view, we therefore have to concentrate on increasing the power of intellectual capital to affect the success of the organization. Many contemporary scientists suggest that the best results from this can be achieved by increasing the effectiveness of knowledge creation and learning, c.f. Knowledge Creation Spiral by Nonaka and Takeuchi [2], Double-Loop Learning by Argyris & Schön [3] and the Learning Disciplines by Senge [4].

This article explores the current status of knowledge and learning culture at academic and business organizations. How effective these processes are gives a strong indication for the future success of the organization. An organization that is capable of mastering its knowledge and learning culture will likely be successful in the competition against rivalries and competitors. The existence of these two types of organizations lies on different principles and therefore the knowledge and learning culture may take different shapes. Common for these two different types of organizations is that individual learning is the cornerstone of their existence and activity now and in the future. Universities' task is to educate and make people learn. Companies' task is to create value for their stakeholders through organizational learning, whereas organizational learning can only happen through individual learning. This article shows how people in business and the academic worlds view their current and envisioned knowledge and learning culture. The evidence suggests that the used methodology is important in revealing the importance of knowledge and learning culture in its complexity to management. First we show the theory behind the knowledge and learning culture, then the methodology that we applied. After that we describe the dataset and show the results.

2 Theoretical Framework

2.1 Folium and Talbot Ontologies

In order to succeed in competition, organizations must have the ability to create new knowledge continuously. Knowledge is an important factor that adds value to an organization's products and services. According to the theory of organizational knowledge creation introduced by Nonaka and Takeuchi [2], knowledge is created in a spiral process where tacit and explicit knowledge interact. This knowledge creation process is based on four different modes of knowledge conversion (the SECI process): socialization, externalization, combination and internalization. Socialization (from tacit knowledge to tacit knowledge) is a process of sharing experiences; externalization (from tacit knowledge to explicit knowledge) is a process where tacit knowledge is articulated to explicit concepts; combination (from explicit knowledge to explicit knowledge) is a process where concepts are systematized into a knowledge system; internalization is a process where explicit knowledge is embodied in tacit knowledge and is closely related to learning by doing [2]. Organizational knowledge creation starts at the individual level and then moves up through communities of interaction crossing sectional, departmental, divisional and organizational boundaries [2]. This spiral process of organizational knowledge creation presents a systemic view on how organizations create new knowledge. It is vital that the organization offers an environment that supports and motivates creative individuals and facilitates interaction between them. Nonaka and Takeuchi describe five conditions that are required in order to promote the knowledge spiral: intention, autonomy, fluctuation and creative chaos, redundancy, and requisite variety [2]. If these conditions are not put into practice, it is impossible to continuously create new knowledge in a spiral process. The knowledge spiral is the only way to expand individuals' knowledge

assets and create new knowledge at an organizational level. Traditional knowledge management only considers some parts of the SECI process, c.f. Malone [5]. Thus something more is needed to support and develop knowledge creation activities within the organization. The next chapter describes a responsive environment that comprises those factors essential in developing a positive learning environment and in supporting knowledge creation activities.

2.2 Organizational Learning

According to Senge, individual learning does not guarantee organizational learning, but without individual learning, no organizational learning occurs [4]. Therefore it is essential that an organization supports and facilitates individual learning and knowledge creation. This creates a chain of positive events: learning, applying new skills/knowledge, and recognition can increase self-confidence in learning new skills and performing them efficiently [6]. The starting point of the organization's learning cycle is its present actions [7]. With the help of feedback systems, diverse feedback is systematically gathered. This feedback is then interpreted in order to gain new knowledge and to clarify the vision, strategy and goals. It is then possible to develop the organization's mental models, actions and know-how. Sydänmaanlakka [7] also argues that strategic learning, an organization's ability to detect weak signals and its ability to regenerate itself, are emphasized in this process. The organization's learning cycle is closely related to single-loop and double-loop learning [3]. Organizational learning and organizational knowledge creation are complementary, supporting theories. Yet how can these theories be grasped in real organizations? Ontologies and fuzzy logic both seem well suited to this task.

2.3 Ontologies

Ontology is an explicit specification of the conceptualization of a domain [8]. Conceptualization is an idea of (part of) the world that a person or a group of people may hold [9]. Ontologies define the common words and concepts (meanings) that describe and represent an area of knowledge [10]. They thus represent a method of formally expressing a shared understanding of information [11]. The main components of an ontology are classes (concepts), relations (associations between the concepts in the domain), and instances (elements or individuals in the ontology) [9]. Using ontologies can have several benefits, such as interoperability, browsing and searching, reuse and structuring of knowledge [12]. Ontologies also enable the computational processing of information. Ontologies are becoming increasingly important in fields such as knowledge management, information integration, cooperative information systems, information retrieval, and e-commerce [13]. Ontologies serve the need for storage, data exchange corresponding to the ontology, ontology-based reasoning, and ontology-based navigation [14]. By its definition, ontologies are well suited to explicitly describing those concepts that belong to organizational knowledge creation and learning domains. To discover how these concepts are actually perceived in real organizations and how to handle the imprecise

human perception of knowledge creation and learning concepts, fuzzy logic is required. This concept is explained in the next chapter.

2.4 Fuzzy Logic

Our ability to make precise yet significant statements about a system's behavior diminishes as the complexity of the system increases [15]. This would mean that accurate observations cannot be made about the most complicated system in the world – the human being. Organizational knowledge creation and learning take place in complex social systems involving many humans and other system parts.

Vagueness in linguistics can be captured mathematically by applying fuzzy sets [16], [17]. This is done by creating linguistic variables that “contain” fuzzy sets. Fuzzy sets represent systems better than crisp sets for two reasons. First, the predicates in propositions representing a system do not have crisp denotations. Second, explicit and implicit quantifiers are fuzzy [18]. ‘Conventional’ mathematical methods require that several preconditions are met before they can be utilized, especially when there is concern about the independence of the factors used. Fuzzy logic allows us to ignore these preconditions due to the use of linguistic variables [19]. Therefore, conventional mathematical methods encounter difficulties when applied to human beings or human systems. A fuzzy set can be defined mathematically by assigning to each possible individual in the universe of discourse a value representing its grade of membership in the fuzzy set. This grade corresponds to the degree to which that individual is similar to or compatible with the concept represented by the fuzzy set [20]. In this work, the perception of different aspects of knowledge creation and organizational learning becomes a degree of membership in fuzzy sets. Just like in real life, everything is a matter of degree. Linguistic variables bridge the gap between the mathematical base variable in the universe of discourse and the meaning in the human mind.

Fuzzy logic is the precise logic of imprecise things [17]. Fuzzy logic allows reasoning using fuzzy sets and fuzzy rules. It has two principle components. The first is a translation system for representing the meaning of propositions and other semantic entities; the second is an inferential system for arriving at an answer to a question that relates to the information resident in a knowledge base [18]. Here, propositions refer to the semantics (statements) of the concepts of organizational knowledge creation and learning. The knowledge base refers to the concepts (ontology) of organizational knowledge creation and learning. In general, a fuzzy logic application resembles an expert's task to evaluate and reason based on linguistic information. A general fuzzy logic application consists of four modules: 1) a fuzzy rule base, 2) a fuzzy inference engine, 3) a fuzzification module, and 4) a defuzzification module [20].

3 Methodology

3.1 Folium and Talbot Ontologies

Folium and Talbot are ontologies that can be used to help the organization's management in the decision making process when target development plans are made to improve and support organizational knowledge creation and organizational learning on an objective level. On a practical level, Folium is used within the organization to evaluate features that describe activities, functions and practices concerning organizational knowledge creation. In the same way, Talbot is used to evaluate features that describe activities, functions and practices concerning organizational learning. Folium and Talbot contain linguistic indicative statements which describe the features of knowledge creation and learning organization in practice, and respondents are asked to evaluate their current reality and future vision as they perceive it according to these statements. As a result of the evaluation, the proactive vision [21] is visualized, i.e. the gap between the current reality and future vision. The reasoning from the indicative statement evaluation to the visualized proactive vision is made with fuzzy logic; the statements are semantic entities and the ontology is the information resident in a knowledge base [15]. The content of the Folium (knowledge creation) ontology [21] is presented in Table 1 and the content of the Talbot (organizational learning) ontology [21] in Table 2.

Table 1. Classes in the Folium ontology

<i>Main classes</i>	<i>Features (sub-classes)</i>
Socialization	Sharing of experiences, Observation of others' work, Spending time and doing things together
Externalization	Articulation of tacit knowledge, Translation of tacit knowledge into an understandable format
Combination	Adoption of new knowledge and combination with existing knowledge, Spreading new knowledge in the organization, Evaluation of new knowledge
Internalization	Making knowledge visible in operations and practices, Exploitation of training and simulation

Table 2. Classes in the Talbot ontology

<i>Main classes</i>	<i>Features (sub-classes)</i>
Learning and toleration of errors	Opportunity for learning, Tolerating mistakes as part of learning, Striving to avoid mistakes

Support of training	Policies and practice support training, Managerial support of training
Requirements for new ideas and learning	Openness to new ideas and changes, Support from co-workers of new ideas, Demand made by the situation
Individual awareness and development	Awareness of the big picture, Expectations of and commitment to a high standard, Own abilities, Satisfaction with development, Training presented as something positive

5.2 The Evolute System

Evolute is an online system that supports specific-purpose fuzzy logic applications to be used over the Internet [22], [23]. The Evolute system allows researchers to develop specific domain ontology and present it online to the target group through semantic entities, such as statements. Evolute provides ontology-based “answers” to perceived propositions. The integral perception of a single person over all the presented propositions will produce an answer, called an instance [22].

The collection of instances reflects a specific Management Object (assets) portfolio under scrutiny. The collection of instances forms the Instance Matrix [22]:

ONTOLOGY_{Identifiers 1-m} (Individuals_{1-n}, Instance)

The instance matrix, as a function of time, describes the Management Object development in the organization. In other words, it charts the organization’s assets over time. The Instance Matrix, as a function of time, can be stated as:

ONTOLOGY_{Identifiers 1-m} (Individuals_{1-n}, Instances_{1-k})

The Instance Matrix is of great use to managers since it represents the collective mind of the target group.

The Evolute system utilizes fuzzy logic to capture the subjective, abstract and vague nature of the learning and knowledge creation environment without the individual having to convert any of this on a numerical scale. The goal is to capture a true bottom-up view of the current reality and envisioned future of the features and practices of knowledge creation and the learning environment of an organization. The Evolute system works as a generic fuzzy rule base system in the following way [c.f. 24]:

1. Evaluation of linguistic statements describing the features of the ontology. Inputs from the evaluation are converted into fuzzy sets (fuzzification).

2. Fuzzified inputs are used by an inference engine to evaluate fuzzy decision rules in the fuzzy rulebase. This results in one fuzzy set per each class in the ontology (inferencing).
3. Fuzzy sets are converted into crisp values that represent the meaning of the perception of the domain by the individual (defuzzification).
4. Defuzzified results (the instance) are presented visually and numerically for decision making.

Folium and Talbot ontologies and their propositions can be fine-tuned as experimental results of knowledge and learning culture increase. The data set of Folium and Talbot instances used for this article are described next.

4 Dataset

With the Evolute system, we collected 264 Talbot instances (216 academic and 48 company instances) and 300 Folium instances (247 academic and 53 company instances) that demonstrate knowledge asymmetries in these concepts. The academic dataset was collected during the period of June 2005 - June 2010 in universities in Finland, Spain, Poland and South-Korea. The company dataset was collected during the period of December 2005 – August 2007 in Finland in organizations that represent different areas of work and business. The datasets do not fully contain detailed demographic data. Adding one's demographic data to instances during the self-evaluation is voluntary in the Evolute system.

5 Results

The initial results of our analyses of the Folium and Talbot runs are presented here. Though the results are general in nature due to the many test runs required, the trend is very clear and offers new ideas and possibilities to develop knowledge creation and organizational learning within the organization. We believe that these results are unique due to the methods that we have used.

5.1 Folium Results

Figure 1 shows the Folium results for the academic and business samples respectively. The classes in the ontology are listed on the left side and the results are represented by bars. The longer the bar, the higher is the perceived level of the class. The difference between the target and current bars shows the participants' proactive vision.

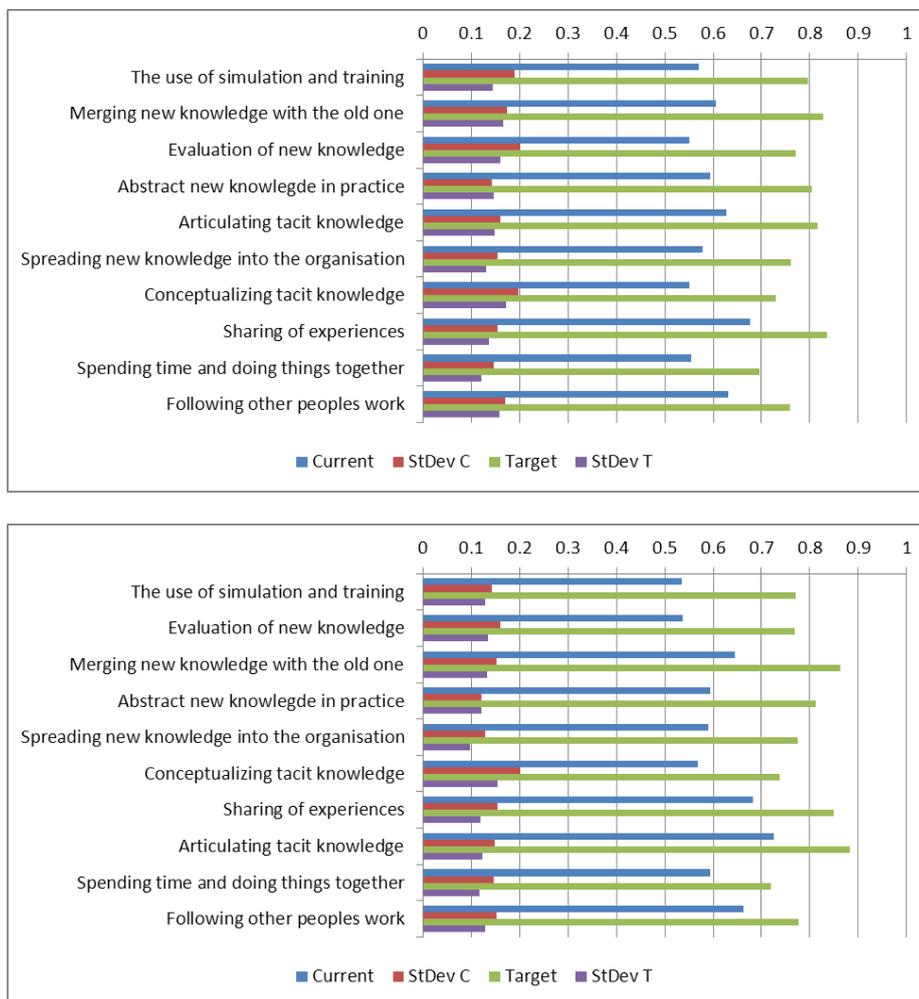


Figure 1: Folium academic case – 247 instances (upper); Folium company case – 53 instances

Based on the numerical data for both groups, the proactive vision for the main classes can be ranked from the largest to the smallest as follows: **1) Internalization (highest priority), 2) Combination, 3) Externalization and 4) Socialization.**

The academic and company results for current and target levels are very close to each other. On the numerical scale the fuzzy bars are in the range of 0.5–0.88. Detailed analysis shows the different aspirations of each group. The high target levels show major support for the improvement of each concept, 110–145% more than current levels. Pressure to improve some of the main knowledge-creation items therefore exists.

Among academic participants the main priorities are the use of simulation and training, merging new knowledge with the old one (knowledge) and the evaluation of new knowledge. Company participants hold the same main priority, while the second and the third priorities change places. The fourth priority is the same for both groups, abstract new knowledge in practice. After this the concepts follow a different order, but both groups end on the same, following other peoples' work. Standard deviations in the current and future stages are at the same level in the results.

Each concept of the ontology could be perceived and evaluated by respondents, and with the collective data gathered we can say that there is a general willingness to improve knowledge creation within these organizations. However, there are different views held by participants. From the above results it is possible to show priorities in the development of items in order to help the design of knowledge creation processes as well as to later follow the development of results.

Detailed analysis shows that those concepts belonging to socialization, externalization and combination have higher (average) perceived current and target levels in the company data set. The situation is the reverse for concepts belonging to the internalization class. In that category, the current level and perceived need is higher in the academic group. We can also see that the proactive vision was bigger in the academic group in all categories except internalization. In short, according to the data set, companies need the most support in the internalization of new content, while universities need the most support in socializing, externalizing and combining aspects of new knowledge.

This material can be used for management and leadership purposes. The results reveal that those in both academic and business environments view knowledge creation as a very important development area as a whole, but with different focus. The clear message from both groups to management is that most help is needed in internalizing new content, then in combination with existing resources, thirdly in externalizing new content, and finally in socializing it. Perhaps the SECI process should be 'rotated' in name to the ICES process according to the perceived need.

5.2 Talbot Results

Figure 2 show the Talbot results for the academic and business samples respectively. Based on the numerical data for both groups, the proactive vision for the main classes can be ranked from the largest to smallest as follows: **1) Support for training (highest priority), 2) Requirements for new ideas and training, 3) Individual awareness and development and 4) Learning and toleration of errors**

The academic and company results for current and target levels with Talbot show bigger differences than in the case of Folium. On a numerical scale the fuzzy bars for the academic sample are in the range of 0.52–0.78 and for the business sample 0.5–0.83. Further analysis reveals different aspirations for each group.

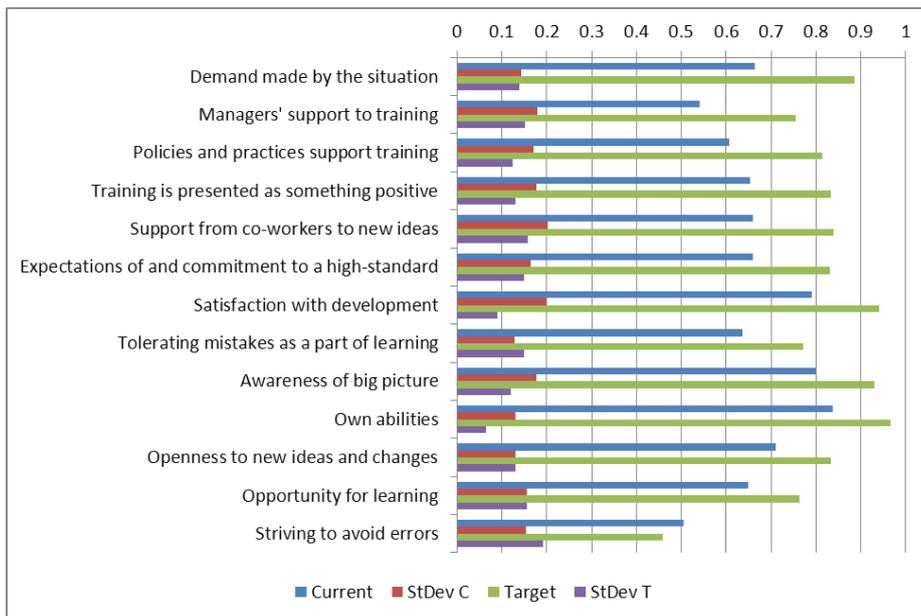
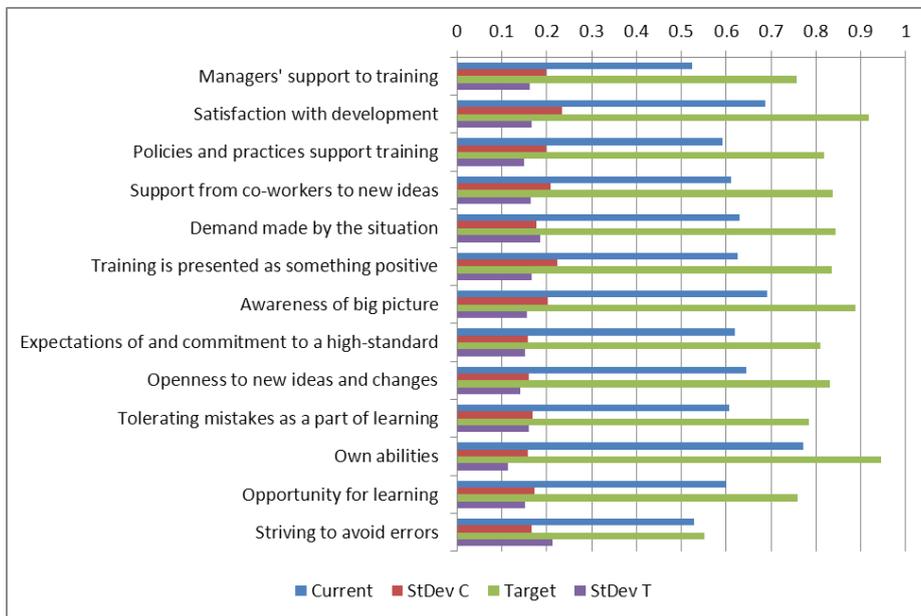


Figure 2: Talbot academic case – 216 instances (upper); Talbot company case – 48 instances

The target level for improvement of each learning concept is 106–156% more than the current level for the academic group. This reflects a collective will to improve the

learning environment. Some individuals have a stronger desire than others in this regard as the deviations in class results show, Figure 2. This indicates many possibilities to improve learning and the learning environment in the academic institutions involved in this research.

The main priorities of the academic sample are managers' support of training, satisfaction with development and policies and practices that support training. For the business group, the highest proactive vision is found in demand created by the situation, followed by managers' support of training and lastly, as with the academic sample, policies and practices that support training. Similar proactive vision is shown from both groups for support from co-workers of new ideas and training that is presented as something positive. Both groups also view tolerating mistakes as part of learning similarly. Awareness of the big picture is not as clear for the academics; however both parties desire to make an effort on this front. Both groups rely on their own abilities, but are willing to improve to develop better competences in the future. Overall, the academic group strives to improve opportunities a little more than in the business world. The academic group shows a light tendency to avoid errors, whereas company participants did not indicate a wish to improve this area – it may be that this item was already so good in the companies that participants didn't think it necessitated further development. However, we must note that the results for striving to avoid errors are not very reliable since a scale-reverse error was found in one of the statements indicating this class in the middle of test runs. Standard deviations in the current and future stages are at the same level in the results.

Again, it is evident that the content of each concept of the ontology could be well perceived and it appears that collectively participants are willing to improve learning inside their organizations. However, there are different views held by the individuals. From the above results it is possible to show the priorities of the various items in order to help design the learning processes as well as to later follow the development of the results.

Detailed analysis shows that the concepts belonging to managers' support of training, requirements for new ideas and learning and toleration of errors have higher (average) perceived levels in the company group than in the academic group. The situation is the reverse for the concepts belonging to individual awareness and development. In that category the current level and perceived need is higher in the academic group. We can also see that the proactive vision was bigger in the academic group in all classes of the Talbot ontology.

These results can be used for management and leadership purposes. The results clearly show that the academic and business groups see that it is very important to improve current knowledge cultures in organizations.

6 Conclusions

Knowledge creation and organizational learning are the most important activities in academic and business worlds – they define the knowledge and learning culture in organizations, and “forecast” how successful organizations will be. The importance of both contents, i.e. knowledge creation and learning, can be extremely difficult to

quantify. We used fuzzy measures to capture these contents in their real settings. The methodology we used offers new ways to understand knowledge creation and learning culture in real settings. The initial results presented in this article give a solid indication of which areas could be improved at universities and in companies in order to really boost knowledge and learning culture and to enable effective knowledge creation and organizational learning in these organizations. The areas, represented in this article by hundreds of individuals, are non-traditional ways to improve how things are usually done in organizations in practice, and they may lead to a real “knowledge performance boost” in the future.

The results for companies and academia are very similar for the Folium ontology while they are somewhat different for the Talbot. Regarding the Folium, this indicates that academia and companies share very similar issues in new knowledge creation. Regarding the Talbot, the difference may be explained by the different nature of work at academia and in companies: in academia the students typically learn course by course, whereas companies can attempt to develop an environment that would be responsive to learning on a longer term.

These results were grouped according to different industry sectors. The reason for this is that industry type information was not collected in all cases. Giving detailed demographic information was voluntary. For further study, it will be interesting to collect this information, and group and analyze the results accordingly.

We believe that these initial results show that effective knowledge and learning culture has to be built in real working environments. Then we can start thinking what would be a good way to lead and manage these improvements towards better knowledge and learning culture in academic and business settings?

References

1. Edvinsson, L. & Malone, M., 1997. *Intellectual Capital*, New York, USA: HarperCollins Publishers, Inc., p. 52
2. Nonaka, I. & Takeuchi, H., 1995. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, New York: Oxford University Press, p. 71
3. Argyris, C. & Schön, D., 1996. *Organizational Learning II: Theory, Method and Practice*, Reading (MA): Addison-Wesley, p. 21
4. Senge, P., 1990. *The Fifth Discipline: The Art & Practice of Learning Organization*, New York: Currency Doubleday, p. 376
5. Malone, D., 2002. Knowledge management A model for organizational learning. *International Journal of Accounting Information Systems*, 3(2), pp.111-123.
6. Tannenbaum, S., 1997. Enhancing Continuous Learning: Diagnostic Findings from Multiple Companies. *Human Resource Management*, 36(4), pp.437-452.
7. Sydänmaanlakka, P., 2003. *Intelligent Leadership and Leadership Competencies: Developing a Leadership Framework for Intelligent Organizations*. Doctoral thesis. Espoo: Helsinki University of Technology.
8. Gruber, T., 1993. A translation approach to portable ontologies. *Knowledge Acquisition*, 5(2), pp.199-220.
9. Gomez-Perez, A., 2004. *Ontology Evaluation*. In *Handbook on Ontologies*. Eds. Staab, S., Studer, R. Berlin: Springer-Verlag, pp. 251-273.

10. Orbst, L., 2003. Ontologies for semantically interoperable systems. In Conference on Information and Knowledge Management. New Orleans, USA: ACM, New York, USA, pp. 366 - 369.
11. Parry, D., 2004. A fuzzy ontology for medical document retrieval. In ACSW Frontiers 2004. Dunedin, New Zealand: Australian Computer Society, Inc., Darlinghurst, Australia, pp. 121-126.
12. Menzies, T., 1999. Cost benefits of ontologies. *Intelligence*, 10(3), pp.26-32.
13. Baader, F., Horrocks, I. & Sattler, U., 2004. Description Logics. In Handbook on Ontologies. Eds. Staab, S., Studer, R. Berlin: Springer-Verlag.
14. Crubezy, M. & Musen, M., 2004. Ontologies in Support of Problem Solving. In Handbook on Ontologies. Eds. Staab, S., Studer, R. Berlin: Springer-Verlag, pp. 322-341.
15. Zadeh, L., 1973. Outline of a new approach to the analysis of complex systems and decision processes. *IEEE Transactions on systems, Man, and Cybernetics*, 1(1), pp.28-44.
16. Zadeh, L., 1965. Fuzzy Sets. *Information and Control*, 8(3), pp.338-353.
17. Lin, C. & Lee, C., 1996. *Neural Fuzzy Systems - A Neuro-Fuzzy Synergism*, Prentice Hall, Inc.
18. Zadeh, L., 1983. Commonsense Knowledge Representation Based on Fuzzy Logic. *Computer*, 16(October), pp.61-65.
19. Wilhelm, M. & Parsaei, H., 1991. A fuzzy linguistic approach to implementing a strategy for computer integrated manufacturing. *Fuzzy Sets and Systems*, 42(2), pp.191-204.
20. Klir, J. & Yuan, B., 1995. *Fuzzy Sets and Fuzzy Logic, Theory and applications*, Prentice Hall, Inc.
21. Paajanen, P., 2006. *Dynamic Ontologies of Knowledge Creation and Learning*. Licentiate thesis. Pori, Finland: Tampere University of Technology.
22. Kantola, J., 2009. Ontology-based resource management. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 19(6), pp.515-527.
23. Kantola, J., Vanharanta, H. & Karwowski, W., 2006. The Evolute System: A Co-Evolutionary Human Resource Development Methodology. In *International Encyclopedia of Ergonomics and Human Factors*. Boca Raton: 2nd Edition.
24. Kantola, J., 1998. *A Fuzzy Logic Based Tool for The Evaluation of Computer Integrated Manufacturing, Organization and People System Design*. PhD thesis. Louisville, KY, USA: University of Louisville.

Flow Models in Information Systems: Is Learning the Missing Element?

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Abstract This article studies how flow theory has been utilized in Information Systems (IS). Key concepts of flow theory are introduced and compared to flow related models in an IS research field. This study shows that Csikszentmihalyi's (1990) idea of self-improvement has been left out from most of the flow models in IS. Researchers are concentrating to antecedents and consequences of flow and their relations with IS constructs. This emphasis can't rigorously predict long-time user behavior. Recent studies like Magni et al. (2010) are implying that flow experience wears off during long-time use of technology. Findings of Oinas-Kukkonen et al. (2009) and Skadberg and Kimmel (2004) support that learning could be the key element for producing long-time flow experiences for users of different IT-artifacts.

Keywords: Flow, Learning, Self-improvement

1. Introduction

The concept of flow has been used in many studies that are related to information systems or ICT in general. Flow has been applied when studying computer-mediated environments (Hoffman and Novak, 1996; Finneran and Zhang, 2003) and more specific areas such as Internet use and online consumer behavior (Novak et al. 2000; Koufaris, 2002; Korzaan, 2003), computer games (Weber et al. 2009; Zagal et al. 2010) or even instant messaging (Zaman et al., 2010). According to Csikszentmihalyi (1990) flow can be described shortly as a joyful experience. Flow is a mental state where an individual is fully focused, involved and immersed in an activity (Csikszentmihalyi, 1990). This doesn't mean that flow is something exceptional, a 'once in a lifetime experience' rather it can be part of every day life. Csikszentmihalyi (1988) uses the term 'autotelic personality' to explain how some persons can achieve a flow state from the variety of activities that most of us would think boring or oppressive. According to Csikszentmihalyi

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(1988) anyone can improve their flow experience skills, in other words, an autotelic personality isn't something that individuals are born with.

Even though flow isn't a fixed emotional state that would automatically spring up after certain antecedents are met, it has been found positively correlating for example revisiting web sites (Novak et al., 2000) and online purchase intention (Korzaan, 2003). If the information system is able to lift user to a flow state, (s)he is very likely to use it again.

Unfortunately flow doesn't seem to be stable state, and it can wear off over time as Magni et al.'s (2010) results are implying. Magni et al. (2010) argue when exploring new technology the effect of instrumental values increases and flow experience decreases in a long run. The result is somewhat surprising since flow isn't related only to novelty factors as Csikszentmihalyi (1990) has presented. On the contrary flow is linked to activities where individuals have developed their skills efficiently enough to match challenges they are facing. In order to produce flow, the activity should be challenging enough so individuals won't feel bored but at the same time it shouldn't be too challenging to affect anxiety to them. (Csikszentmihalyi, 1990.) This fundamental balance between challenges and skills is surprisingly hard for IT-artifacts to handle. For example, when considering web pages, if flow would have a positive affect on a user's intentions' to revisit and purchase, one can ask: How long? After the challenge is gone, it's not the flow that motivates users to visit the web site. Something must be constantly changing. If designers keep increasing a webpage's challenge via technical features, then newcomers would feel frustrated. It seems that only computer games can address this problem easily because of their skill–challenge aptitude (Weber, 2009). Is it possible for IS developers to design IT-artifacts that support users' flow state as a lasting experience?

One potential solution can be found from Oinas-Kukkonen et al.'s (2009) study, where they compared the use of seven different medical databases with their own webflow model. Databases were provided by the Finnish Medical Association Duodecim and almost half of the physicians who responded to the survey used the information system daily (a total of 232 respondents). Only two of the respondents used information system less often than once a month (Oinas-Kukkonen et al., 2009), so it is safe to argue, that users are dealing with a system that is familiar for them. As a result Oinas-Kukkonen et al. (2009) found

that participants experienced flow most strongly when they felt they were also learning. Oinas-Kukkonen et al. (2009) argues that learning can be the kind of stimuli which can keep users in flow state, at least in knowledge based work context.

Oinas-Kukkonen et al.'s (2009) findings can reach even further than what they had in mind. Csikszentmihalyi (1990) argues when experiencing flow 'self' becomes complex and person learns to become more than what (s)he was before. In other words through flow we are extending our individual boundaries, and according to Csikszentmihalyi (1990) once individuals experienced flow, they will double the effort to feel it again. This is actually how self grows (Csikszentmihalyi, 1990).

The following chapter represents flow more deeply. Third section discuss some of the problems related to flow theory and its utilization in IS field. Fourth part of this article introduces Oinas-Kukkonen's (1999) Webflow model and how Oinas-Kukkonen et al.'s (2009) study found strong relation between flow and learning. Chapter also covers Hoffman and Novak's (2009) review of flow studies, and points out how learning is missing almost all of them. Lastly there are conclusions.

2. Flow theory

The concept of flow is developed by Csikszentmihalyi (1990), and the motivation to his studies comes from the question: What makes people happy? He was puzzled with the fact that after people's basic needs were satisfied by increase of living standards didn't increase happiness. What other options other than wealth could explain happiness? It was when Csikszentmihalyi collected the individual's descriptions of activities that brought happiness and joy he discovered phenomenon of flow (Csikszentmihalyi, 1990).

Flow is often associated with entertainment or smooth effortless experience and it's easy to forget that many subjects that Csikszentmihalyi interviewed were seeing much effort for what they were doing. Csikszentmihalyi makes a clear distinction between pleasure and enjoyment. Pleasure is a feeling of contentment when all the basic needs are fulfilled but pleasure doesn't ultimately bring happiness. Csikszentmihalyi (1990) uses the word enjoyment to

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describe a feeling when a person has gone beyond his or her old limits and has achieved something new and unexpected.

One of Csikszentmihalyi's (1988) examples is a painter who is passionately working with his canvas. Csikszentmihalyi was curious to see how artist gave so little interest to the painting after it was finished. The artist didn't worry if the paintings won't make him rich and famous. There weren't any extrinsic rewards that would explain his enthusiasm. Yet the artist was determinant to better his skills and take new challenges. The rewards of painting came from painting itself. (Csikszentmihalyi, 1988.)

Flow is an optimal experience where consciousness is in order. The opposite state of flow is the condition of psychic entropy (Csikszentmihalyi, 1990). As Csikszentmihalyi (1990) argues that when a person chooses a goal and invests himself in it to the limits of his concentration, whatever he'll do is enjoyable. Once they have experienced this joy, a person will double their efforts to feel it again. According to Csikszentmihalyi (1990) this is how self grows. As a result of experiencing flow the self becomes complex and we learn to become more than what we were (Csikszentmihalyi, 1990).

According to Csikszentmihalyi (1990) the descriptions of flow were surprisingly similar no matter what the activity was. Long-distance swimmers, composers or chess players described their feelings almost identically when they experienced the state of flow (Csikszentmihalyi, 1990). Culture, social class, age or gender didn't have an effect of experiencing flow although it played a big role in what different groups did to experience enjoyment (Csikszentmihalyi, 1990). According to Csikszentmihalyi's (1990) studies there are eight major components for the experience of flow. When people reflected their feelings of flow they mention often all, but at least one of the following components:

1. a challenging activity that requires skills
2. the merging of action and awareness
3. clear goals and feedback
4. concentration on the task at hand
5. the paradox of control
6. the loss of self-consciousness
7. the transformation of time
8. the autotelic experience (Csikszentmihalyi 1990).

A challenging activity that requires skills

The overwhelming proportion of optimal experiences is reported with goal-directed activities that require concentration and relevant skills (Csikszentmihalyi, 1990). Balance between challenge and skills are often thought as the most important elements of flow also in the IS field (Finneran and Zhang, 2005; Weber et al., 2009).

The Merging of Action and Awareness

When a person's appropriate skills are needed to deal with the challenge, the person's all attention is concentrated to the activity. As the individual is so involved to the activity, what they're doing becomes almost automatic. A person isn't aware of oneself anymore and are merged to the action he's performing. Their experience of flow seems to be effortless but it requires disciplined mental activity. (Csikszentmihalyi 1990.)

Clear Goals and Feedback

Complete involvement to a certain task often requires clear goals and immediate feedback. In some activities the goals are not clear in advance, and a person must have a strong sense of his intentions (Csikszentmihalyi 1990). Csikszentmihalyi (1990) claims that it's often unimportant what kind of feedback we get from activities. What matters is the meaning of the feedback that goals of our intentions are succeeding (Csikszentmihalyi, 1990).

Concentration on the Task at Hand

During the flow experience a person often loses their awareness of all other things. Enjoyable activities require total concentration and while it lasts, the person is able to forget all the unpleasant things in life. This dimension is one of the most frequently mentioned dimensions of flow according to Csikszentmihalyi (1990).

The Paradox of Control

The sense of control has often involved with the flow experience, or as Csikszentmihalyi (1990) describes it more precisely, in flow one isn't worrying about losing control. What people enjoy in the flow state isn't to be in absolute control, but to feel the sense of exercising control in difficult situations (Csikszentmihalyi 1990).

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The Loss of Self-Consciousness

During the flow state a person loses the sense of self and feels united with the world around him. Csikszentmihalyi (1990) describes this almost as a religious experience where an individual participates in an action greater than what they have before.

The Transformation of time

Csikszentmihalyi (1990) argues that loss of the feeling of time is one of the most common descriptions of flow experience. During the optimal experience the sense of time bears little relation to “real” time measured by clock.

The Autotelic Experience

Autotelic experience is a different flow component compared to the previous seven. When an activity is autotelic, an individual is paying attention to the activity for its own sake. Exotelic activities on the opposite are done only for external reasons. Most things we do in ordinary life aren't purely autotelic or exotelic. In the worst typical case we do our work just for the sake of money and spend our leisure time passively without using any skills or exploring any new opportunities. In that way everyday life juggles between anxiety and boredom with little sense of control. (Csikszentmihalyi, 1990.) Csikszentmihalyi (1990) claims that we can evolve our activities from exotelic to autotelic experiences, thus we have the potential to make our life richer and more meaningful. We can train ourselves to enjoy whatever we do. Csikszentmihalyi (1988) uses the term ‘autotelic personality’ to explain how some persons can achieve a flow state from the variety of activities that most of us would think boring or oppressive.

3. Flow in IS

The flow concept is used in many studies with other constructs that are familiar to IS research field. The main motivation for researchers to make re-conceptualizations of flow is to match it better with ICT-based questions, like for example Oinas-Kukkonen's (2000) Webflow model and Finneran & Zhang's (2003) Person-Artifact-Task (PAT) model. Some studies adapt parts of flow into other widely used theoretical models like Korzaan (2003), where flow is integrated with the Theory

of Reasoned Action (TRA). Another, and more referred is Koufaris' (2002) study, where he unites flow with a technology acceptance model (TAM).

Various research approaches have rose also critics in IS research field, and probably the most thorough critics have presented Finneran and Zhang (2005). They argue that in literature, adapting the phenomenon of flow to computer users shows high inconsistencies and discrepancies. Flow is badly defined because it is conceptualized, operationalized and measured numerous ways (Finneran and Zhang, 2005). According to Finneran and Zhang (2005) there isn't many researchers that focus on flow experience exclusively, so it's difficult to build rigorous predictive models.

Finneran and Zhang (2005) compared five different flow models where the flow phenomenon is the main focus: Ghani (1995), Hoffman and Novak (1996), Novak et. al (2000), Chen (2000) and Skadberg & Kimmel (2004). Comparison showed that each model is unique. Some of the flow components are in all of the models, and some are only in one particular model. What is common to all of them is that they all suggest three stages as flow framework: antecedents, experience and consequences. (Finneran and Zhang, 2005.)

Finneran and Zhang (2005) argue that based on their findings of comparison of different flow models the discrepancies are considerable. For example, perceived control is flow antecedent for Ghani (1995) and Chen (2000), consequence to Hoffman and Novak (1996) and totally missing from Novak et al.'s (2000) model. Based on the models, only compulsory constructs for flow would be challenges and skills (Finneran and Zhang, 2005). Finneran and Zhang (2005) argue that concerning how much effort have been invested to study flow it would be expected to have some standard constructs in flow theory. They declare that the conceptualization problem should be realized and resolved before adding more flow models which will only worsen inconsistent understanding (Finneran & Zhang, 2005).

Guo and Poole (2009) tested the complete structure of the flow model (Csikszentmihalyi, 1988) in the context of online shopping. Their results support that web site complexity affects flow. Only clear goals didn't correlate to flow experience, which might be explained by the nature of online shopping. According to Guo and Poole (2009) online-shopping don't have as clear goals as other online tasks have, such as information searches, online games or communication.

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Guo and Poole's (2009) findings are interesting, but they are revealing frozen moments of an experiential online experience, and their model can't predict any further than that. Novak et al. (2003) studied distinction between goal-directed and experiential web use, and they found that flow experiences were more prevalent among those who use web for goal-directed activities, rather than just for fun.

One can also question if all of the flow components are necessary to measure flow? As the majority of flow related studies in IS are quantitative and model-testing, it's seen as a risk to use incomplete flow models (Finneran and Zhang, 2005; Guo and Poole, 2009). It can be dangerous when flow itself is forgotten and the experience is measured through different flow elements. As Hoffman and Novak (2009) noticed Koufaris (2002) and Richard and Chandra (2005) bypasses measuring flow altogether, instead of measuring a set of constructs related to flow. Other than that there is no need for having all the constructs in the flow-oriented models. Csikszentmihalyi was collecting experiences of joy and happiness, and individuals are capable of estimating experience themselves when asked. Korzaan (2003) combined flow with TRA and used only one instrument for measuring flow developed by Novak et al., (2000). The resultant model explained 60% of individuals' intentions to purchase online (Korzaan, 2003). Also, other studies have proved to have predictive power even though they don't use whole spectrum of flow constructs (for example Skadberg and Kimmel, 2004; Novak et al., 2000; Magni et al. 2010). Despite the critics of Finneran and Zhang (2005) current way to do research is producing results.

4. IS flow models and learning

IS researchers have quite often merged flow concepts with other theoretical models and constructs. In this chapter we're introducing Oinas-Kukkonen's (2000) webflow model as an example how the concept of flow has been utilized in the IS field.

Webflow is a research vehicle developed originally by Oinas-Kukkonen (1999) and it's based on the works of Csikszentmihalyi (1977), Novak et al. (2000) and Trevino and Webster (1992). Webflow is a single item construct study, which studies relations between flow and 9 elements: challenge, skills, control, navigation, orientation,

focused attention, ease of use, usefulness and learning (Oinas-Kukkonen et al., 2009).

Oinas-Kukkonen et al.'s (2009) webflow model follows the work of Trevino and Webster (1992) who suggests that *ease of use* can be an intermediate variable between challenges and flow. Between skills and flow is another intermediate variable *usefulness*, which has been found to predict behavior in the technology acceptance research stream. (Oinas-Kukkonen, 2000.) Another fresh example of taking a body of knowledge into account is Magni et al.'s (2010) study, where they revised Agarwal and Karahanna's (2000) model and used measuring instruments of Hoffman and Novak (2000).

Oinas-Kukkonen et al. (2009) studied the mobile information system where physicians could use seven different medical databases. Despite of its name, webflow is useful tool also to study mobile systems (see also Oinas-Kukkonen, 1999). As a result Oinas-Kukkonen et al. (2009) found five prerequisites that were found to predict flow: navigation, learning, focused attention, challenges and orientation. Oinas-Kukkonen et al. (2009) found also correlation between learning and focused attention as well as between navigation and orientation. Figure 2 displays the prerequisites found in Oinas-Kukkonen et al.'s (2009) study.

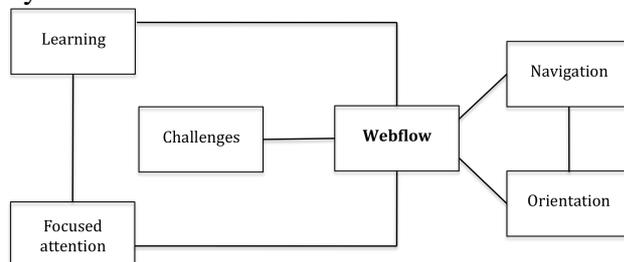


Figure 2. The prerequisites of flow.
Oinas-Kukkonen et al. (2009)

According to Oinas-Kukkonen et al. (2009) surprisingly, ease of use and usefulness did not have an effect on user experience, but instead the connection between flow and learning was unexpectedly high (Oinas-Kukkonen et al., 2009). Their findings also reveal that flow has a dual role, both as a consequence and as an antecedent (Oinas-Kukkonen, 2009).

Hoffman and Novak (2009) listed 20 articles presenting either conceptual or structural models of flow. From models they gathered flow antecedents, experience, and consequences (Hoffman and Novak,

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2009). Naturally the table didn't have the all possible flow models, for example Oinas-Kukkonen et al.'s (2009) model is missing, but it does give good picture of most referred flow related studies that has been done in the IS research field recently (Hoffman and Novak, 2009). This study lists only empirically tested structural models from Hoffman and Novak (2009) table (Table 1).

Table 1. Summary of Conceptual and Structural Models of Flow
Modified from Hoffman and Novak (2009)

Authors	Antecedents	Flow	Consequences
Agarwal and Karahanna (2000)	Playfulness, personal innovativeness	Higher-order construct of "cognitive absorption" (curiosity, control, temporal dissociation, focused immersion, heightened enjoyment)	Perceived usefulness, perceived ease-of-use, behavioral intention
Choi, Kim and Kim (2007)	Learner interface, interaction, instructor attitude toward students, instructor technical competence, content	Unidimensional flow	Attitude toward e-learning, learning outcomes
Chou and Ting (2003)	Repetitive behavior	Higher-order construct (empathy, discovery)	Addictive behavior, self-control disorder, obsession, goal confusion
Hsu and Lu (2003)	Perceived ease of use	Unidimensional flow	Attitude toward playing online game, intention to play online game
Huang (2003)	Complexity, interactivity, novelty	Multi-dimensional construct (control, attention, curiosity, and interest)	Utilitarian and hedonic web performance
Huang (2006) <i>Structural model</i>	None specified	Three higher-order constructs: 1) Flow (control, curiosity, enjoyment, interest); 2) Situational Involvement (curiosity, interest, risk, attention focus, personal relevance); 3) Enduring Involvement (enjoyment, interest,	None specified

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		personal relevance, self-relevance	
Korzaan (2003)	One specified	Unidimensional flow	Exploratory behavior, attitude, intention to purchase
Koufaris (2002) *only these constructs had significant relationships	Product involvement*, skill*, search mechanisms*, challenge*	Not directly measured. Instead used control, shopping enjoyment*, concentration, perceived usefulness*, ease of use	Unplanned purchases, intention to return*
Luna, Perrachio and de Juan (2003)	Attention, challenge, interactivity, attitude toward site	Unidimensional flow	Purchase intention, revisit intention
Novak, Hoffman and Yung (2000)	Online tenure, skill, control, interactivity, challenge, arousal, importance, focused attention, telepresence, time distortion	Unidimensional flow	Exploratory behavior (via telepresence)
Richard and Chandra (2004)	Reasons to visit, OSL, skill, challenge, interactivity, navigational cues, need for cognition, site involvement	Not directly measured	Exploratory behavior, attitude, prepurchase intention
Sanchez-Franco (2006)	Usefulness, ease of use	Higher order construct (enjoyment and concentration)	Attitude, intention, usage
Skadberg and Kimmel (2004)	Ease of use, speed, attractiveness, interactivity, skill, challenge	Higher-order construct (time distortion, enjoyment)	Learning about a place, change of attitude and behavior

When going through Hoffman and Novak's (2009) table, it is striking to see how learning (or self-improvement in a broader meaning) is missing from nearly all of them. Only Skadberg and Kimmel (2004) have an empirically tested model, where learning is an affecting element. Also Choi et al. (2007) have learning in their model, but they are concerned of flow's affect on e-learning and learning outcomes. To make a needed distinction it might be better to use the term self-improvement rather than learning to describe Csikszentmihalyi's (1990) idea of how self grows.

Skadberg and Kimmel (2004) studied people's flow experience while browsing a web site. They measured also individuals' changes of

attitude and behavior with three actions: inquiring for more information after visiting the web site; coming back to the web site later for information; and taking positive actions, such as visiting the place presented (Skadberg and Kimmel, 2004). Skadberg and Kimmel (2004) found that flow experience contributes to increased learning, and increased learning has biggest impact on changing attitude and behavior.

5. Conclusions

This study reviewed flow theory and showed an example how it is used in IS research field. Flow related IS studies and Hoffman and Novak's (2009) summary that were covered in this study, are implying that Csikszentmihalyi's (1990) idea of self-improvement has been left out from IS flow models. It is seen, that most of the researchers are concentrating to different flow elements and their relations to IS related constructs. This emphasis doesn't utilize flow theory as its full potential and can't rigorously predict long-time user behavior. Findings of Oinas-Kukkonen et al. (2009) and Skadberg and Kimmel (2004) support that learning could be the key element for producing long-time flow experience for users of different IT-artifacts.

Hoffman and Novak's (2009) summary reveals also that 'autotelic personality' seem to be totally missing from flow models. The concept of 'autotelic personality' wasn't covered in this study, but it should be addressed in future studies. 'Autotelic personality' could have direct effect on flow, in a sense that it measures people's willingness to learn and improve themselves.

The biggest limitation of this study is that it isn't an empirical study or even a conceptual one. This article doesn't present a solution of how self-improvement or autotelic personality should be modeled. Another major limitation is that this paper leans solely on Hoffman and Novak's (2009) and Finneran and Zhang's (2003) findings. First step in the future is to make rigorous literature review to clarify if the gap really exists. If the gap is verifiable, there is need for longitudinal study, preferably on an area other than IS aided knowledge work, so that relation between flow and learning are more reliable. On a third face it would be reasonable to do qualitative study. Do individuals themselves

feel extending their boundaries when experiencing flow via IS, or is it just gathering information?

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References

- Agarwal, R. & Karahanna E. (2000). Time Flies When You're Having Fun: Cognitive Absorption and beliefs about Information Technology Usage. *MIS Quarterly*, 24 (4), pp. 665–694.
- Chen, H. (2000). Exploring Web Users' On-line Optimal Flow Experiences. Unpublished PhD Dissertation, School of Information Studies, Syracuse University, Syracuse.
- Choi, D.H, Kim, J., Kim, S.H. (2007). ERP training with a web-based electronic learning system: The flow theory perspective. *International Journal of Human-Computer Studies*, 65(3), pp. 223–243.
- Csikszentmihalyi, M. (1977). *Beyond Boredom and Anxiety*. Jossey-Bass, San Francisco.
- Csikszentmihalyi, M. (1988). The Flow Experience and Human Psychology. In Csikszentmihalyi, M., Csikszentmihalyi, I.S. (Eds.). *Optimal Experience: Psychological Studies of Flow in Consciousness*. Cambridge Univ. Press., Cambridge.
- Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experience*. Harper & Row, New York.
- Finneran, C.M. & Zhang, P. (2003). A Person-artefact-task (PAT) model of flow antecedents in computer-mediated environments. *International Journal of Human-Computer Studies*, (59)4, pp. 475–496.
- Finneran, C. M., & Zhang, P. (2005). Flow in computer-mediated environments: promises and challenges. *Communications of the AIS*, 15 (4), pp. 82–101.
- Ghani, J. (1995). Flow in Human Computer Interactions: Test of a Model. In Carey, J. (Ed.), *Human Factors in Information Systems: Emerging Theoretical Bases*. Ablex Publishing Corp, New Jersey, pp. 291-311.
- Guo, Y.M. and Poole, M.S. (2009). Antecedents of flow in online shopping: a tes of alternative models. *Information Systems Journal* 19, 369–390.
- Hoffman, D. L. & Novak, T.P. (1996). Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations. *Journal of Marketing*, 60 (July), pp. 50–68.
- Hoffman, D.L. and Novak, T.P. (2009). Flow Online: Lessons Learned and Future Prospects. *Journal of Interactive Marketing*, 23(1), 23–34.
- Korzaan, M. L. (2003). Going with the flow: Predicting online purchase intentions. *Journal of Computer Information Systems*, 43(4), 25-31.
- Koufaris, M. (2002). Applying the Technology Acceptance Model and Flow Theory to Online Consumer Behavior. *Information Systems Research* (13)2, pp. 205–223.
- Magni, M., Taylor, M.S., Venkatesh, V. (2010). 'To play or not to play': A cross-temporal investigation using hedonic and instrumental perspectives to explain user intentions to explore a technology. *International Journal of Human-Computer Studies*, 68, 572–588.

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- Novak, T.P., D.L. Hoffman, and Y.-F. Yung (2000). Measuring the Customer Experience in Online Environments: A Structural Modeling Approach. *Marketing Science* (19)1, pp. 22–42.
- Novak, T.P., D.L. Hoffman and Duhachek A. (2003). The Influence of Goal-Directed and Experiential Activities on Online Flow Experiences. *Journal of Consumer Psychology*, 13 (1&2), 3–16.
- Oinas-Kukkonen, H. (1999). Mobile Electronic Commerce through the Web. *Second International Conference on Telecommunications and Electronic Commerce (ICTEC '99)*. Nashville, USA, October 6-8, 1999, 69-74.
- Oinas-Kukkonen, H. (2000). Balancing the vendor and consumer requirements for electronic shopping systems. *Information Technology and Management*, 1(1), 73-84.
- Oinas-Kukkonen H., Räisänen T., Leiviskä K., Seppänen M. and Kallio M. (2009). Physicians' User Experiences of Mobile Pharmacopoeias and Evidence-Based Medical Guidelines. *International Journal of Healthcare Information Systems and Informatics* 4(2): 57–68.
- Richard, MO. And Ramdas C. (2005). A Model of Consumer Web Navigational Behavior: Conceptual Development and Application. *Journal of Business Research*, 58, 1019–1029.
- Skadberg, Y.X. and Kimmel, J.R. (2004). Visitors' Flow Experience while Browsing a Web Site: Its Measurement, Contributing Factors and Consequences. *Computers in Human Behavior* (20), pp. 403–422.
- Trevino, L.K. and Webster J.W. (1992). Flow in Computer-Mediated Communication. *Communication Research*, vol. 19, no. 5, 539-573.
- Weber, R., Tamborini, R., Westcott-Baker, A. and Kantor, B. (2009). Theorizing Flow and Media Enjoyment as Cognitive Synchronization of Attentional and Reward Networks. *Communication Theory*, 19 (4), pp. 397–422.
- Zagal, J., Chan, S. S., Zhang, J. (2010). Measuring Flow Experience of Computer Game Players. *AMCIS 2010 Proceedings*. Paper 137.
- Zaman, M., Murugan, A.R. and Qizhi, D. (2010). Experiencing flow with instant messaging and its facilitating role on creative behaviors. *Computers in Human Behavior*, 26 (5), 1009–1018.

A Framework for Requirements Management in Order to Align Business Process and IS Development

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Abstract. This paper explores requirements management needs particularly where there is a demand for integration between business process (BP) and information system (IS) development activities within development projects. Earlier studies have shown that good IS project and IS requirements management practices are not sufficient for integrating BP and IS development. This motivated us to look for a new framework in order to integrate BP and IS development within a development project context. To include the dynamics of requirements changes, our framework integrates the requirements management approaches widely used in BPs (e.g. ISO 9000) and in ISs (e.g. the waterfall method) as well as in project management (e.g. PMBOK). To understand and refine our framework we conducted a case study in a large multinational company. The results indicate that the changes in requirements need to be handled in a dynamic way. The findings also suggest a direction for further measures aligning BP and IS development.

Keywords: Business process management, Alignment, IS development, Requirements management, Project management.

1 Introduction

Many studies have shown that newly developed or purchased Information Systems (IS) do not always fulfill the business needs [1, 2]. From the business perspective, there are many known problems in IS projects, e.g. projects overrun their budgets and time schedules; projects scope creep; IS projects are difficult to plan and follow up, the outcomes of the IS projects are debatable to say the least, and the newly developed information systems are sometimes not even deployed because of their poor results (see e.g. [1, 2, 3, 4]). In the more conventional industry projects, e.g. in case of an acquisition of a new production line or machine, these kind of problems are not approved of nor tolerated but in IS projects those problems seem to occur over and over again.

It is commonplace that the development of business processes create needs that cause changes to the related information systems or underlying IT, which companies have set up in order to support their processes. In addition, it is also common that changes in information systems are becoming more and more complex than they used

to be; there are no standalone systems any more. Also, the ever increasing number of stakeholders (internal and external users with different uses), business units (with their own needs and requirements) and processes (within the company boundaries and passing) are involved in IS development [5, 6]. Typically, the changes concerning ISs are done in projects, which are one-of-a-kind and independent of one another, having a well-defined scope and their own personnel, i.e. project organization. Often the requirements are the only discussion “method” between ongoing business development and IS development. Using the requirements as an integration tool is very challenging and problems in the requirements management is reported being one of the most significant causes of projects’ failures. Furthermore, many of these problems in requirements management seem to be caused by problems in communication, see e.g. [1, 6]. In other words, business people and IS developers do not speak “the same language”. The requirements that are used for integrating the different development projects are normally not as thorough as they should be nor are they centrally managed, organized, or well-coordinated.

The aim of this paper is to identify requirement collection, analysis, and management needs in order to align business process (BP) development with information system (IS) development. We have conducted a case study in an organization, which is a large multinational corporation with five different business units and several thousand employees globally. The purpose was to look for new ways to integrate BP and IS development by using requirements within development project context. In this paper BP and IS requirements management models found in literature are collated to the findings from the case study and a new framework based on them is proposed.

The paper is organized as follows; first we present the theoretical framework after which the methodology of this study is explained. In chapter four, findings are overviewed and then discussed in chapter five. Our preliminary framework is introduced in chapter six, and conclusions and suggestions for future research are presented in the final chapter.

2 Framework

The framework of this study consists of software development practices, requirement classification, requirements management, project management, business process development, and the alignment of IT and business with regard to the necessary collection, coordination, and management of requirements in order to develop IT systems that enable and enhance organizations’ operations. These different viewpoints form the theoretical background of this paper and are used in the analysis of the findings of this case study in order to present our preliminary framework for requirements management.

2.1 Software Development

Today there are many different methods used in software development. The best known and the most used one is the waterfall method. The waterfall method is based

on distinct phases: requirements analysis and definition, system and software design, implementation and unit testing, integration and system testing, operation, and maintenance [7]. Moving from one phase to another requires that all the activities in the previous phase are accomplished. The waterfall method is a very straightforward way to develop software, but it has many known problems, e.g. early mistakes are found late and they are difficult (and costly) to solve. The method also assumes that no changes happen during the software development, i.e. what is defined in the beginning will be implemented in the later phases. Even if all the definitions have been done correctly in the first place, it does not guarantee success in IS development since circumstances might have changed during development [5, 6, 7].

In addition to the waterfall method, there are more flexible methods, e.g. RUP and agile methods, which seem to take better care of failures in defining and planning phases, and the changes during the development project. Those methods are becoming more and more popular and (at least) in theory they solve many of the problems related to the waterfall method. [7, 8]. Because those more flexible methods are not yet widely used in the case company and likely they are not suitable for all kinds of IS projects, we concentrate in this paper on waterfall based methods, which still are widely used everywhere.

2.2 Requirement Classification

There are many definitions for requirements in the literature, and requirements could be classified in many different ways, see e.g. [9, 10, 11]. Even within one, single project requirements might be defined differently in various contexts. Furthermore, those different requirements can be and usually are in fact just different perspectives to real business needs and stakeholders expectations [7, 6, 12]. Below, we have listed various requirements classifications that are relevant in this study's context.

Requirements by different roles Business managers, process owners, end users, stakeholders and developers have different perspectives to requirements. Business managers take care of the business needs; behind business needs there are business strategy decisions and business models, which can cause needs for changes according to a particular situation. Process owners are looking for solutions on how to implement the selected improvement steps to existing processes and how to develop optimal processes and information systems supporting or enabling them. The most important thing for the end-users is how it is possible to fulfill their given tasks and whether the processes and information systems are either supporting or impeding their work. Developers, on the other hand, are mostly interested in solving technical problems.

Also other stakeholders (e. g. customers, vendors, partners, public officials, other processes owners) might be involved in the projects one way or another. Typically, they are not members of the development project teams.

Hierarchy of requirements Based on the roles mentioned above it is possible to see strategic, tactical, and operational level requirements. Operational level requirements should be traceable from strategic level requirements and so forth. It is often useful to distinguish business strategy and IT strategy: both create requirements, which have to be taken into account in development projects.

Abstraction level of requirements It is also possible to construct requirement hierarchy according to the abstraction level of requirements. For example, the lowest level of abstraction contains operational IT level requirements, which are information system software level requirements, and they have to be concrete enough for the developers in order for them to be able to implement them (see e.g. [13]).

Requirement types Similarly, It is possible to divide requirements into different types. This type of classification is widely used in requirement elicitation and analysis, and many slightly different classifications are in use. For example, business requirements, stakeholder requirements, solution requirements (which include functional requirements and non-functional requirements), and transition requirements, see e.g. [7, 13].

Requirements by priority One important classification of requirements is connected to project portfolio management; which requirements are topical, which requirements are already realized, which ones are coming topical later on, and which ones will be left out, which requirements are allocated to which projects, and what is the priority of requirements [14].

Requirement by challenge Hansen and Lyytinen [6] in their study divided challenges into three categories: individual cognitive challenges, interpersonal challenges, and complexity-based challenges based on their level of abstraction. One of the observations Hansen and Lyytinen [6] has is that requirement engineering research has focused on the lower levels of abstraction and there is less research about challenges dealing with broader systemic complexity, which is also an issue that this paper tries to address.

All in all, the discussed classifications of requirements are overlapping. However, using these classifications helps to build a more complete picture about requirements management. In literature, it is not often discussed what real business needs are but only what software should do. Business needs are rarely highlighted [11].

2.3 Requirements Management

Requirements management provides tools for managing requirements and their interdependencies. That means not only managing requirements from a high level to a low level and vice versa, but also managing requirements from different sources and in different projects and the relationships between them.

There are some readymade guidelines about requirements management. For example Sommerville and Sawyer introduce REGPG (Requirements Engineering Good Practice Guide) framework [9], which gives a structural way to collect and manage requirements. In addition, many other techniques have been developed as well. To get better understanding of those techniques, researchers have created contingency models for appointing techniques to specific contexts, see e.g. [15]. Those models are valuable tools, when new requirements management processes are designed. However, they seldom offer ready-made solutions but rather good lists of issues that need to be paid attention to. In order to get the most out of these kind of quite formal (and sometimes very theoretical) models, the users should understand the nature of IS projects, the nature of business development projects and the role of requirements in an IS development project [11]. The users should also take into

account the different types and levels of requirements mentioned in the previous chapter.

Even though requirements management should cover both BP and IS development, in general, the requirements management models and guidelines seem to be mostly for IS development and business requirements are not covered.

2.4 Project Management

Many studies have been carried out in order to find out reasons behind the success and failures of information systems projects, see e.g. [1, 2, 16, 17]. One of the most important reasons behind the failures seems to be related to inadequate requirements. This does not mean that project management is unimportant since poorly done project management will undoubtedly cause problems.

Furthermore, one major cause for problems seems to be that business processes are developed by their own developing methods, for example by using different kind of roadmaps, see e.g. [18, 19]. While going through all the roadmap steps, the process development takes a long time and therefore it could be said that process improvement is continuous, i.e. it is a process (or program) itself. The “normal” situation is that companies have many processes developed at the same time. In turn, ISs are usually developed in many (individual) projects. These projects have specific objectives, time schedule and resources. And when the project ends, the outcome is delivered and the project organization is disbanded.

In most cases, projects are not the best way to support continuous improvement since projects are not flexible enough. Many project management methods are based on the stage-gate model [20], and if the stage-gate model is strictly followed in a project, it has a tendency to lead to similar methods, such as the waterfall style of development and BPR-like (Business Process Re-engineering) process development. This is one reason behind the fact that agile methods have recently become more popular. With them it is possible to add more flexibility in project management, even if strict project management methods and guidelines are used within an organization, e.g. see rolling planning in Project Management Body Of Knowledge (PMBOK) [21, 22].

A project portfolio is a tool for managing projects so that company’s business strategies are taken into account. Projects in a project portfolio should be aligned with strategy, and that way the project portfolio is also a tool for managing how business requirements are being fulfilled. Different types of projects are selected to the portfolio and there are different ways to select projects, see e.g. [14]. The project portfolio quite often concentrates on categorizing existing projects (already started or proposed). Issues regarding the needs and requirements out of projects and between ongoing projects are very limited; there is a risk of “project silos”. This means that a project portfolio does not automatically solve conflicts between continuous process improvement and “fixed” projects. However, a project portfolio is a popular tool for managing existing IS development projects [23].

2.5 Business Process Development

One noteworthy basis for business process development is quality management. There exist extensive models for quality management, for example TQM (Total Quality Management) and EFQM (European Foundation for Quality Management excellence model), which cover all the activities in an organization, including not only the processes but also its products and services. For example EFQM has nine categories and processes are just one of them [24]. There are also models and standards, which are based on quality management concentrating more on process management. There are variety of quality based process management standards, which have had a remarkable effect on their respective industries, for example Capability Maturity Model Integration (CMMI) and Software Process Improvement and Capability determination (SPICE, ISO 15504) in software industry and ISO 9000 family of quality standards in product manufacturing [25]. If we think of the overall business process development, the most widely used development models seem to be based on ISO 9000.

Process development could be done in a one, large change project, or in smaller steps. For example, Business Process Re-engineering (BPR) is a widely used development method, where the whole business process is redesigned [26, 27]. The idea of BPR is that companies should not just automate their existing (manual) processes, but redesign (improve and optimize) them first. Otherwise, the automation project dictates what the new business process will be like. Also, this kind of “destructive” re-engineering has its risks; doing a big change project is like using waterfall method in business process development. Due to known limitations of BPR and other earlier methods, Business Process Management (BPM) is taken more into usage as it gives a wider perspective to continuous process development management and diagnosis [28].

Business processes are normally developed in independent projects. Requirements for business process development projects are normally derived from business strategy, using for example road mapping as a tool to manage different development steps [18, 19].

2.6 Alignment of IT and Business

Few decades ago IT departments were independent support organizations for business. Business units developed their business models and, after that, IT department delivered the sufficient tools in order to support business. Distribution of work was clear and both sides had their own responsibilities. Unfortunately, that model led to big problems: after some time there were a large number of independent applications, which had no connections to each other, applications processed data without any relations to other applications, there were no coherent master data; business did not know about the strategic possibilities of new technology, and so on. In the long run that kind of approach becomes chaotic and it was seen necessary to have some architectural planning and deeper co-operation between IT and business units, see e.g. [29, 30].

It has been known for a while that good IT infrastructure capability is important when business processes are changed or re-engineered [23, 31]. These days, when more and more BPM systems are implemented, it has been noticed that BPM in itself does not automatically guarantee alignment between Business and IT, see e.g. [32]. IT infrastructure should be designed on the grounds of business. In general, enterprise architecture has been seen as a good tool to improve co-operation. As a part of it, the engagement model should include the practices with which to align IT and business objectives. Also requirements management can be seen as a part of this engagement model. Now the role of IT becomes an issue: is it a technology provider, service provider, or a strategic partner for business? [31]

2.7 Overview of the Framework

Regarding the requirement classifications that were reviewed in chapter 2.2, it is good to remember that there are certain interdependencies, e.g. business requirements are higher-level statements of the goals, objectives, or needs of the enterprise and they describe business needs by using the business language. By looking from different viewpoints, it is possible to see that business requirements have different types of attributes, some of them are general (e.g. the same within the level of organisation) and some attributes are requirement specific.

By understanding the different requirement levels and different types of requirements it is possible to gain an overview and manage the requirement interdependencies and traceability. With interdependencies it is important to understand that the information system point-of-view should not be the only perspective since also interdependencies should be considered from business perspective; in many cases this means going over a single IS project's boundaries. There seldom are "pure" IS projects but business processes are usually developed at the same time and the majority of requirements are primarily related to business development. Hence, IS development is normally only representing the changes done to processes.

In addition, requirements are typically allocated to a certain project and are verified against that project's (current) objectives. Everything that is not within the project's scope is left out. Therefore, one can say that these requirements are no longer (primarily) business requirements but become the project's (in question) requirements. Furthermore, requirements verification for relevance is important as there are different types of requirements; thus, there has to be also different types of verifications. Ideally, business requirements should have owners, business, other stakeholders, technology architects, data architects, etc., who are able to verify the relevance of the requirements.

In the literature, it is possible to find certain kind of polarisation: there are the research-oriented academic publications and on the other hand there are the practice-oriented frameworks or reference models such as Software Engineering Body Of Knowledge (SWEBOK), Business Analysis Body Of Knowledge (BABOK), PMBOK, Control Objectives for Information and related Technology (COBIT), CMMI and standards such as ISO/IEC 12207. Even though those practical frameworks and standards are usually based on academic research (some more and

some less) and are widely used in the business world, they are very seldom mentioned in the academic research studies themselves. This indicates that there seems to be a gap between the two “worlds”.

3 Methodology

This explorative study follows the interpretive approach to qualitative research as we conduct a case study and analyse the findings using the framework presented in the previous chapter. The case study’s unit of analysis [33] is the case company’s way of managing its IS projects and associated requirements in relation to business processes development. The case company is a large multinational company with thousands of employees globally and has a large number of companywide systems in addition to different business units’ own information systems. Therefore, we think that the case company provides useful insights on the subject matter also for other companies. The main issues that we wanted to explore were how a large, international company can improve its IS development especially regarding requirements management and how to align IS projects with business process development.

In this study, the most important part was to examine the case company’s requirements management tools in relation to the development of business processes and information systems. In order to evaluate and chart the situation in the case company, a project about requirements management was conducted. This project was concluded during fall 2009 and spring 2010. For the purposes of this case study, information was gathered via interviews and discussions with the case company’s employees and by reviewing internal project management and business process related documentation. Eight information gathering sessions were held with twelve case company’s employees ranging from project management to IT department management. In addition, four interview sessions were held with six employees in order to gain a thorough understanding of the case company’s project management, requirements management, and business process models and their development. The interviews followed a semi-structured model with open ended questions in which the gathering of experiences from previous IS development projects was emphasized. In the next sections we will review the case study’s findings by using the theoretical framework.

4 Case Study’s Findings

As a part of the process management in the case company, improvement proposals are used. These improvements proposals are collected, prioritised, and managed centrally and they (may) act as a trigger to new business development projects. These development projects can also include IS development tasks. The project management process itself in the case company is based on PMBOK and the stage-gate model. IS projects are normally managed by the case company’s own personnel who are from the IT department but the project team usually comes from outside supplier(s). This has its own effects on requirements management, since requirements have to be

gathered and specified quite precisely and they also have to be defined before it is even possible to ask potential suppliers for offers. This has been found to easily lead to waterfall-kind of development.

In addition, when a project is started, there usually are other challenges related to it as well, e.g. the project team may have very limited experience of the business area and its operation environment in the case company. Also, the project team usually has no direct contact to the business people in the case company, which means that they have to depend heavily on requirements specifications. As a result, one example of the difficulties is that if the outside supplier's team is doing development on only one information system (or to a part of it), it can be very difficult for them to get an overview of the other related ISs or understand the underlying improvement proposals that could be important and related to their work.

We discovered that processes which handle requirements are not well known, they differ or are differently understood and used in different business units. Furthermore, in most cases the management of requirements in operational development projects is handled by the IT department, which means that the business side or end-user ("customer") participation seems to be limited.

Current initiators for starting new projects include technical development, regulatory changes (e.g. systems need to comply with Sarbanes-Oxley Act, i.e. SOX), changes in work methods and processes, and other reasons including demands from business units. Additionally, the way that requirements are collected and analyzed at the beginning of projects seems to vary from project to project, e.g. the role of improvement proposals is somewhat controversial. Altogether these findings mean that the presets for IS development projects are challenging.

In addition to problems in coordination and communication between the on-going business process development and IS development projects, there have been problems also in defining a comprehensive level of development covering these two areas. In some cases, there has not been seen a need for business process development (i.e. existing processes have been just automated), but only an IS project is carried out and that has caused major problems in IS projects. Before a process is automated, end-users have had a freedom to complete the tasks of the process with the best possible way they have chosen and after automation only one way is supported, even though the process itself has not really changed. Not surprisingly, the end-users easily experience that there is an IS project, which is done only for IT's own purposes and therefore the benefits of the new system are hard to achieve. Afterwards it has been seen that in those projects, there has also been a need for a related business development project.

Although this case study concentrated on only one company and its requirements management regarding BP and IS development, the results of this case study can be said to be generalisable on the analytical level, which is commonplace with case studies [33]. According to Lee and Baskerville's generalizability framework, the findings of this study would fall into the category of generalizing from data to description [34].

5 Discussion

Many improvements concerning the project management have been made in recent years in the company in question. Therefore, we see that the development focus should not be on the project management practices themselves but it is more important to focus on how things regarding the changes in the business environment and processes that affect the current project will be handled. For example, how the changes in requirements are managed and how they affect the project work and the related outcome.

In the case company, there is possible to find some minor things that could be easily done. Although there exists many minor problems, we think it would be more rewarding to consider the larger whole, i.e. how IT and business units should cooperate inside and also outside of projects and how they could utilize requirements as a negotiation and coordination tool for development. After doing that, the focus should be turned on considering the actual project related details, which means, e.g. how things will actually be done in a certain project, with what resources, and what kind of interfaces will be needed.

Based on our findings, it seems that the case company could also benefit from developing their project portfolio management by taking better care of the handling of the projects and their requirements concerning especially the projects' goals and overall content. This would ensure that the phenomenon and side effects of project silos and overlaps in projects themselves could be handled in a holistic manner from the viewpoint of the corporation as a whole and, moreover, the different units' development efforts could be united and coordinated better. The currently used project management model presumes that cooperation is "automatically" taken care of during the project, but that is not so self-evident based on our findings. Because the world around us is not unchangeable, static, nor absolute, requirements should not be such either.

In addition, one important area in need of development effort is the communication between the different departments and the handling of responsibility. One of the major reasons why the business requirements are poorly documented and managed in (not just) the case company is the lack of the necessary business "buy-in". It often seems as if business stakeholders relieve their responsibilities regarding the stating of the business requirements to the IT project management. The IT department or outside consultants hardly know the same as the business organisation does about what the real business needs are. The sponsorship, ownership, conception, documentation, and analysis of business requirements belongs to the business organization because they are the best experts in knowing what their business needs are.

Based on our findings, we also noticed that using good project management practices and good IS development methods is not enough. In IS development projects, there seems to be a lack of knowledge of BP development. We suggest that co-operation between BP and IS development should be improved by developing requirements management to be independent of IS or BP development methods.

6 Proposed Requirements Management Framework

There does not seem to be a clear connection between theoretical models, reference models, and standards and how these are applied in day-to-day operations in different industries, in order to enhance and enable business using ISs. Also, this requires that IS development projects need to be integrated with business process development. According to our findings and earlier proposed methods we propose a framework (see Fig. 1.) for requirement collection, coordination, and management in order to better manage the business needs from organizational, processes', and information systems' perspectives.

It is seen that business and IT within an organization need to communicate and collaborate better. IS development projects and business processes' development seem to be neither well synchronized or related to one another and the theoretical frameworks and practical-oriented reference models and standards seem to have a gap in between them. Taken all that together, it means that a practical-oriented framework, based on a strong theoretical foundation, which takes the stakeholders different views into account and communicates them in a meaningful way in order to better coordinate their management, is well called for.

	Enterprise level	Business units	External parties
Processes			
Organisation (including end-users)			
Information systems			
systems			

Fig. 1. Preliminary requirements management framework: a matrix representing the different levels of organisation, associated stakeholders, and entities.

This preliminary requirements management framework is proposed as a tool for collecting the requirements from different stakeholders and to gather them also from the viewpoints of the processes, organizational, and other ISs related to the one being planned. Within each node in the matrix, there are different needs and requirements related to those two entities. For example, in the node where processes and enterprise level converges, there are issues such as companywide processes and their business needs and requirements related to both of those entities. Prioritization is also a matter of importance. It arises from different, conflicting needs and (often) scarce resources that need to be resolved in relation to importance, value-added, and underlying technological issues. We also noted that this simple but illustrative framework can also be used as a check list in order to make sure that all the necessary viewpoints (classifications of requirements) are considered, also the minor issues as well as the

larger ones that encompass many of the entities in the matrix. However, this matrix is not comprehensive or self-evident in itself, i.e. its users have to have a good knowledge of the requirements and of all the necessary viewpoints related to them. The users of the framework should also take into account the concepts of responsibility and ownership of the different issues. The framework can be divided into several matrixes where the first one can contain only some of the needed features to be implemented and later ones the rest. That helps to manage and illustrate the prioritization of requirements and provides a roadmap of the features that are to be developed and in which order. For analytical purposes, also the “map of current features” and the “map of needed/wanted items” can be constructed and then communicated in a meaningful way also to other people without an IT background.

7 Conclusions

The aim of this paper was to identify requirements management needs, chart out new possibilities for the development of requirement collection, analysis, and management, and find out how to improve the current situation within the case company. We conducted a case study and based on it we proposed a requirements management framework, which can be used as a tool in order to better align business and information system development.

Within the case company, the IT department is a cross-organizational unit and as such, one option could be to use it in a centralized requirements management role. Additionally, in this way IT would move from the mere supporting role to the enabling and enhancing roles, i.e. it would gain strategic importance. In addition, we found that it is essential to have a better overview of BP and IT development and requirements management concerning them. It is very useful to consider the business processes’ development from multiple perspectives regarding requirements. The preliminary requirements management framework is one step forward in taking the above mentioned different viewpoints into account and to make them more manageable and concrete. The framework should be next tested in different types of projects.

In our case study we concentrated on the development work done in projects. However, there is a lot of development work outside the projects as well: the so called continuous improvement or organizational learning. In further studies also these matters should be taken into account.

In conclusion, since this study concentrated only on exploring the case company’s requirements management, the generalizability and transferability of our findings are limited. Therefore, we propose that further studies are conducted in other companies regarding their development projects and processes in order to develop and validate this preliminary requirements management framework. The overall goal would be to create a requirements management framework that is both useful and relevant also for other companies in their requirements collection, analysis, and management regarding IS and BP development.

References

1. McManus, J., Wood-Harper, T.: Understanding the Sources of Information Systems Project Failure. *Management Services* 51, 38--44 (2007)
2. Nelson, R.R.: IT Project Management: Infamous Failures, Classic Mistakes, and Best Practices. *MIS Quarterly Executive* 6, 67--78 (2007)
3. Moløkken, K., Jørgensen, M.: A Review of Surveys on Software Effort Estimation. In: *IEEE International Symposium of Empirical Software Engineering ISESE 2003*, pp. 223--230
4. Jørgensen, M., Moløkken-Østfold, K.: How large are software cost overruns? A review of the 1994 CHAOS report. *Information and Software Technology* 48, 297--301 (2006)
5. Jarke, M., Pohl, K.: Requirement Engineering in 2001: (Virtually) Managing a Changing Reality. *Software Engineering Journal* 9, 257--266 (1994)
6. Hansen, S., Lyytinen, K.: Challenges in Contemporary Requirements Practice. In: *43rd Hawaii International Conference on System Sciences*, pp. 1--11 (2010)
7. Sommerville, I.: *Software Engineering*. Addison Wesley, Essex, England (2004)
8. Moløkken-Østfold, K., Jørgensen, M.: A Comparison of Software Project Overruns - Flexible versus Sequential Development Models. *IEEE Transactions on Software Engineering*, 31, 754--766 (2005)
9. Sommerville, I., Sawyer, P.: *Requirements Engineering: A good practice guide*. John Wiley & Sons, Chichester, England (1997)
10. Institute of Electrical & Electronics Engineers: *Guide to the Software Engineering Body of Knowledge (SWEBOK)*. Los Alamitos, California (2004)
11. Kauppinen, M.: *Introducing Requirements Engineering Into Product Development: Towards Systematic User Requirements Definition*. Doctoral Dissertation. Helsinki University of Technology, Espoo (2005)
12. Kauppinen, M., Vartiainen, M., Kontio, J., Kujala, S., Sulonen, R.: Implementing requirements engineering processes throughout organizations: success factors and challenges. *Information and Software Technology* 46, 937--953 (2003)
13. International Institute of Business Analysis: *A Guide to the Business Analysis Body of Knowledge (BABOK Guide)*. Toronto, Canada (2009)
14. MacMillan, I.C., McGrath, R.G.: *Crafting R&D Projects Portfolios*. *Research-Technology Management* 45, 48--59 (2002)
15. Mathiassen, L., Saarinen, T., Tuunanen, T., Rossi, M.: A Contingency Model for Requirements Development. *Journal of the Association for Information Systems*, 8, 570--598 (2007)
16. Delone, W.H., McLean, E.R.: The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *J. Management Information Systems* 19, 9--30 (2003)
17. Jørgensen, M., Moløkken-Østfold, K.: How large are software cost overruns? A review of the 1994 CHAOS report. *Information and Software Technology* 48, 297--301 (2006)
18. Groenveld, P.: Roadmapping integrates business and technology. *Research Technology Management* 40, 48--56 (2007)
19. Phaal, R., Farrukh, C., Probert, D.: Customizing Roadmapping. *Research Technology Management* 47, 26--37 (2004)
20. Cooper, R.G.: *Stage-Gate Systems: A new Tool for Managing New Products*. Business Horizons (1990)
21. Project Management Institute: *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*. Newton Square, Pennsylvania (2004)
22. Griffiths, M.: *Using Agile Alongside the PMBOK*. PMI Global Congress Proceedings, Anaheim, California (2004)
23. Broadbent, M., Weill, P., St Clair D.: The Implications of Information Technology Infrastructure for Business Process Redesign. *MIS Quarterly* 23, 159--182 (1999)

24. Van der Wiele, A.: ISO 9000 Series Registration to Total Quality Management: the Transformation Journey. *International Journal of Quality Science*, Vol. 2 No. 4, 1997, 236--252. MCB University Press, 1359-8538
25. Davenport, T.H.: The Coming Commodization of Processes. *Harvard Business Review* 506, 1--8 (2005)
26. Davenport, T., Short, J.: The New Industrial Engineering: Information Technology and Business Process Redesign. *Sloan Management Review* 31, 11--27 (1990)
27. Hammer, M., Champy, J.: *Reengineering the Corporation: A Manifesto for Business Revolution*. Harper Business Books, New York (1993)
28. Van der Aalst, W.: *Business Process Management Demystified: A Tutorial on Models, Systems and Standards for Workflow Management*. *Lectures on Concurrency and Petri Nets* 2003: 1--65 (2003)
29. Henderson, J.C., Venkatraman, N.: Strategic alignment: leveraging information technology for transforming organizations. *IBM Systems Journal* 32, 472--484 (1993)
30. Sallé, M.: *IT Service Management and IT Governance: Review, Comparative Analysis and their Impact on Utility Computing*. HP Research Labs (2004)
31. Ross, J.W., Weill, P., Robertson, D.C.: *Enterprise Architecture as Strategy*. Harvard Business School Press, Boston, Massachusetts (2006)
32. Cleven, A.: *Exploring Patterns Of Business-IT Alignment For The Purpose Of Process Performance Measurement*. *European Conference on Information Systems* (2011)
33. Yin, R.: *Case Study Research: Design and Methods*. Sage Publications, Thousand Oaks, California (2003)
34. Lee, A., Baskerville, R.: Generalizing Generalizability in Information Systems Research. *Information Systems Research* 14, 221--243 (2003)

Protocol for Systematic Mapping of Wikipedia Studies

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Abstract. Wikipedia has become one of the ten most visited sites on the Web, and the world's leading source of Web reference information. Its rapid success has inspired hundreds of scholars from various disciplines to study its content, communication and community dynamics from various perspectives. This article presents a protocol for conducting a systematic mapping (a broad-based literature review) of scholarly research on Wikipedia. The purpose of this review is to analyze particular trends in research and offer the basic groundwork for future studies. We identify what research has been conducted; what research questions have been asked; which have been answered and which remain unanswered; and what theories and methodologies have been employed to study Wikipedia. This protocol follows the systematic literature review methodology to conduct a systematic mapping study. The review process is work in progress, and has thus far identified over 2,100 studies. We will proceed to data extraction and synthesis with 682 publications we have chosen using our exclusion criteria.

Keywords: Wikipedia, systematic literature review, open content, open knowledge, free cultural works, open source

1 Introduction

With the dramatic increase in interest in Wikipedia during its ten-year history, it has become one of the ten most-visited sites on the Web, and the world's leading source of Web reference information. The encyclopedia is a prime example of Web 2.0 with its 18 million¹ articles based on the collaborative efforts of volunteers from around the globe.

This popularity has both shocked and intrigued scholars. This has resulted in an increasing abundance of scholarly research that has studied the Wikipedia phenomenon from many different angles, ranging from shared knowledge creation to the epistemological implications of such an influential source of human knowledge [2]. Researchers have studied Wikipedia from a wide variety of perspectives, including such diverse topics as automated content agents [3], contributors' motivations [4, 5] and the global reach of Wikipedia content [6].

¹ <http://stats.wikimedia.org/EN/TablesArticlesTotal.htm> (April 30, 2010)

Much of this research can prove valuable in guiding Wikipedia contributors and administrators, on developing policies and best practices to improve the quality, performance, and overall value of Wikipedia. Moreover, such research is helpful to understand the implications of the burgeoning field of open content, which applies the same open-source development principles to the creation of non-software media such as books, music, video, and other information products [7]. In order to consolidate and critically assess the current work on Wikipedia, as well as to offer a solid base for future targeted research, we have embarked on a thorough literature review on this rapidly-growing subject of research.

The Wikimedia Foundation, Wikipedia's non-profit sponsor, attempts to maintain an online catalogue of scholarly articles and researchers.² However, while a good start, this page currently lists only a small portion of articles and makes no effort beyond basic classification. Besides the Wikimedia foundation listing, only three stand-alone literature reviews of scholarly work on Wikipedia have thus far been published [2, 8, 9]; none of these has attempted an in-depth critical analysis of the subject. After ten years of Wikipedia, there is the crucial need for an exhaustive literature review of scholarly work on Wikipedia to analyze particular trends in research and offer the basic groundwork for future directions.

Until recently, there has been a distinct lack of guidelines for systematic literature reviews (SLRs) in the fields of computer science, software engineering, and management information systems. Though a few high quality literature reviews were being written and published, there was a distinct variance in the methodologies employed and often an apparent lack in description of the search procedure. Subsequently, most of the literature reviews published in leading journals are impossible to replicate, standing in stark contrast to other empirical work for which clear disclosure for replicability is a must. As a result, we have turned to detailed guides from health sciences [10], the social sciences [11, 12] and software engineering [13] for assistance in planning a systematic literature review.

However, because of the broad multidisciplinary nature of Wikipedia research, the most appropriate SLR methodology that we have identified is one that was developed with a specific view of the multidisciplinary nature of information systems research [14]. Following this specification, we describe here a systematic literature review, defined as "a systematic, explicit, [comprehensive,] and reproducible method for identifying, evaluating, and synthesizing the existing body of completed and recorded work" [10]. In particular, our headings in this protocol follow Okoli and Schabram's guideline for conducting a systematic review.

One of their recommendations is that a protocol be developed in advance of actually conducting the study. The protocol should be externally validated to verify its rigour. A protocol is "a plan that describes the conduct of a proposed systematic literature review" [13]. Thus, this article presents a detailed specification of our intended review, disseminating the protocol for public review and in itself providing an exemplar for the execution of similar studies.

Because of the abundance and tremendous diversity of research on Wikipedia, what is appropriate at this stage is not a literature review, strictly speaking. Kitchenham and Charters point out that with very broad topics of inquiry, what is

² <http://meta.wikimedia.org/wiki/Research>

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more appropriate is what is called a systematic mapping study, or a scoping study, defined as a study “designed to provide a wide overview of a research area, to establish if research evidence exists on a topic and provide an indication of the quantity of the evidence” [13]. A systematic mapping is a precursor to more focused literature reviews with more focused research questions. The research questions of a systematic mapping are broader in scope, as we proceed to describe.

Our review will offer an overview to the plethora of Wikipedia-influenced research. We will offer a categorization of studies, and an analysis of research trends. Our scoping study will be a valuable asset for the research community, as it will capture the key aspects from the pool of publications, and synthesizes the results in an easily digestible way. We assume that a study that properly captures the whole decade of research into one publication will become a highly cited paper. The publication will help researchers to address their research questions towards the revealed opportunities in the knowledge base. In addition, we hope that our review will inspire other researchers, so that it offers a useful basis for more topic-focused reviews.

The present article is structured as follows. Next we will elaborate on the research questions we apply in our review. Then we demonstrate the central role of the protocol document in training each other, and coordinating the work process in this rigorous multi-author project. Section four describes the planning and execution of the literature search process. In the subsequent section we formulate our practical screen principles: inclusion and exclusion criteria for accepted types of publications. Section six depicts the data extraction process: how answers to each research question were picked from each paper. The following sections describe how we synthesize our review data into a coherent story, and how we disseminate our results to different audiences. The last section concludes the key aspects of this protocol.

2 Research questions

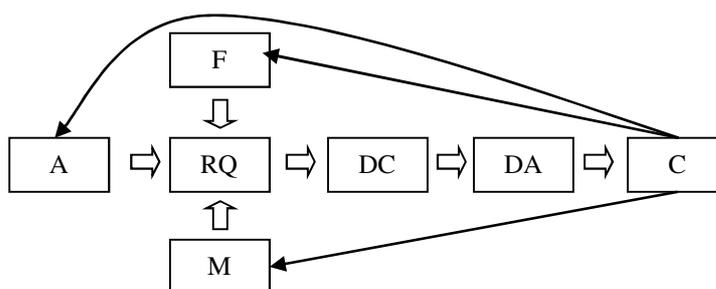


Fig 1 - Components of a research publication (adapted from [1])

For our systematic mapping study of Wikipedia, our questions are fairly broad, as they intend to cover the breadth of research that has been conducted on this vast field. We position our research questions to Mathiassen et al’s [1] research framework. The frame depicts the components of a typical research project. In the center of the model

there is a research question (RQ) that is formed as a combination of a method (M), theoretical framework (F) and an area of concern (A). The research question is answered by data collection (DC) and data analysis (DA). The purpose for any research is to make a contribution (C), an addition to the existing base of knowledge. Contributions can be theoretical (F), methodological (M), or practical (A).

We have seven specific research questions:

1. *What high-quality research has been conducted with Wikipedia as a major topic or data source? Who (which authors) have published, when (year), and where (journal, conference)?* We intend to seek out and catalogue the existing high-quality research (as defined later in this protocol) that has been conducted on Wikipedia, for the benefit of helping potential consumers of this research become aware of its existence. We shall also analyze research publication trends during the first decade of Wikipedia.
2. *What research questions have been asked by various sources, both scholarly and practitioner?* We want to know both the subjects that the existing research has covered, and also catalogue key questions that practitioners would like to be answered, whether or not academic research has broached these questions. Also we categorize the research questions based on their purposes.
3. *What theoretical frameworks and reference theories have been used to study the topic?* We are very interested in theory-driven research on Wikipedia, and would like to identify and categorize such work. We adopt Burton-Jones et al.'s [15] definition for a theory: "all theoretical accounts will consist of at least two elements: 'concepts' and 'relationships among concepts'" (p. 4).
4. *What research designs have been applied?* As a guide to future studies, we would like to identify what approaches have been adopted. We will employ Järvinen's [16] categories: non-empirical theoretical studies, empirical theory-developing studies, empirical theory-testing studies, innovation-building studies, and innovation-testing studies. Note that "theoretical" in this context is different from that in RQ3: it is not necessary for studies to identify concepts and relationships; the point is that they observe Wikipedia without creating or evaluating new artifacts.
5. *What kind of data has been collected for research purposes?* We assume these include various kinds of texts from different language versions of Wikipedia, and interviews with Wikipedians.
6. *What conclusions have been made from existing research?* That is, what questions from RQ2 have been answered, and what are these answers? (These constitute lessons learned.) We shall evaluate theoretical, methodological, and practical contributions, respectively.
7. *What questions from RQ2 are left unanswered?* (These present directions for future research.) Unanswered questions fall into two categories:
 - i. No quality research has been conducted to address the question.

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- ii. Research has been conducted, but the results are inconclusive, or they are suspect because of the unsatisfactory quality of the research.

Through our review, we hope to collect a comprehensive list of available articles as well as their locations in literature databases. We will identify and organize the lines of thought that have been pursued thus far, to understand the history and direction of the field, and to offer a guide for potential future research and practical application. Based on these findings, we will apply the research conclusions to the practical functioning of Wikipedia and highlight implications for policy and administration for Wikipedia contributors, administrators and its sponsor, the Wikimedia Foundation.

RQ2 and RQ7 provide a peculiar quandary: RQ7 asks for unanswered questions. However, if these questions constitute only information from the identified literature, then unanswered questions would only include those that researchers have asked but have been unable to answer; they could not include the questions that practitioners would like answered but which researchers have not attempted to investigate.

To resolve this problem, we need to seek practitioner questions independent of what researchers have addressed in the scholarly literature. The Wikimedia Foundation maintains such a list.³ By using this as a question bank, and seeking out other sources of practitioner-driven research questions, we can help assure the relevance of this mapping study, to be able to identify what scholars have contributed thus far in knowledge that matters to those who work with Wikipedia on a day to day basis. Specifically, we have e-mailed the foundation-l mailing list (which discusses issues pertinent to the Wikimedia Foundation) to update the page with practitioner research questions of interest. We have also mailed wikipedia-l, the original and oldest Wikipedia-related mailing list, and wikiEN-l, a list dedicated to discussion on the English Wikipedia.

Similarly, there is a page set up for Wikipedia researchers to discuss their projects, which also features a list of research questions.⁴ This seems to be a list of researcher-driven research questions. We have asked wiki-research-l members to update that page with their questions of interest.

3 Protocol and training

Most systematic literature reviews, because of their broad scope, cannot be conducted by a single researcher. Both in the case of emergent fields such as the study of Wikipedia and of fields that have been in existence for very long periods of time, it is impractical to comb through the entire literature single-handedly—particularly when a review of all pertinent articles would mean thousands of articles in the case of Wikipedia. Even if it were possible, the long period of time it would take would most certainly lead to changes, and hence, inconsistencies, in the reviewers' interpretations. Finally, collaboration on academic work has often been advocated as leading to more concentrated and prominent work [17]. For all three reasons, it is essential that all

³ <http://strategy.wikimedia.org/wiki/Wikimedia-pedia>

⁴ http://en.wikipedia.org/wiki/Wikipedia:WikiProject_Wikidemia

reviewers involved in a literature review study be thoroughly trained in both note-taking and reviewing techniques.

The primary tool of training is the development of a protocol document. By specifying the protocol explicitly in advance, the multiple reviewers can all be on the same page. The protocol is an iterative document; it is modified as necessary as the review progresses. However, it establishes a framework for the rigour of execution of the study, and it further serves as a training manual for the reviewers. This document serves that purpose.

4 Searching for the literature

For our Wikipedia review, the recent nature of the subject matter (Wikipedia was launched in January 2001), does not lend itself to physically browsing for books or articles in a library. To assure exhaustiveness in our search, we do not want to presume what kind of database of research literature might or might not contain studies on Wikipedia. Consequently, we searched through all 484 databases available to us. These databases span all areas of inquiry: business/commerce, the fine arts, humanities, science and engineering, and the social sciences.

One notable database that we will not search is Google Scholar. Because of its vast number of references to Wikipedia website, as much in studies that treat it as a subject of inquiry as in studies that only make passing references to it, such a search is impractical to sieve through. Google's database is highly unstructured: there is no way to restrict searches to titles or abstracts.

Although keywords are normally a critical choice in a literature review, in the case of our systematic mapping, the choice is very simple: we will search *only* for three words: "wikipedia," "wikipedian," and "wikipedians." (A "wikipedian" is a person who contributes to Wikipedia.) Other than these three keywords, no synonym is appropriate, as our study is uniquely on Wikipedia. We are not studying wikis other than Wikipedia; we are not studying MediaWiki (Wikipedia's wiki platform); we are not studying other Web 2.0 phenomena such as blogs; we are not studying any Wikimedia Foundation project other than Wikipedia. For our purposes, these three simple keywords are sufficiently inclusive (to capture all relevant studies) and exclusive (to not capture unrelated studies). Depending on the specificity of the database, our initial search for articles is in titles, abstracts and keywords or subject entries. We will only search the full text when a database does not permit limiting searches to the abstract.

In a preliminary search following this methodology, we were able to eliminate the majority of 484 databases as not containing a single relevant article; we were left with a total of 74 applicable databases that contain one or more articles on Wikipedia.

As we searched through these databases, the majority of articles were indeed found through them. Those that were not, 33 articles on the Wikimedia Research Bibliography and 181 on the Wikipedia in Academic Research page, were either written in a non-English language (all our searched databases are English), or were written recently enough to not yet be indexed in relevant databases. By matching our own database search to these independent bibliographies, we were able to establish

with certainty that our databases would tag all pertinent work and we were not missing any important search mechanisms.

By December 12, 2010, we collected 6,107 articles from all the databases, before we removed duplicates across databases. After removing duplicates, we had 2,678. In addition, AISEL adds 2 valid journal articles (1 original, 1 duplicate) and 10 valid conference articles (all original); 2 invalid conference articles in the AISEL search were not included. Thus, after duplicates, we have 2,689 articles. This number is before removing articles that fail the practical screen.

After acquiring 1,500 conference articles, we were uncertain whether or not to include conference papers at all in the review—it is impractical to review so many articles in one study. We considered excluding conference articles completely, but after feedback from the wiki-research-l mailing list (a list of researchers of Wikipedia and other Wikimedia Foundation projects), we realized that some of the best and highest-cited Wikipedia research is actually published in conferences. Moreover, in some subfields of computer science such as Human-Computer Interaction, conference articles are terminal publication targets of the best quality work, rather than journals. Therefore, we made a citation-per-year ranking of the conference articles, using citation data from the ACM Digital Library. After this we decided to include the top 50 highest-cited conference articles in our review, as well as a few other core publications suggested by wiki-research-l members.

To validate the exhaustiveness of our databases, we verified our results by consulting with subject “experts” [10]. For our topic, we have two sources of “experts” who are competent to validate our search. First, the Wikimedia Foundation offers two bibliographies of research on Wikimedia projects^{5,6} (including non-Wikipedia studies). These lists were compiled by various researchers who self-reported their work and that of others to the Foundation wiki pages.

We have compared these lists of studies with the list that we retrieve from our searches. By exhaustively examining each item posted on these pages, we identified only 13 peer-reviewed journal articles and 4 doctoral theses that were not already located by our prior searches. The reasons that we missed them were that 3 were either forthcoming or indexed past our cut-off date of November 2010; 3 North American articles and 2 European articles were not indexed in any database at all (except perhaps Google Scholar); 4 European articles were published in journals that normally publish non-English articles; 1 article was marginally relevant to Wikipedia, and did not mention it in the title or abstract; 3 of the 4 theses were published outside North America; and 1 North American thesis (published in 2010) was indexed after November 2010.

In addition to these, we added 1 article we personally knew about that was relevant, yet did not mention Wikipedia in the title or abstract; we also added 1 forthcoming article we learnt about from the Wikipedia Signpost weekly newsletter.⁷ This gave a total of 603 peer-reviewed journal articles, 29 doctoral theses, and 50 conference articles for a total of 682 items.

⁵ http://en.wikipedia.org/wiki/Wikipedia:Academic_studies_of_Wikipedia

⁶ <http://meta.wikimedia.org/wiki/Research>

⁷ <http://en.wikipedia.org/wiki/Wikipedia:Signpost>

We merged the articles from these pages with our own search results and have posted them back onto the page listing academic studies of Wikipedia⁸.

The second source for experts is the Wikimedia researchers' mailing list (wiki-research-l) hosted by the Wikimedia Foundation. The subscribers to this list are active Wikipedia researchers; we have presented our compiled list up to this point to them, and asked them to identify any research they are aware of that meets our criteria which we might have missed. So far, we have identified a further five to ten articles through this source.

5 Practical screen

To assure an unbiased selection process, we specify in advance in the protocol the criteria for inclusion and exclusion of articles from the final study. This "practical screen" [10] is carried out at the initial stage to weed out articles, not based on their quality, but rather on two practical criteria: 1. whether the study's content is applicable to the research questions; and 2. whether it meets other explicit practical constraints. Based on Fink's criteria for the practical screen, we restrict our included studies to content limited by RQ1, and to research found through our English-language databases.

First, we address RQ1: "What high-quality research has been conducted with Wikipedia as a major topic or data source?". When available as a search option, we limit our search to the articles' title or abstract, since we insist on including only articles that treat Wikipedia as a significant subject, rather than those that merely use it as a reference tool. When such a refined search is not an available option for a given database, we will retrieve all articles that contain the keyword, and upon examining the full text, eliminate those articles that only have minor references to Wikipedia. Whenever possible, we will also conduct a more refined keyword search, sometimes called a "subject search." We will not conduct any full text search as these would bring up hundreds of articles, citing Wikipedia as a simple reference rather than a topic of inquiry.

Second, because of the practical limitation of the research milieu of our research team, and because of the vast number of studies under consideration, we have to restrict our search to studies in English-language databases. It is unfortunate that this study has to exclude the significant work being conducted in other languages, such as German or French. However, we hope that the explicit reporting of this review would serve as a model for replication in other languages.

Finally, we choose to include work only peer-reviewed publications. This includes peer-reviewed journal articles and peer-reviewed conference proceedings. In addition, in this literature review, we extend the definition of "peer-reviewed" to include doctoral theses, as these studies are reviewed by qualified academics. We are aware of some significant work that has been done by students, and do not believe that it would be in the interest of identifying quality research to exclude these arbitrarily. However,

⁸ http://en.wikipedia.org/wiki/Wikipedia:Academic_studies_of_Wikipedia

for the sake of restricting the practical scope of our study, we do not include any non-peer-reviewed study in our review.

Because of the relative recency of Wikipedia, and our desire to be as exhaustive as possible, we do not apply any other practical screening criterion beyond those listed above.

In the case of our Wikipedia study, we have a total of four reviewers. Two reviewers go through each article; the two other reviewers would supervise their work. We selected the articles for inclusion by following this procedure:

First, three of the four reviewers worked through around 15 to 25 of the articles together, to ensure that everyone understood the working principles; these articles should were randomly selected from fairly diverse databases, to give a taste of the variety of what might be encountered.

Next, the two reading reviewers each randomly received half the articles; the randomization was achieved by sorting the articles alphabetically by title. Each reviewer scanned their articles, and decided whether to include or exclude them. Reasons for exclusion of specific articles was be recorded. Then each reviewer verified the articles that the other excluded. Brereton et al. [18] found that, in a large systematic review, having one reviewer score and another verify the decision is more or less as effective in decision quality, yet more efficient in time, than having both reviewers score all articles in detail. Any article that one of these reviewers felt should be included was be retained; thus, at this stage, we favoured the retention of articles in the study. Inter-rater reliability (for initially excluded articles) will also be calculated for the final inclusion decision.

6 Data extraction

In order to answer research questions 2 to 6, we need to read the papers more carefully than was done in our original scan for inclusion. As of March 2011, we are currently in the data extraction stage. Because of the sheer quantity of the studies, it will not be practical to read each paper thoroughly. However, with a focused data extraction protocol, the necessary answers to the research questions can be systematically obtained. The readers will read the title, abstract, introduction and conclusion of all their assigned articles, then also whatever is necessary to extract the data needed to answer the following research questions:

2. *What research questions have been asked by various sources, both academic and practitioner?*
 - a. The research question for each study will be explicitly recorded in one or more sentences. These should usually be available to be copied or paraphrased from the abstract or introduction.
 - b. Also we map the Wikipedia related body of knowledge into a typology of sciences to see the areas to which Wikipedia has had the most contribution.

Our categories are: Mathematics and logic; Natural sciences; Social sciences; Humanities; and Culture.⁹

- c. We should additionally indicate the sub-category, if relevant, e.g. Natural sciences (computer science) or Humanities (linguistics).
3. *What theoretical frameworks and reference theories have been used or developed to study the topic?* For the primary SLR, we will only identify the names or general descriptions of the theories that are identified as such. We also presume that some of the studies might not have a theory at all.
4. *What research designs have been applied?* Methodologies used will be recorded.
5. *What kind of data has been collected for research purposes?*
 - a. Primary vs secondary data: Field research (specify types); experiment/laboratory; simulation; survey; literature review.
 - b. Time dimensions: cross-sectional (one-time snapshot) vs longitudinal (multiple collection of similar data over time)
 - c. Unit of analysis: e.g. article, user, edit, language, subjects, website
 - d. Wikipedia data extraction techniques: data collected from the live Wikipedia, or using some cloned or preprocessed data set obtained from Wikipedia.
 - e. Wikipedia page category or namespace (article pages, article talk pages, user pages, user talk pages, community pages, community talk pages and others).
 - f. Wikipedia language version
6. *What conclusions have been drawn from the existing research? That is, what questions from RQ2 have been answered, and what are the answers?* Conclusions will be summarized in one or more sentences.
 - a. These should usually be available to be copied or paraphrased from the abstract, discussion or conclusion.
 - b. We should summarize whether or not the study's research question was satisfactorily answered (by the author's own judgment). The options are either "Yes" or "Inconclusive".

Similarly to the practical screen, we will follow a procedure to assure consistency in the classifications: Again, all four reviewers would work through around 15 to 25 of the articles together, to ensure that everyone understands the working principles; these articles should be selected so as to assure broad variety in the kind of studies.

Once everyone is generally satisfied that the data extraction procedures are understood, then each of the four reviewers will receive a random number of the articles and will extract data from them independently. The number of articles at this stage will be chosen so as to assure statistical significance. They will scan and extract data from these articles independently.

⁹ We have adopted these categories from <http://www.mrtc.mdh.se/publications/0446.pdf>.

Next, the two junior reviewers will each randomly receive half the articles. Each reviewer will extract data from their articles. Then each reviewer will receive a random number of the articles and will extract data from them independently. Interrater reliability will be calculated; if satisfactory, the decisions will stand; however, discrepancies in the sample where both raters rated will be resolved by discussion with each other and with the other two reviewers.

7 Synthesis

As already mentioned, we aim to synthesize all published studies concerning Wikipedia. When choosing our synthesis method, it required us to consider the varying forms of research on the field. The plethora of Wikipedia studies may include many types of research paradigms, ontologies, epistemologies, methods, and so forth. Therefore we had to omit several methodological candidates. For example, meta-analysis is a common method of synthesizing data from a literature review; however, it is exclusively restricted to quantitative studies.

We think that health sciences provide the most sophisticated approaches in synthesizing both qualitative and quantitative evidence, e.g. Dixon-Woods et al. [19] and Pope et al. [20]. Their message is that qualitative and quantitative evidence can be combined, and there are various ways to do this. However, one should not invent new synthesis methods for secondary studies, i.e. literature reviews. Primary research methods should be valid for secondary studies as well. Of the various research methods available, we shall apply content analysis and thematic analysis.

We are aware that some scholars argue incommensurability across research paradigms, e.g. between positivist and interpretivist studies. We refer to Weaver & Gioia [21], arguing that results from any type of research can be combined. In fact, dealing with various kinds of research is central to systematic mapping studies.

We approach synthesis as an interpretivist enterprise. In our view, it bears strong epistemologic similarity to content analysis [22]. In defining content analysis, Klaus Krippendorff criticizes the popular misconception that it would be an objectivist and quantitative method, as defined earlier by e.g. Lacity & Janson [23]. Krippendorff writes that “all reading of texts is qualitative, even when certain characteristics of a text are later converted into numbers” (p. 16). Krippendorff emphasizes the interpretivist nature of content analysis. “Texts do not have single meanings that could be ‘found’, ‘identified,’ and ‘described’ for what they are”, and texts have “no objective—that is no reader-independent—qualities” (p.22). Moreover, he depicts content analysis as an *abductive* inquiry. “Deductive and inductive inferences are not central to content analysis” (p. 36), ... “the whole enterprise of content analysis may well be regarded as an argument of an analyst’s abductive claims” (p.38). In answering our research questions, we shall use *a priori* frameworks, while maintaining an open mind for anomalies rising from data. Krippendorff points out that a research process should be replicable, which is “the most important form of reliability” (p. 18).

When the data is synthesized, we will write up the review following guidelines provided by various sources on writing a literature review [13, 24, 25].

8 Dissemination strategy

By addressing research questions that are obtained from both academic and practitioner sources, we expect the results of this study to be highly relevant and useful to both categories of readers. Thus, we will target the dissemination of results to both groups.

The bibliography on research on Wikipedia is expected to be extensive, comprising hundreds of articles. We intend to publish this by updating the Wikimedia Foundation research bibliography. This will not only contribute results to a website where it is available internationally, but will maximize the data's currency, as any subsequent editor can update the bibliography to add new research as it becomes available.

To reach academic researchers, we will submit the full study results with detailed methodology to a peer-reviewed scholarly journal for publication. Our first preference is *Journal of the American Society for Information Science and Technology* (JASIST). It is a well cited high quality journal, that has published both Wikipedia related studies and systematic literature reviews.

To reach practitioners with the results, we will try to present the results of this study to the annual Wikimania conference, which is the largest gathering focused on Wikipedia and related matters. In addition, we will try to publish a summary version of the results in a trade magazine.

9 Conclusion

Wikipedia's phenomenal success has attracted the interest of scholars who desire to understand the inner workings of this exemplary open content application. Much of this research can prove valuable in guiding Wikipedia governance and development, on improving policies and best practices to improve the quality, performance, and overall value of Wikipedia. Of course, this knowledge is valuable in many other contexts as well. As Famiglietti [26] has stated, "even if Wikipedia itself does someday fade from the scene, the method of production it employs, peer production, is deeply embedded in a variety of other spaces of digital communication and information production, from social media to blogging, and is likely to endure" (p. 254).

This article presented the protocol of a review of scholarly research on Wikipedia currently being conducted by our research team. Based on these findings, we will present the research conclusions drawn to academic researchers as well as highlight implications for governance and development for Wikipedia collaborators, and the Wikimedia Foundation.

We believe that scholarly research is a critical contributor to thoroughly understanding the workings of Wikipedia, an important and widely used global resource. This study would help bring this understanding to the people who actively construct Wikipedia, enabling them to leverage this valuable knowledge base. This systematic mapping review will make sense of the varied research that has been done

to date, and set directions for future research on this fascinating and important extension to the research area.

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References

1. Mathiassen, L., Chiasson, M., Germonprez, M.: Compositional Styles in Action Research: A Critical Analysis of Leading Information Systems Journals. *Sprouts: Working Papers on Information Systems* 9, (2009)
2. Okoli, C.: A Brief Review of Studies of Wikipedia in Peer-Reviewed Journals. *Third International Conference on Digital Society*, pp. 155-160. IEEE Computer Society, Cancun, Mexico (2009)
3. Niederer, S., van Dijck, J.: Wisdom of the crowd or technicity of content? Wikipedia as a sociotechnical system. *New Media Soc* 12, 1368-1387 (2010)
4. Nov, O.: What Motivates Wikipedians? *Commun ACM* 50, 60-64 (2007)
5. Schroer, J., Hertel, G.: Voluntary Engagement in an Open Web-Based Encyclopedia: Wikipedians and Why They Do It. *Media Psychol* 12, 96 - 120 (2009)
6. Rask, M.: The reach and richness of Wikipedia: Is Wikinomics only for rich countries? *First Monday* 13, (2008)
7. Okoli, C.: Beyond Open Source Software: An Introduction to Researching Open Content and Wikipedia. *Sprouts: Working Papers on Information Systems* 9, (2009)
8. Ayers, P.: Researching Wikipedia - Current approaches and new directions. *Proceedings of the American Society for Information Science and Technology* 43, 1-14 (2006)
9. Miller, N.: Wikipedia Revisited. *ETC: A Review of General Semantics* 64, 147-150 (2007)
10. Fink, A.: *Conducting Research Literature Reviews: From the Internet to Paper*. Sage Publications, Inc, Thousand Oaks, CA, USA (2005)
11. Hart, C.: *Doing a Literature Review: Releasing the Social Science Research Imagination* Sage Publications Ltd, London (1999)
12. Ridley, D.: *The Literature Review: A Step-by-Step Guide for Students*. Sage Publications Ltd, London (2008) <http://www.dur.ac.uk/ebse/guidelines.php>
14. Okoli, C., Schabram, K.: A Guide to Conducting a Systematic Literature Review of Information Systems Research. *Sprouts: Working Papers on Information Systems* 10, (2010)
15. Burton-Jones, A., McLean, E.R., Monod, E.: On Approaches to Building Theories: Process, Variance and Systems. Working paper, Sauder School of Business, University of British Columbia. (2010)
16. Järvinen, P.: *On research methods*. Opinapajan kirja, Tampere (2004)
17. Figg, W.D., Dunn, L., Liewehr, D.J., Steinberg, S.M., Thurman, P.W., Barrett, J.C., Birkinshaw, J.: Scientific collaboration results in higher citation rates of published articles. *Pharmacotherapy* 26, 759-767 (2006)

18. Brereton, P., Kitchenham, B.A., Budgen, D., Turner, M., Khalil, M.: Lessons from applying the systematic literature review process within the software engineering domain. *J. Syst. Software* 80, 571-583 (2007)
19. Dixon-Woods, M., Agarwal, S., Jones, D., Young, B., Sutton, A.: Synthesising qualitative and quantitative evidence: a review of possible methods. *J Health Serv Res Policy* 10, 45-53 (2005)
20. Pope, C., Mays, N., Popay, J.: *Synthesizing Qualitative and Quantitative Health Research: A Guide to Methods*. Open University Press, Berkshire (2007)
21. Weaver, G.R., Gioia, D.A.: Paradigms Lost: Incommensurability vs Structurationist Inquiry. *Organ Stud* 15, 565-589 (1994)
22. Krippendorff, K.: *Content Analysis: An Introduction to Its Methodology*. Sage Publications, Thousand Oaks, California (2004)
23. Lacity, M.C., Janson, M., A.: Understanding qualitative data: a framework of text analysis methods. *J Manage Inform Syst* 11, 137-155 (1994)
24. Bem, D.J.: Writing a review article for Psychological Bulletin. *Psychol Bull* 118, 172-177 (1995)
25. Webster, J., Watson, R.T.: Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quart* 26, xii-xxiii (2002)
26. Famiglietti, A. (2011). *Hackers, Cyborgs, and Wikipedians: The Political Economy and Cultural History of Wikipedia*. Unpublished Doctoral thesis, Bowling Green State University, Bowling Green, OH, USA.

A Perspective of Post-Merger Integration: Employees Do Not Necessarily Resist Changes – in Fact, they Might Wish for Further Reengineering Initiatives

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Abstract. Mergers often fail, which makes it important to understand more about what could promote successful mergers. This paper reports on a longitudinal case-study following a merger from the administrators' perspectives. Prior findings showed administrators that were positive to the merger and to reengineering initiatives and that were confident about their skills. The present study showed that the administrators wished for further development even if some found the realized changes to have influenced their work negatively. The findings confirm the importance of applying various types of advice on how to prevent resistance to changes, which includes embracing openness to changes and the necessity of providing means for adapting to new systems and to contribute to new routines. The case-study aims at adding further to the knowledge base on how to facilitate post-merger integration with a focus on understanding the human factors that either contribute to or hinder a merging process.

Keywords: Post-Merger Integration (PMI), Business Process Reengineering (BPR), resistance to changes, Information Systems (IS)

1 Introduction and background of the longitudinal case-study

There are many studies about organizational changes and mergers, focusing on expected resistance to changes whilst providing advice on how to prevent resistance to change (e.g. Kotter and Schlesinger [1]). The topic is important because post-merger integrations (PMI) are known to fail more than they succeed [2] [3] [4]. When the information systems (IS) are subject to changes in an organizational change employees who are discontented with the new situation could blame the IS instead of searching for the underlying reason [1]. To acknowledge the role of the human factor (i.e. how the people in the organization are thinking and acting) is critical. If the employees are invited to participate in the processes and understand the reasons behind the merger they will more likely contribute to a successful merger and PMI [5] [6] [7] [8] [9] [10] [11] [12] [13]. Otherwise, the prospect of having to change their IS, routines, place of work and colleagues could worry the employees and make them act with resistance to the approaching changes. Management has to be prepared for

various manifestations of resistance and reactions in a merger as: lowered productivity, motivation and performance, absenteeism, voluntary turnover, health problems and power struggles [14] [15].

An ongoing longitudinal case-study (Fig. 1) follows a merger between two universities, from the administrators' perspectives. It was a friendly merger of relatively equals taking the best from each other. The new organization aimed at using the resources more effectively and to better take advantage of opportunities for organizational development but also for rationalizations. The case-study investigates the administrators' opinions about their Information Systems (IS) and their work situation in general in the merger. The organizations that are studied, Org D and Org E (pseudonyms out of consideration for the respondents), were located on different sites at a distance of about 100 kilometers – so even after the merger (will be referred to as the DE-merger). The administrative staff's assignments embrace a variety of duties, for which they need IS. Both organizations handled the same type of duties. Therefore a reengineering of the existing administrative processes was inevitable in order to hinder the administrators' duties at the two sites overlapping or interfering with each other – but also because of the intention behind the DE-merger to gain in effectiveness and use the potential for rationalization.

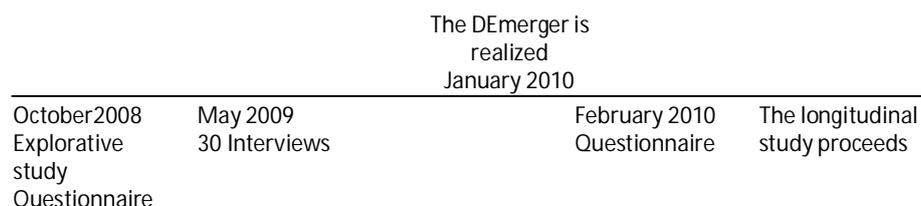


Fig. 1. The timeline of the longitudinal case-study.

The starting point of the study took place before the merger directly involved the administrators even if decisions were made earlier. The findings conflicted with what is mostly argued in the literature about employees that are anxious and troubled about organizational change. A majority (57 %) of the respondents was positive to the merger and they also expected changes (63 %) of their assignments [16] [17]. They were confident of their abilities to learn to handle new IS and of their IS skills and knowledge. A majority had a high level of education – 67 % had an academic degree and 14 % some academic education. They found themselves to be dependent on well-functioning IS to perform their duties and wanted to keep their IS as it was and further develop it in the merger (not replace it).

Findings from the second study in 2009 were also conflicting with the common opinion of employees resisting change. The study showed that a clear majority (93 %) were explicitly open-minded to redesign of their IS and routines; they were not worried (60 %) and they considered their competencies as utilized (63 %) in the merger; they were happy with the overall information (85 %) even if 44 % of those lacked specific information about their employment. The fact that the administrators at the two sites performed the same duties pointed to a possible down-sizing of the staff. From document reading it was obvious that the top managers were appointed

very late in the process, which was pointed out as a reason for many administrative decisions to have been postponed [18] [19].

The purpose of the present empirical study was to add further to the knowledge base on how to succeed with PMI from a soft side perspective – i.e. acknowledging the humans who could either contribute to or hinder a successful integration process. The search for solutions to the high degree of merger/PMI failure does not necessarily mean finding immediate solutions but to “open up new ways of seeing” the problems of practical concern [20]. The findings from prior studies of the DE-merger were promising for a successful post-merger integration because of the administrators’ positive expectations of the merger in general, of the reengineering and their own competences [16] [17] [18] [19]. These themes should therefore be further investigated and the research questions for this paper are:

- Do the administrators find the reengineering attempts that were made successful?
 - What influence do new routines have on the administrators’ work situation?
 - What influence do new IS have on the administrators’ work situation?

Findings from the present study are reported and discussed in the theoretical framework of reengineering, in the light of expected employee resistance to organizational changes. Common wisdom and findings from other studies that employees are mostly resistant to organizational changes will be challenged as our findings conflict with them.

The rest of this paper is structured as follows: First the theoretical framework of the study is presented and its relevance for the DE-merger, second the method is discussed. Subsequently key findings are presented and discussed before concluding the article.

2 Theoretical framework of the study – reengineering aspects of the DE-merger

The theoretical framework’s relevance for, and connection to, the DE-merger is emphasized (*italics*).

Business Process Reengineering (BPR) is about reengineering in order to enhance and optimize the performance of companies by using Information Technology (IT). A good starting point for reengineering initiatives is to carefully consider what processes are really needed and to focus on how to optimize those [21] [22]. *In the DE-merger there was a potential need for reengineering of the administrative processes especially since the former operations must remain approximately the same which does not necessarily mean that they have to be performed at both places.* Pentland et al. [23] define routines as recurrent patterns of action and argue that the same routine can generate many different patterns. *Applying this definition on the DE-merger implies that the same duties that we know occurred at both the former organizations, most likely could*

have been accomplished in different ways. Hence the processes must be understood, analyzed and probably also redesigned in order to avoid inefficiency and misunderstanding. However BPR initiatives do sometimes result in down-sizing which the BRP programs have been criticized for [24] even if this is not a goal in itself [25]. *Down-sizing might be necessary in the merger since the two organizations probably have duties that overlap even if some will be regarded as necessary to handle at both locations. The prospect of a possible down-sizing could have worried the personnel and interfered with their participation in the reengineering process.* How down-sizing can worry employees is discussed in the literature [24] [25].

Bashein and Markus [26] argue some important conditions for preventing BPR failure and find for example empowered and collaborative workers to be a precondition for successful BPR. *The findings from prior studies [16] [17] [18] [19] point towards facilitating conditions regarding these issues.* Bashein and Markus [26] argue the importance of positive preconditions concerning the strategic context of growth and expansion as well as of shared visions and sound management processes. *These seem to have been met in the former Org D and Org E because the focus was not on downsizing but on further development – a vision that was shared during a rich communication/information process that was appreciated by the administrators during the process [17] [19].*

Information Technology (IT) has always been a fruitful partner in the BPR program [27] [28] [29] [30]. Hammer and Champy [28], (p. 5) claim that “Without reengineering, information technology delivers little payoff; without information technology, little reengineering can be done”. *In the DE-merger the IS are important and the physical distance between the two locations implies that the administrators have to rely on well-functioning technical solutions for e-meetings and reliable web based applications for cooperation in order to be more effective while performing with the level of quality that is required.* Hammer and Champy [28] point out the need for reengineering teams with a mix of insiders (that are familiar with the processes) and outsiders (i.e. employees outside the actual processes). Harrington et al. [29] report on a case study where the employees were happy about the possibilities offered by their new IS but experienced problems with empowerment, control and commitment in the new organization (after the reengineering). *These are relevant issues after the DE-merger - not least because of the two locations and the inherent need for managers to give attention to both places equally (which was a criterion for the appointments of managers in the new organization) and for the administrators to co-operate effectively.*

Grey and Mitev [24] discuss the increase of unemployment that BPR might cause and find this to be worrying for those who remain after a down-sizing since they have to face all that the change brings on. *If the DE-merger ends up with a down-sizing this would likely influence the job situation for the administrators.*

3 Method and data collection

The present empirical study was realized shortly after the merger and follows up on two prior studies. The longitudinal case study follows the Yin [31] methodology and

combines qualitative and quantitative methods with document reading in order to triangulate the findings.

3.1 About the data collection

Before the longitudinal case study started the administrators' participation was solicited by top managers in both organizations – as recommended by Bell and Opie [32]. The distribution list for this study was based on the administrator list from 2008. A total of 302 questionnaires were sent to the administrators employed in the former Org D and Org E. Before this the distribution list from the first round was revised and those (13 administrators) were removed that were known to have left the new organization. Newly employed administrators were not included in the list because of the scope for the longitudinal case study.

Before the questionnaire was sent to the administrators there were two people within the organization (not administrators) who tested the functionality (e.g. that the follow up questions were presented when they should) and proofread the questionnaire. This procedure led to minor changes in the formulation of a couple of answering alternatives. The pre-test was also to estimate the time required to answer the questions.

After the questionnaires were sent out, auto replies from the e-mail system provided information saying that another 21 administrators had left their jobs, after the first round of questionnaires was sent. With these people excluded, 281 questionnaires had a realistic opportunity of reaching administrators in the new organizations. A total of 179 respondents participated in the study and the total response rate is 64 % (in Org D 60 % and in Org E 69 %). The fall off is larger in Org D (40 %) than in Org E (31 %).

Because the study aims at being a total study of the administrative staff it is important to take a closer look into the group that did not participate. One factor to scrutinize was the respondents' gender. The web-survey tool made it possible to see who got reminders and their names revealed their gender: of those who did not participate 15 % are male and 85 % female. The corresponding figures in the respondent group are 22 % male and 78 % female. They are not the exact proportions but not quite different either – still it is important to bear this in mind while concluding from the study. Statistical analysis of the data was conducted using SPSS 17.0 and Texttalk Websurvey. I am following Bell's [33] definition of anonymity which means that not even the researcher should be able to connect any answer to any individual; the web-survey tool provided the required functionality.

The longitudinal case study follows the DE-merger process and the administrators are in the middle of a change process – which is likely to continuously influence their opinions. However, if the study would be performed in another merger with a context of that kind, the study could result in similar findings. Bell [33] discusses the importance of acknowledging if something special has happened just before the data collection that could have influenced the respondents' answers. In this case the merger had newly been carried out. The reason for realizing a study after such a short time was to get an on-the-spot account of the administrators' opinions at just that time – i.e. when it was almost inevitable that their emotional reactions to the merger and how it

was handled would influence the findings. I consider this an important phase of the process seen in a longitudinal perspective.

The participants were informed of the ongoing longitudinal study in the autumn of 2008 which could have been helpful for their understanding of this follow-up questionnaire. No technical failure or any misunderstanding of the questionnaire was reported. As recommended by Eliasson [34] I have carefully checked that data were correctly coded and entered in SPSS.

3.3 Discussion of the research method

An important fact to consider while studying organizational problems is the researcher's pre-understanding of the problem and the institutional context. According to Gummesson [35] the researcher's access to real-world data and pre-understanding are more likely to occur for a researcher with initiated knowledge of the organization that is investigated. Such knowledge is available to a consultant or someone inside the organization.

Concerning the ongoing longitudinal case study it should be declared that I have individual knowledge about the organizations in the DE-merger that provides pre-understanding of the problems studied and of the organizational culture. Full information on how/why is not revealed because of the nature of the study, which is anonymous. However, it could be said that I have earlier been working with administrative tasks for many years in different public organizations (similar context and culture) and during these periods I have been involved in a lot of networking activities that have helped to form pre-knowledge of the problem and of the organizational culture in this case setting. I have a thorough pre-understanding of the problems I am investigating and of the organizational customs in Org C and Org D. The administrators, participating in the study, are fully aware of my knowledge of the situation and the organizations and I have not had any negative remarks about it.

Shotter [36] introduced the "witness-thinking" and contrasts it with the "aboutness-thinking". An important perspective of Shotter's [36] concept deals with how the researcher meets with the participants in a certain study and he argues the importance of an open-ended dialogue. The present study, where the data collection is handled by a questionnaire could be seen as totally contradictory to the inter-activity that lies in the "witness-thinking" concept. However I consider my pre-knowledge, as described above, as a base for the inside knowledge that was used during the formulation of the questionnaire. I had knowledge of the problems that the administrators were facing in the merger and the post-merger integration.

The individual knowledge of the studied organizations has also given access to plenty of documents and information about the merger – these information sources could have been made available anyway but the pre-knowledge and understanding of the context made it easier and not so time consuming.

Zundel and Kokkalis [20], (p. 1211) argue the need for researchers performing organizational studies to "lighting up' new ways of seeing". An approach that could be applied on the longitudinal case study since a large part of the research's relevance is to gain further understanding of the problems that the referred practice experiences – i.e. how human factors could hinder or contribute to a successful PMI process. In the

literature numerous suggestions on how to prevent PMI failure and resistance to organizational changes are proposed. Nevertheless, these insights are not always acted on - and when they are it does not always solve the problem. Hence “new ways of seeing”, as Zundel and Kokkalis [20], (p. 1211) argue, are likely to be an appropriate way of narrowing down the PMI problems.

The study is a longitudinal single-case study [31] which calls for caution on generalizing the findings even if Gummeson [35] argues that too much weight is given to generalization.

4 Findings

The study was performed shortly after the merger so the findings should be looked upon in the light of the short time that has elapsed. Anyhow seven respondents have revealed their concerns for the fairness/correctness of judging the merger effects after such a short time - which was not at all subject for this study.

4.1 Descriptive characteristics of the respondents

The total response rate is 64% (Org D 60 % and Org E 69 %). A majority (78 %) of the participants are female (Org D = 75.5 %; Org E = 82.4 %) and 31 % are younger than 41 years (Org D = 28.7 %; Org E = 33 %). Before the merger 52.5 % of the respondents were employed at Org D and 47.5 % at Org E.

4.2 Changed routines are more negatively experienced than IS changes

There were 57 % of the respondents that found that their IS gave sufficient support “mostly” or “always”. A majority had “totally” or “partly” changed IS (78 %) or/and routines (79 %) after the merger. (Fig. 2.)

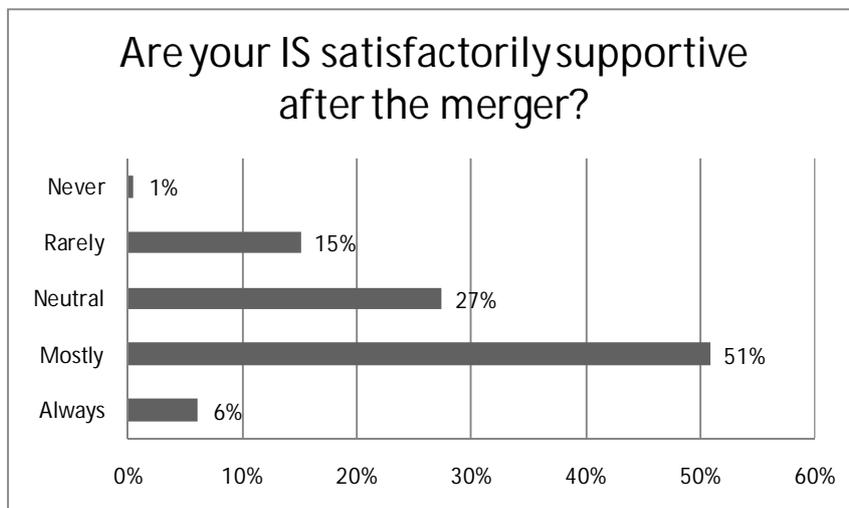


Fig. 2. Respondent opinions about IS' supportiveness (N=179).

A majority (56 %) of the respondents that had changes of their IS found the changes to have a "neutral" influence on their job and 41 % of those that had routine changes found the influence to be "neutral" (Fig. 3). Of those whose routines had not been changed there were 26 % that wished for changes of their routines and 19 % that wished for changes of their IS.

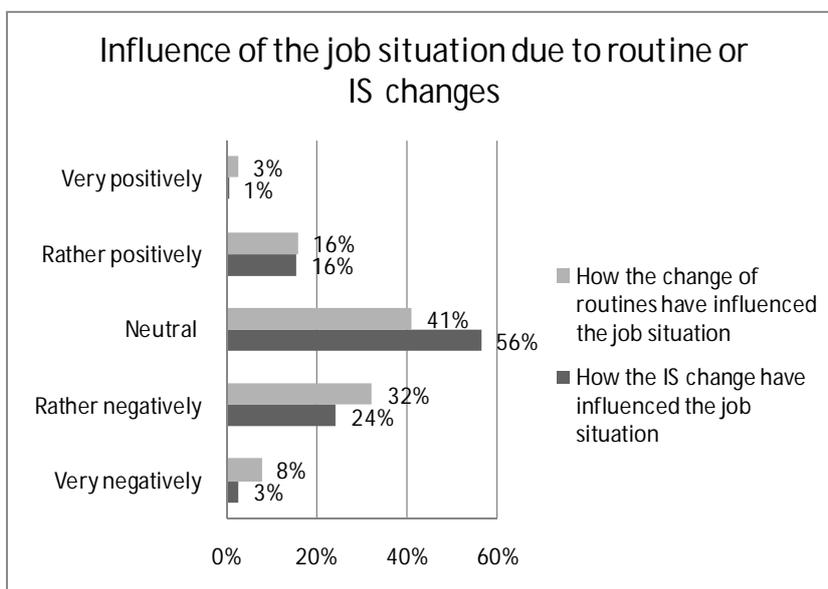


Fig. 3. Respondent opinions about IS and routine changes (N=179).

Nevertheless, the changes of routines were found to have more negative influence on the job as 40 % found them to have a rather negative or very negative influence. The corresponding figure for the influence of the IS changes was 27 % that found them to have a rather negative or very negative influence on their job situation (Fig. 3). Figures 4 and 5 show cross-tabulation of opinions of IS to be supportive and of how changes of IS and routines have influenced the work situation. There are more counts on the negative side of the experienced influence of carried out changes (both routines and IS) than on the positive.

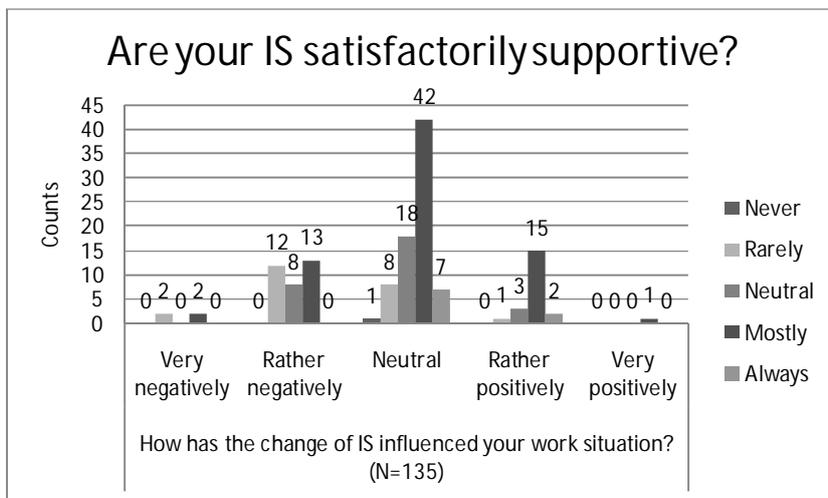


Fig. 4. Cross-table showing opinions about IS’ supporting capabilities and how changes of the IS had influenced the work situation.

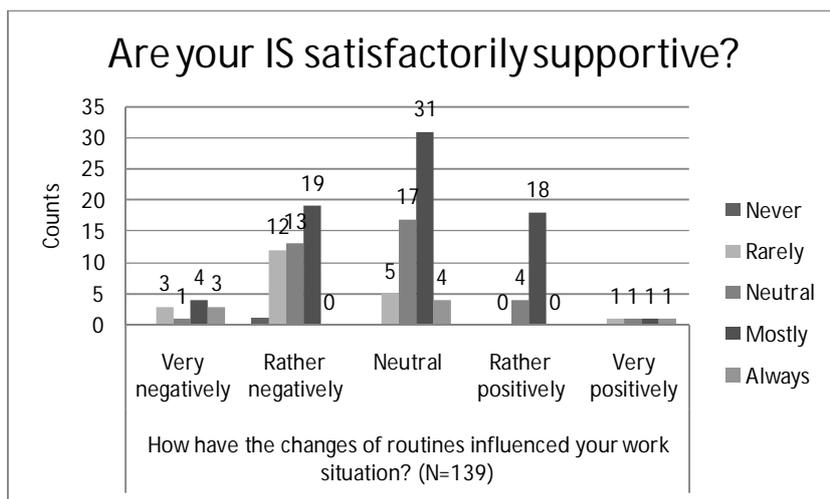


Fig. 5. Opinions on IS’ supportiveness and influence of routine changes.

There were no differences in opinions about the influences of IS and routines on the job situation depending on gender (Mann-Whitney U-test) or age (Kruskal-Wallis test) [37]. The difference that was found with the Mann-Whitney U-test concerned how IS changes have influenced the job situation depending on the former employer ($r = -0.22$; $mdn=3$). However, the influence was found to be small - below .3.

Table 1: Shows test statistics from SPSS for Mann-Whitney U-test; (N=135)

Test Statistics

	How has the change of IS influenced your job situation?
Mann-Whitney U	1669,000
Wilcoxon W	4297,000
Z	-2,948
Asymp. Sig. (2-tailed)	,003

a. Grouping Variable: Former employment organization.

A majority of the administrators that participated in the survey found the opportunities for further development as not being utilized satisfactorily since 58 % said that the management should have taken the chance to change more and 27 % had no specific opinion – 15 % found the management to have done what it takes to exploit the opportunities for further organizational development in the merger. As Figure 6 shows, dissatisfaction with the managements' efforts for further organizational development did not totally hinder the respondents' experience of IS to be supportive.

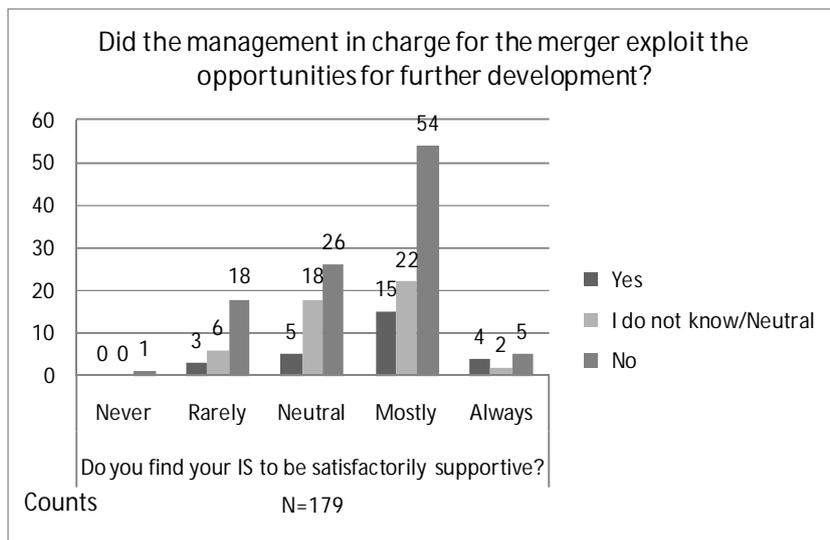


Fig. 6. Cross-table showing opinions about IS' supportiveness and how the management's efforts of exploiting the opportunities for development were apprehended.

5 Discussion

Since the present study is part of a longitudinal case study, and follows up on earlier carried out studies, the findings are discussed in the light of those prior findings.

5.1 Prior findings showed a promising starting point for a successful PMI

Employee resistance to change is often presupposed in the literature. The most frequently argued means for easing resistance to change could be comprised into four categories: i) trust and understanding; ii) training and education; iii) participation and opportunities to make use of one's competencies and knowledge, and iv) information and communication (Figure 7).

Table 1. Factors recommended in the literature for avoiding resistance to change.

Author(s)	Trust & under- standing	Training & education	Participation & to use competencies	Information & communication
Abrahamsson 2000 [6]			X	
Alaranta & Viljanen 2004 [14]	X		X	X
Blake & Mouton 1984 [2]	X		X	X
Bradt 2008 [7]	X		X	
Cartwright & Cooper 1995 [15]	X			X
Empson 2000 [8]	X		X	X
Epstein 2004 [3]				X
Hallier 2000 [9]	X			X
Kotter & Schlesinger 2008 [1]	X	X	X	X
Marks & Cutcliffe 1988 [4]	X	X	X	X
Michelman 2007 [11]	X			
Schweiger & Denisi 1991 [10]	X			X
Schweiger & Weber 1989 [5]	X			X
Smith 2005 [12]	X		X	X
Washington & Hacker 2005 [13]	X		X	X

Prior findings from the ongoing longitudinal case study [16] [17] [18] [19] indicate that these suggested means have been applied in the merger process, which would explain the conflicting findings.

5.2 A majority had their IS and/or routines changed

A clear majority had their routines (79 %) or IS (78 %) changed totally or partially. However more than half of the respondents (57 %) were satisfied with the support they received from their IS after the merger. The study from 2008 showed that a majority was dependent on well-functioning IS to perform their duties and wanted to keep their IS as it was and further develop it [16] [17]. The study from 2009 showed that 83 % were satisfied with their IS [19]. Hence the present study shows that the satisfaction with the IS has diminished some even if a majority is still satisfied with their IS.

The management must facilitate organizational change by communicating the change message e.g. [9] [12]. Prior findings [19] showed that the administrators were satisfied with the information they had received - even if they lacked information about their employment and of what would happen to their IS after the merger. Despite of this a clear majority still looked forward to the merger with enthusiasm [19]. Those findings could be related to the former management's actions that had followed recommendations for avoiding employee resistance.

The findings, showing that the changes of IS (27 %) and of routines (40 %) were considered to have a negative influence on the job situation, are important for management to notice and further follow up on. These findings could partly be

explained by the fact that the implementation phase is not quite finished and the routines have been implemented recently. Nevertheless, more troublesome understanding of the findings is that something happened during the implementation phase that disrupted the earlier well-managed merger process [18] [19]. A reason could be administrator opinions of not being involved and allowed to participate after the merger to the same (high) extent as before the merger [19]. There was no difference in opinions about the influences of IS and routines on the job situation depending on gender or age. The difference that was found concerned how IS changes have influenced the job situation depending on the former employer – anyhow the influence was found to be small (below .3).

5.3 Despite of some setbacks - a majority wished for further changes

Involvement and participation in an organizational change is argued in the literature to facilitate the process e.g. [6] [12] [13]. Before the merger there was a good atmosphere regarding the changes and a majority found their competencies to be utilized in the merger process [19]. This study found that a majority (58 %) considered the efforts for more far-reaching changes to be insufficient. Hence it could be a little confusing that 27 % of the respondents found the IS changes and 40 % of them found the routine changes to have a negative influence on their work situation. A plausible explanation could be that the changes that were realized were not what the respondents had expected or they did not find them to be adequate. One has to keep in mind that the administrators were looking forward to the merger with high expectations and were well-prepared for reengineering (93 %), which included a preparation for extensive changes [16] [17] [18]. Time is another factor that probably has influenced this opinion since only a short time had elapsed since the merger was carried through. It must be taken into account that the administrators had not yet been introduced to all the changes that would be undertaken due to the merger since the new organization was not quite in place. Decisions were postponed and/or delayed; at least to some degree due to late appointment of the top-managers and the administrators were used to getting rich information during the merger [19]. The use of IT for enhancing and optimizing the processes are viewed in the literature as an important part of reengineering and the systems have to be built, implemented and used in a way that supports the administrators' duties [21] [22] [23] [26] [27] [28] [29] [30]. As discussed above the respondents were content with the support they got from their IS but this has diminished somewhat compared to studies before the merger.

A reengineering initiative is known to introduce a risk for down-sizing the work force [24] [25]. Prior findings did not show that the administrators feared down-sizing since they were looking forward to the merger and thought of it positively as also to reengineering initiatives to come [18]. Still an earlier study [16] found that there were respondents with time-limited employment (17.4 %) that could easier be dismissed. The present study did not explicitly look for opinions about job loss but asked how the merger met the respondents' expectations of the merger. The finding was that nearly half (49 %) of the respondents did not have any special expectations. However, a majority of the respondents were positive towards the merger and looked forward to it

with excitement in prior studies [16] [18]. Even if this could be related to the study being performed shortly after the merger still a majority of the administrators were not satisfied with the reengineering initiatives so far.

6 Conclusion and future research

The findings provide an on-the-spot account of the administrators' opinions, after the DE-merger was carried out, in order to create a basis for subsequent studies that will add further to the knowledge base on how to succeed with PMI – intentionally by gaining new insights on the problem surrounding merger failure. This section comprehensively concludes on the research questions, suggests implications of the findings and gives proposals for further research.

Do the administrators find the reengineering attempts that were made successful?

The answer on this comprehensive research question points to a *No* since a majority (58 %) consider those to be insufficient. The sub-questions asked about how the respondents apprehended carried out changes of IS and/or routines to influence their work. The routine changes were found to have a more negative influence on the work situation (than the IS changes). The latter could be explained by the fact that the administrators were confident of their knowledge (well-educated) and found themselves to be skilled at mastering their IS and to learn to handle new IS [16] [17]. It was not made clear if those who considered the changes to be negative were generally against changes or if they just did not find the changes that were undertaken to be functioning and/or not in accordance with their expectations and needs. However, a majority was not regarding the changes to have a negative influence on their work situation. However, this could point to that the reengineering, which was actually carried out, to be successful. Despite of this the reengineering attempts were too few and thereby were the further development processes not entirely successful. Prior findings had shown an explicit openness to reengineering of their duties and to the merger [19]. Hence the administrators were not afraid of changes; rather quite the reverse.

Common wisdom and findings from earlier research [1] [2] [3] [4] [5] [6] [7] [8] [9] [10] [11] [12] [13] [14] [15] (cf. Table 1) are challenged because the findings so far from the longitudinal case-study [16] [17] [18] [19] show that the administrators are not resistant to the changes in the merger. The present findings are also supporting the prior findings (from before and during the merger) - that were in conflict with the picture of employees to be resistant and reluctant to change. Notwithstanding, some of the respondents found the realized changes of IS and routines to influence their work situation negatively; a majority did not find the management's efforts for further development as satisfactorily. So, there was actually a wish for more changes as the present findings pointed to administrators that were open-minded towards reengineering even after the merger was carried out.

The implication for practice is an important insight that administrators are not necessarily against organizational changes - at least not if the advices in the literature, about how to prevent resistance to changes, are applied.

The implication for research is an inspiration to undertake further research in the field of reengineering of public administration focusing on management actions on how to prevent post-merger failure caused by human factors.

More studies have to be realized in order to proceed with the longitudinal case study and to follow how those positive opinions remain in a longer run. Themes that should be focused in future studies are for example how undertaken changes will continue to influence the administrators' duties and their opinions and use of IS.

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References

1. Kotter, J.P., Schlesinger, L. A.: Choosing strategies for change, *Harvard Business Review*, vol. 86, no. 7-8, pp. 130-139 (2008)
2. Blake, R. R., Mouton, J. S.: *How to Achieve Integration on the Human Side of the Merger in Solving Costly Organizational Conflicts: Achieving Intergroup Trust, Cooperation and Teamwork*, Jossey-Bass Inc., Publishers, San Francisco (1984)
3. Epstein, M. J.: The drivers of success in post-merger integration. *Organizational Dynamics*, vol. 33, no. 2, pp. 174-189 (2004)
4. Marks, L.M., Cutcliffe, J. G.: Making Mergers Work, *Training and Development Journal*, vol.42, no. 4, pp. 30-36 (1988)
5. Schweiger, D.M. and Weber, Y.: Strategies for Managing Human Resources During Mergers and Acquisitions: An Empirical Investigation, *Human Resources Planning*, vol. 12, no. 2, pp. 69-87 (1989)
6. Abrahamson, E.: Change without pain. *Harvard Business Review*, no.4, pp. 75-79 (2000)
7. Bradt, G.: we've merged or reorganized. now what?. *Supervision* vol. 69, no. 2, pp.16-18 (2008)
8. Empson, L.: Merging professional service firms. *Business Strategy Review*, vol. 11, no.2, pp. 39-46 (2000)
9. Hallier, J.: Security abeyance: coping with the erosion of job conditions and treatment. *British Journal of Management*, vol. 11, pp. 71-89 (2000)
10. Schweiger, D. M., Denisi, A. S.: Communication with employees following a merger: a longitudinal field experiment. *Academy of Management Journal*, vol. 34, no. 1, pp. 110-135 (1991)
11. Michelman, P.: Overcoming resistance to change. *Harvard Management Update*, vol. 12, no. 7, pp. 3-5 (2007)
12. Smith, I.: Achieving readiness from organisational change. *Library Management*, vol. 26, pp. 408-412 (2005)
13. Washington, M., Hacker, M.: Why change fails: knowledge counts. *Leadership and Organization Development Journal*, vol. 26, no. 5, pp. 400-411 (2005)
14. Alaranta, M., Viljanen, M.: Integrating the IS personnel after a merger. *Proceedings of the 12th European Conference on Information Systems*, Turku, Finland (2004)
15. Cartwright, S., Cooper, C. L.: Organizational marriage: "hard" versus "soft" issues. *Personnel Review* vol. 24, no. 3, pp. 32-42 (1995)

16. Lundqvist, S.: The Role of Information Systems in an Organisational Merger. In: Proceedings of the 32nd Information Systems Research Seminar in Scandinavia, IRIS 32, Inclusive Design, 2009. Norway: Molde University College. J. Molka-Danielsen, (ed.), ISBN 978-82-7962-120-1 (2009)
17. Lundqvist, S.: Well-Functioning IS are Important for the Administrators' Effectiveness - and by that for the Organization as a Whole, Research report 1/2010, Institute for Advanced Management Systems Research (IAMSR). Finland: Åbo Akademi University, ISBN: 978-952-12-2447-8 (2010a)
18. Lundqvist, S.: In a Merger: Administrators are Open-Minded to Reengineering of their Assignments, Research report 2/2010, Institute for Advanced Management Systems Research (IAMSR), Finland: Åbo Akademi University, ISBN: 978-952-12-2448-5 (2010b)
19. Lundqvist, S.: In a Merger: A Lack of Information about IS and the Job Situation. In: Proceedings of the 33rd IRIS Seminar 2010. Denmark: Rebild. H. W. Nicolajsen, J. Persson, L. Heeager, G. Tjørnehøj, K. Kautz, P. A. Nielsen (eds). ISBN 978-87-992586-1-7, [CD] (2010c)
20. Zundel, M., Kokkalis, P.: Theorizing as engaged practice. *Organization Studies*, vol. 31, no. 9&10, pp. 1209-1227 (2010)
21. Ascari, A., Rock, M., Dutta, S.: Reengineering and organizational change: lessons from a comparative analysis of company experiences. *European Management Journal* vol. 13, no. 1, pp. 1-30 (1995)
22. Hammer, M.: Reengineering work: Don't automate, obliterate. *Harvard Business Review*, vol. 68, no. 4, pp. 104-113 (1990)
23. Pentland, B. T., Haerm, T., Hillison D.: Comparing organizational routines as recurrent patterns of action. *Organization Studies*, vol. 31, no. 7, pp. 917-940 (2010)
24. Grey, C., Mitev, N.: Re-engineering organizations: a critical appraisal. *Personal Review*, vol. 24, no. 1, pp. 6-18 (1995)
25. Marjanovic, O.: Supporting the "soft" side of business process reengineering. *Business Process Management Journal*, vol. 6, no. 1, pp. 43-53 (2000)
26. Bashein, B. J., Markus, M. L.: 'Preconditions for BPR success. *Information Systems Management* vol. 11, no. 2 (7 p.) (1994)
27. Hammer, M., Champy, J.: *Reengineering the corporation – A manifesto for business revolution*. London: Nicholas Brealey Publishing (1995)
28. Hammer, M., Champy, J.: *Reengineering the corporation – A manifesto for business revolution, revised and updated with a new authors' note*, New York: Collins Business Essentials (2003)
29. Harrington, B., McLoughlin, K., Riddell, D.: Business process re-engineering in the public sector: a case study of the Contributions Agency. *New Technology, Work and Employment*, vol. 13, no. 1, pp. 43-50 (1997)
30. Willoch, B. E.: *Business Process Reengineering - En praktisk introduktion och vägledning*, Sweden: Docendo Läromedel AB (1994)
31. Yin, R. K.: *Case Study Research – Design and Methods*, 3rd edn, Sage Publications, Inc. USA (2003)
32. Bell, J., Opie, C.: *Learning from research – getting more from your data*, UK: Open University Press (2002)
33. Bell, J.: *Introduktion till forskningsmetodik*, 4th edn, Lund: Studentlitteratur (2006)
34. Eliasson, A.: *Kvantitativ metod från början*, Lund: Studentlitteratur (2006)
35. Gummesson, E.: *Qualitative methods in management research*, USA: Sage Publications (2001)
36. Shotter, J.: Understanding process from within: an argument for 'witness'-thinking. *Organization Studies*, vol. 27, no. 4, pp. 585-604 (2006)
37. Field, A.: *Discover statistics using SPSS*, 3rd edn, Sage publications (2009)

Comparison of older users of mobile phones, senior mobile phones and non-users in Japan

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Abstract. This paper describes an exploratory study for comparing users of and their attitudes toward mobile phones in Japan. Based on survey of 17 older Japanese users of normal mobile phones and Raku-Raku senior phones and 6 non-users of mobile phones, the aim of the study is to find similarities and differences between these three groups of older people. The study indicates that Raku-Raku senior phone users' attitudes are between the attitudes of non-users and older users of normal mobile phones. The opinions and attitudes of friends seem to influence the attitude towards mobile phones.

Keywords: exploratory study, older people, Japan, Raku-Raku, mobile phones

1 Introduction

The accelerating ageing of the world's population is a well-known fact [21]. The speed is highest in Japan, where the proportion of people older than 65 years is estimated to reach 35.7% in 2050 [19]. Additionally, the traditional family concept, *ie*, in which older people live with their son or daughter, is breaking. Japan is moving towards Western nuclear family model, where older people form their own households [20]. This will put pressure on health care and social services, but equally on technology as well as on businesses in providing devices and services for the potential user group of older people. Unfortunately, most of the major mobile phone manufacturers seem to neglect this big target group as to the design of mobile phones. In Japan, however, Fujitsu launched a mobile phone for senior citizens in September 2001. This Raku-Raku Phone meaning "easily" or "easy-to-use" has been doing well; NTT Docomo has sold over 17,8 million Raku-Raku phones by summer 2010 [5].

Adoption and use of mobile phones have been studied intensively from the perspective of older people [1], [9], [10], [14], [15] and the requirements for adequate devices for older people are well known [7], [10], [13]. In addition to some physical features of mobile phones hindering the use, such as small screens or tightly placed buttons, there are also social, psychological and situational factors impacting on the behavior to use mobile phones. For instance, fear and anxiety towards technology [11], privacy matters [11] and social environment [1], [11] as well as the situation

where mobile phone is used [12] may influence the older people's use of mobile phones. Reluctance of taking mobile phones in use can also be interpreted with the theories of mental equilibrium [16] or status quo bias [8], [17]. The latter theory lists three categories of explanations for status quo bias: 1) rational decision-making in the presence of transition costs and/or uncertainty, 2) cognitive misperceptions or loss aversion, which refers to the psychological principle of people giving more weight to possible disadvantages than to possible benefits, 3) psychological commitment, which can be derived from four different factors: sunk costs, regret avoidance, a drive for consistency and a feel of control

When older people have taken a mobile phone in use, they have passed an important threshold of making the decision. What happens to their attitudes towards mobile phones and other people using phones? This paper tries to approach this topic by comparing the attitudes of older mobile phone users, Raku-Raku senior phone users and older people not using a phone at all.

The next section describes structures of the survey forms and methods used in this paper. Then the study continues to analysis and discussion of the results.

2 Methods

Japanese surveys of 32 mobile phones users, 15 females and 17 males, and surveys of 7 non-users, 4 females and 3 males, were inducted in Tokyo by two native Japanese and two Finnish persons speaking Japanese. The age of the participants varied between 20 and 81 years. Out of the interviewees 17 were older than 60 years. The survey form was written in English and translated to Japanese by native Japanese after which the form was discussed and translated back to English by another Japanese person. Data collections were made during Finnish industrial design exhibition in OZONE fair center in Tokyo by sampling passers-by (23 persons) and by using convenience samples among Japanese acquaintances (16 persons). Young and middle-aged Japanese people filled the survey by themselves, but the Japanese assistants helped the older participants by interviewing and filling the survey for them. Because the sample size was relatively small, the data was analyzed using cross-tabling.

The study used two different survey forms; for mobile phone users and for non-users. Both groups were asked demographic information, such as gender, age group, civil status, education and housing. Housing means if they lived alone, with a spouse, with children, (grand) parents or service home. Both forms also included a 5-level semantic differentiation scale between adjective pairs to measure attitudes towards mobile phones, use of mobile phones as well beliefs about how their friends and families regard mobile phones as follows:

貴殿の携帯電話への意識について	良い	+-----+-----+-----+	悪い
I think that mobile phones are	good	+-----+-----+-----+	bad

The survey for mobile phone users collected also information, for instance, about operator, phone model, duration of having had a phone and plans to buy a new phone. The interviewees were also asked to specify the three most important persons or groups to whom she or he makes phone calls. The purpose of mobile phone use was recorded as well by asking frequencies of different services the interviewee used. The services included, in addition to making or receiving a normal phone call, for instance reading mails, gaming, watching mobile TV, taking photos, browsing internet or using social media. In the survey for non-users of mobile phones the questions about actual mobile phone use were replaced by 5-level likert (agree - somewhat agree - neither agree nor disagree - somewhat disagree - disagree) propositions about mobile phones.

3 Results

The group of interest of this study is older people aged 60 years or more. There were 6 persons using a normal mobile phone, 5 persons using Raku-Raku phone and 6 non-users that fulfill the age criteria. The basic information about the interviewees is presented in Appendix A.

All mobile phone users had owned a phone more than three years. The age distribution of Raku-Raku phone users and non-users were approximately the same, half of the persons belonged to group of 61-70 years old and the rest to over 70 years old. All normal phone users' age was between 61 and 70 and they were still active in business life. Three of five Raku-Raku phone users had not bought their phones, but received them from their family. However, all users of normal phones had bought their phones by themselves and the majority of them had the phones in daily use, whereas the majority of Raku-Raku phone users did not use their phones on daily basis. The most important persons or stakeholders with whom the interviewed older people made or received phone calls were own business contacts, spouses, children and friends, whereas no-one ranked grandchildren, private services, such as accommodation or restaurant, and public services among the most important contacts.

The profiles of use for older users of normal and Raku-Raku phones are presented in Figure 1. In both groups making phone calls was the most frequent action. However, Raku-Raku phone users did not do that daily. Emails, which replace SMS in Japan, reached the second place among users of normal phone, but alarm clock and calendar seemed to be more important for Raku-Raku users than reading mails. Internet browsing and playing games are used occasionally among older normal phone users, but never among Raku-Raku users. In older Raku-Raku models that browsing function has been missing, which may explain the result. Pedometer to calculate steps was developed for Raku-Raku in order to activate older people to move and some older people seem to have found that. According to this survey, SNS (Social Network Service), such as Facebook or the Japanese version of it, Mixi and blogging through mobile phones have not reached older people yet.

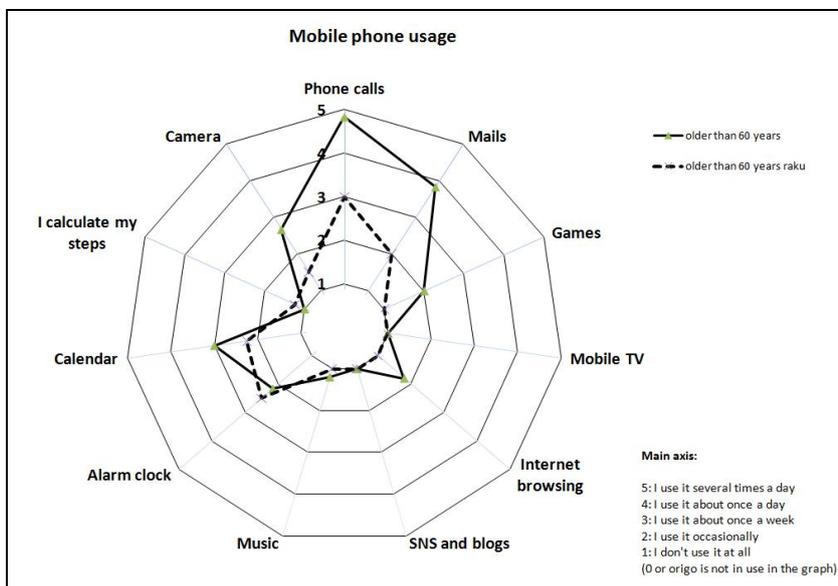


Fig. 1. Average frequencies of different mobile phone use purposes

In this survey mobile phone users and non-users were asked to fill a semantic differentiation task. Some of the interviewees regarded this task difficult, but everyone answered and expressed their opinions. The results are presented in Figure 2. The graph is interpreted as follows: the closer the point is to outer sphere the closer the opinion is to the right-hand side adjective. For instance, the older users of normal mobile phones agree all that mobile phones are “useful” and non-users’ opinions are closer to “useless” than “useful”. The sphere with level 3 is the neutral answer.

The semantic differentiation measured attitudes toward mobile phones and their use as well as beliefs about the opinions of families and friends regarding mobile phones. The users of normal mobile phone described mobile phones strongly with adjectives such as good, useful and easy to make a call. The non users respectively preferred terms bad, useless and difficult. However, this group admitted to some extent that mobile phones can be practical. Similarly, users of normal phones thought that their families and friends share positive attitudes about to have mobile phones and the non users’ opinions were similar to normal users’ although not as strongly. However, the non users thought that their friends regard mobile phones bad in general, although to have a phone can be good and wise. Interestingly, the Raku-Raku phone users’ attitudes were in many cases between the other two groups with some exceptions. For instance, compared to users of normal mobile phones, Raku-Raku users regarded mobile phones as more individual than general public and more indifferent than cute.

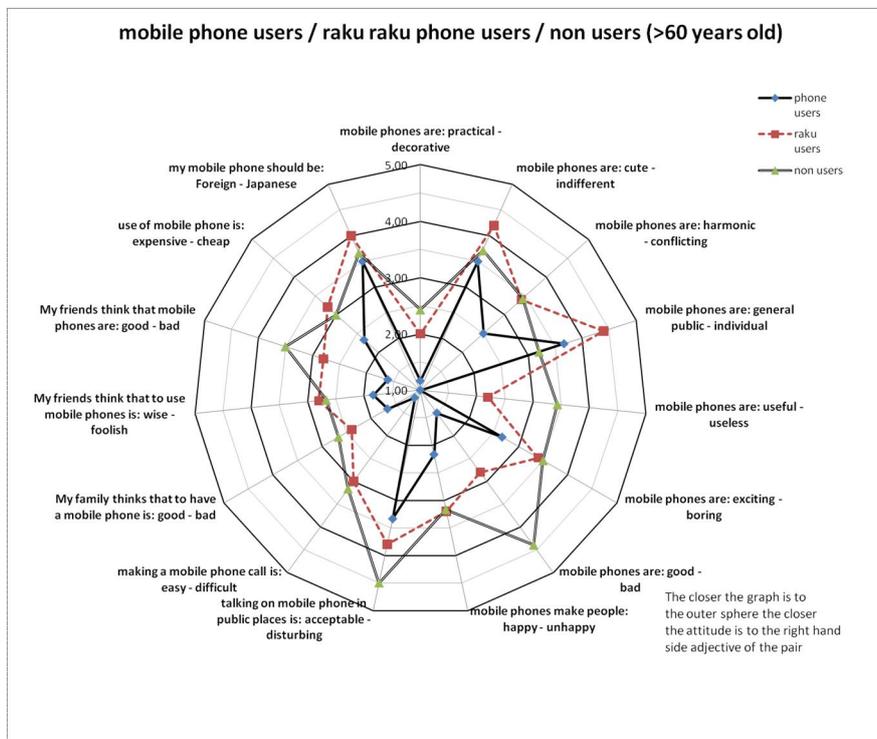


Fig. 2. Semantic differentiation: Attitudes of older people towards mobile phone use

The semantic differentiation is also presented in the appendix B, in which the answers are categorized by the basic interviewee information from appendix A. This categorization is used in the discussion to interpret the findings. However, any generalizations cannot be done because of the small sample size.

4 Discussion

The two profiles of mobile phone usage presented in Figure 1 resemble each other; the differences are mainly in the frequencies of use. When comparing the results they seem to be very similar with a survey that was made among older and younger users in Japan year 2006 [18]. The top three functions younger people were: making phone calls, sending and reading emails and browsing internet. For older people same list consisted of phone calls, emails and taking photos. Calendar and alarm clock were not included that survey, but these two features have been listed as important ones in other studies [11]. The findings seem to support the idea that the driving factor to use a mobile phone is the rational benefit the user can obtain [1], [9], [10], [14]. The Raku-Raku feature, the pedometer, also appeals to benefits what the users may gain by calculating steps and motivating them to move. Entertainment seems not to be in a

strong role, although using a camera and listening music can serve that purpose as well. Mobile internet may be unpopular, because for older people the web-pages can be difficult to see and to navigate. This study did not ask which internet pages the users visit.

The semantic differentiation revealed that Raku-Raku users' attitudes seem to be between the other two groups' attitudes. This result could be interpreted so that the attitudes of Raku-Raku phone users have changed after they have started to use a phone. However, in this study we don't know about their original attitudes. But if older person has succeeded to win his or her suspicions for mobile phones with a help of easy-use senior phone, he or she probably has to change the opinions and this way attitudes toward mobile phones. Re-evaluation of attitudes is needed to maintain peace of mind or status quo [16], [17]. Also the role of friends (peers) and family is visible in the graph. Non-users think that their friends share the attitude about mobile phones being bad, but the families of all three groups seem to regard mobile phones good. This is very often the case and children buy mobile phones for their parents or grandparents. This was also asked in this study and half of the Raku-Raku users had bought the phone by themselves. However, all the users of normal phones had bought the phones by themselves. According to data in appendix B, the users not having bought the phones by themselves regard phones more useless, bad and difficult to use than persons who have bought the phones for themselves. The purchase decision should come from the user herself; children may make a disservice for their parents or grandparents by buying a device that is not desirable. A positive attitude is an important factor when taking mobile technology in use [4].

All the users of normal phones were still active in work-life; this can be the reason why they used mobile phone daily. The users who did not use their phones every day had differences in their attitudes. First, they think that mobile phones are less beneficial (less practical and less useful) compared to daily users. Secondly, they regard making a phone call more difficult and, thirdly, talking on mobile phone in public places more disturbing compared to daily users. This use behavior, not having mobile phone in active use, is not uncommon among older people [9], [10] and it explains why using mobile phone can turn difficult for older people. Actually, it becomes a wicked circle; the users are not willing to use the phone and when they eventually use it, they have forgotten how the phone works, which increase the resistance to use the phone.

The users (1 normal phone and 1 Raku-Raku user) who had answered "friends" as the most important persons they are calling have interesting behavior and attitudes. First of all, they did not use phone daily and secondly they thought strongly that their friends regard mobile phones bad. These persons also did not score practicality and usefulness as high as people making calls on daily basis. If this phenomenon is inspected from the point of view of theory of reasoned action [3], the subjective norm depicts individual's thoughts about the beliefs of the social group, to which he or she belongs. And the attitude toward the behaviour should compete with the subjective norm forming the weighted sum of intention. In this case, it looks like the subjective norm would have a direct or indirect influence to attitude. Theory of planned behavior [2], however, says that second hand information has an impact to subjective norm via normative beliefs and influences also behavioural attitude as well as behavioural control.

The male and female non-users thought that mobile phones are relatively practical. However, male non-user respondents had stronger negative opinions on several other factors compared to females. They thought that phones are useless and bad, but easy to use. Actually, one of the male respondents expressed explicitly in the interview that he hates mobile phones, but did not explain the reason.

This is one example of the limitations of this study. The respondents just filled the survey without explaining their answers. The study should have gathered information about the thoughts behind the answers as well by interviewing them or using open questions. The major limitation of this study is small sample size. The results cannot be generalized and interpretations can be unreliable without larger mass of answers.

To overcome these limitations a new study including an updated survey, interviews and focus groups will be executed in Japan this year and it will be expanded to a cross-cultural study at least between Japan and Finland.

5 Conclusions

Two surveys, one for users of mobile phones and one for non-users, were made in Japan in the autumn 2010. The study distinguished normal mobile phone users and Raku-Raku senior phone users. Raku-Raku senior phone is developed by Fujitsu using Universal Design principles [6]. The survey included questions about demographic data, use purposes of mobile phones as well as semantic differentiation about attitudes toward mobile phones, their use and about beliefs of opinions of peers and family. The results indicate that the usage profiles of mobile services are generally similar between users of normal phones and Raku-Raku phones, but the differences are in the frequencies of using the services. The attitudes towards mobile phones differ strongly between older users of normal mobile phones and non-users, but attitudes of Raku-Raku phone users stay between these two groups. The opinions of friend seem to impact the attitude toward mobile phones among all these groups.

A more extensive study is on its way due to the small sample size of this study.

Appendix A. Basic interviewee information

user	gender	age	civil status	housing: living with	education	social status	have owned a phone	phone in daily use	buyer of the phone	the most important person/group	the 2nd important person/group
user 1	male	61-70	single	alone	BSc	working	> 5 years	no	myself	friends	business
user 2	male	61-70	married	spouse	BSc	working	> 5 years	yes	myself	spouse	business
user 3	male	61-70	married	spouse + children	BSc	working	> 5 years	yes	myself	business	spouse
user 4	male	61-70	married	spouse	BSc	working	> 5 years	yes	myself	business	spouse
user 5	male	61-70	married	spouse	BSc	working	> 5 years	yes	myself	business	spouse
user 6	male	61-70	married	spouse	BSc	working	> 5 years	yes	myself	business	spouse
raku 1	female	over 70	married	spouse + children	high school	working	3-5 years	no	spouse	spouse	children
raku 2	female	61-70	married	spouse + children	high school	home	> 5 years	no	children	friends	children
raku 3	female	61-70	married	spouse	high school	home	> 5 years	no	myself	children	
raku 4	male	over 70	married	spouse + children	high school	retired	> 5 years	no	myself	spouse	children
raku 5	male	over 70	married	spouse + children	BSc	retired	3-5 years	yes	spouse	children	spouse
non-user 1	female	over 70	married	spouse	MSc	widow					
non-user 2	female	61-70	married	spouse + children	high school	home					
non-user 3	female	61-70	married	spouse	high school	home					
non-user 4	male	over 70	married	spouse	PhD	working					
non-user 5	male	61-70	married	spouse	BSc	retired					
non-user 6	female	over 70	married	spouse + children	high school	home					

Appendix B. Semantic differentiation in detail

	Mobile phones are: practical - decorative	Mobile phones are: indifferent - cute	Mobile phones are: conflicting - harmonic	Mobile phones are: general - individual	Mobile phones are: useful - useless	Mobile phones are: exciting - boring	Mobile phones are: good - bad	Mobile phones make people: happy - unhappy	Talking on mobile phone in public places is: acceptable - disturbing	Making a mobile phone call is: easy - difficult	My family thinks that to have a mobile phone is: good - bad	My friends think that mobile phones is: wise - foolish	My friends think that mobile phones are: good - bad	Use of mobile phone is: cheap - expensive	My mobile phone should be: Japanese - Foreign
Phone bought by the user	1,5	2,4	3,4	3,9	1,3	3,0	1,8	2,4	3,6	1,5	1,9	2,1	2,0	3,5	2,1
Phone bought by someone else	1,7	1,7	2,3	4,3	2,3	3,0	3,0	3,3	3,3	3,3	2,3	2,7	2,7	2,7	2,7
Phone used daily	1,0	2,3	3,2	3,7	1,0	2,7	1,7	2,3	3,0	1,0	1,3	1,7	1,5	3,3	2,5
Phone not used daily	2,2	2,0	3,0	4,4	2,2	3,4	2,6	3,0	4,2	3,2	2,8	3,0	3,3	3,2	2,0
Male user of phone (normal and Ra	1,3	2,1	3,1	4,0	1,0	3,0	1,8	2,4	3,3	1,1	1,8	1,9	1,7	3,3	2,4
Female user of phone (normal and f	2,3	2,3	3,0	4,0	3,0	3,0	3,0	3,3	4,3	4,3	2,7	3,3	3,3	3,3	2,0
Male non user	2,0	2,0	4,0	5,0	4,0	2,0	4,0	2,0	4,5	2,0	2,0	2,5	3,5	2,5	2,0
Female non user	2,0	3,0	2,8	3,3	2,8	3,5	3,3	3,0	4,5	3,8	2,5	2,3	3,3	3,3	2,0
Primarily for business calls	1,0	2,5	3,3	4,0	1,0	3,0	1,5	2,5	3,0	1,0	1,5	2,0	1,8	4,5	2,3
Primarily for calling the spouse	1,3	1,7	3,7	3,7	1,7	3,0	2,0	2,3	5,0	2,3	2,0	2,3	2,3	2,3	1,7
Primarily for calling friends	2,5	2,5	3,0	4,0	2,0	3,0	2,5	3,0	3,5	3,0	3,5	3,0	4,0	3,5	3,5
Primarily for calling children	2,0	2,0	2,0	4,5	2,0	3,0	3,0	3,0	2,5	2,5	1,5	2,0	2,0	2,0	2,0

References

1. Abascal, J., & Civit, A.: Universal Access to Mobile Telephony as a Way to Enhance the Autonomy of Elderly People. (2001) pp. 93-99
2. Ajzen, I.: The Theory of Planned Behavior. *Organizational Behavior & Human Decision Processes*, **50** (1991)
3. Ajzen, I., & Fishbein, M.: *Understanding Attitudes and Predicting Social Behavior*. (1980)
4. Carlsson, C., Hyvonen, K., Repo, P. et al.: Asynchronous Adoption Patterns of Mobile Services. *System Sciences, 2005. HICSS '05. Proceedings of the 38th Annual Hawaii International Conference on*, (2005)
5. Fujitsu Ltd: Fujitsu Releases One-Touch Internet Access "Raku-Raku" Mobile Phone. (2010)
6. Irie, T., Matsunaga, K., Nagano, Y.: Universal Design Activities for Mobile Phone: Raku Raku Phone. *Fujitsu Sci Tech J*, **41** (2005) pp.78-85
7. Kaikkonen, A., Kaasinen, E., Ketola, P.: Handheld devices and mobile phones. In: Stephanidis, C. (ed.) *The universal access handbook*. CRC Press, 2009., Boca Raton, FL (2009)
8. Kim, H., & Kankanhalli, A.: Investigating User Resistance to Information Systems Implementation: A Status Quo Bias Perspective. *MIS Quarterly*, **33** (2009) pp. 567-582
9. Kubik, S.: Motivations for Cell Phone use by Older Americans. *Gerontechnology*, **8(3)** (2009) pp. 150-164
10. Kurniawan, S.: Older People and Mobile Phones: A Multi-Method Investigation. *Int. J. Hum. -Comput. Stud.*, **66** (2008) pp. 889-901
11. Kurniawan, S., Mahmud, M., Nugroho, Y.: A Study of the use of Mobile Phones by Older Persons. (2006) pp. 989-994
12. Mallat, N., Rossi, M., Tuunainen, V. K. et al.: The Impact of use Situation and Mobility on the Acceptance of Mobile Ticketing Services. *System Sciences, 2006. HICSS '06. Proceedings of the 39th Annual Hawaii International Conference on*, **2** (2006)
13. Morris, J., Mueller, J., Jones, M.: Tomorrow's Elders with Disabilities: What the Wireless Industry Needs to Know. *J. Eng. Des.*, **21** (2010) p.131
14. Oppenauer, C.: Motivation and Needs for Technology use in Old Age. *Gerontechnology*, **8(2)** (2009) pp. 82-87
15. Renaud, K., & van Biljon, J.: Predicting Technology Acceptance and Adoption by the Elderly: A Qualitative Study. (2008) pp. 210-219
16. Rogers, E. M.: *Diffusion of Innovations*. (2003)

17. Samuelson, W., & Zeckhauser, R.: Status Quo Bias in Decision Making. *Journal of Risk & Uncertainty*, **1** (1988) pp. 7-59
18. Suzuki, Y., Yonekura, R., Nakano, S. et al.: Mobile Phones as Multiple Information Terminals: From the Research Project "People and Media Usage in Japan". (2007)
19. Tsuno, N., & Homma, A.: Ageing in Asia - the Japan Experience. *Ageing Int.*, **34** (2009) 1-14
20. Ueno, C.: *The modern family in Japan : Its rise and fall*. Trans Pacific Press (2009)
21. United Nations: *The Ageing of the World's Population*. (2010)

INFORMATION TECHNOLOGY ROLE IN SUPPLY CHAINS' STRATEGIC AGILITY

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Abstract

Strategic agility offers a solution to the challenges brought about by a volatile business environment. For the business to adequately attain strategic agility and enjoy its benefits there is need to fully understand what it is and how to promote it. This study seeks to clarify strategic agility and more so in the supply chain environment. Furthermore, the role of information systems in promoting strategic agility is thereby highlighted. Specifically, strategic agility in supply chains is defined and this is done by developing a conceptual model. This model incorporates the strategic agility of the whole chain as well as for individual supply chain partners.

Keywords

Strategic agility, Supply chain, Information systems product and service, competitive business environment, conceptual-analytical research

1. Introduction

The role of information technology (IT) in business performance has received mixed views from researchers. For instance, Sambamurthy et al., (2003) argue that IT plays a crucial role in enhancing business performance. Researchers also differ in arriving to this conclusion, for example, Ordanini and Rubera (2010) noted that there are two approaches first, that IT impacts directly business performance and second that it impacts indirectly. Other authors, such as, Carr (2003) surprisingly conclude that IT does not matter. This study inclines to the view that IT indirectly impacts business performance. Specifically the purpose of this study is to highlight how IT is used to enhance strategic agility (Doz and Kosonen, 2008), which is a business imperative especially in a competitive environment. Strategic agility is defined as the ability to detect and respond to business environment tactfully with ease, speed, and dexterity (Tallon and Pinsonneault, 2011). Additionally, a supply chain (SC) context is considered in this research as it is one of the business responses to the competitive environment. A SC is a loosely related group of companies set up to achieve mutually agreed goals through collaboration (Christopher, 2000).

Using Brereton et al. (2007) guidelines we conducted a systematic literature review and also as advocated by Kitchenham et al. (2009) utilizing four databases. We did not find a research which specifically seeks to highlight IT capabilities taking into consideration SC context in order to promote strategic agility. Moreover, there is wide research on SC, for example, Spekman et al. (1998), Mentzer et al. (2001), Mouritsen et al. (2003) and Fawcett et al. (2008). And several researches have analyzed the role of IT in SC, such as, Williamson et al. (2004), Gunasekaran and Ngai (2004), Swafford et al. (2008), White et al. (2005). The need of strategic agility especially in a hyper-competitive environment (Sahay, 2006) has also been advocated for in research, for example by Tallon and Pinsonneault (2011). However, there is a gap noted in literature on precisely researching on how IT could be used to foster strategic agility in SC setting.

Information system (IS), in this research, is considered as the function or department within a company responsible for information technology and systems. An example of an IS product is enterprise resource planning (ERP) system and its service is integrating the company functions or departments to facilitate the flow of information. Note information technology (IT) in this research is used to refer to the IS product. Also note that the IS's services is referred to as IT capabilities in this research. Swanson (1994) highlighted that IS's product and services impact company's processes and services to influence and reshape the organization. This research takes this into consideration and in addition the IS's product and services influence on the business environment. Therefore, this research seeks to investigate the role of IS, specifically IS's product and services influence the business and its environment from a strategic agility point of view.

This research seeks to address IT capabilities required for strategic agility concerns of companies within a supply chain (SC). This is done by comprehensively developing a strategic agility model and thereby highlighting the required IT capabilities. Then how the strategic agility model fits the SA setting is elaborated. Formally, the following research question illustrates the research focus, how does IS's product or service impacts strategic agility in supply chains?

This research follows the conceptual-analytical research steps as elaborated by Järvinen (2004). In Section 2, the business environment is briefly explained. Then in Section 3 strategic agility concept and the required IT capabilities are highlighted. After that Section 4 strategic agility defined in the SC context, which is the perspective of this research. Then there is the discussion section and finally conclusion section.

2. Business Environment - Defining the environment

The business environment characterized by technology advancement, global competition and powerful customers among other factors has been termed differently in the literature, for example, volatile environment (Tallon and Pinsonneault, 2011), business pressures (Tuban et al., 2008) and hyper-competitive environment (Sahay, 2003). These business environment characteristics are of relevance to this research. Researchers such as SubbaNarasimha (2001), Pun (2001), Wirtz et al. (2001) and Turban et al. (2008) also consider these characteristics as prevalent today. Industries, such as, Telecommunications, pharmaceuticals and computer software sector are operating in this environment. Companies in these industries, such as, Nokia have to respond to these environment challenges and opportunities.

A significant number of researchers such as SubbaNarasimha (2001), Pun (2001), Wirtz et al. (2001), Doz and Kosonen (2008) and Turban et al. (2008) have conducted research related to this environment. This environment is characterized by fast speed of change which is complex in nature. Furthermore, Inkinen and Kaivo-oja, (2009, 47) states that “companies face very complex and emergent systemic strategic situations. They also face rapidly developing situations, where winners and losers can be recognized very early – without anyone even noticing any signals or seeds of change.” This environment is also characterized by irruption of new technology (SubbaNarasimha, 2001), imagination of new business models (Wirtz et al., 2007) and global marketplace (Pun, 2001; SubbaNarasimha, 2001). This has led to drastically shorted market visibility, increased uncertainty, shortened product life cycles, increased demand for product variety and fragmented global markets (Swafford et al., 2006).

SubbaNarasimha (2001) and Pun (2001) emphasized that the competitive business environment has brought challenges to companies seeking to achieve sustained competitive advantage. Doz and Kosonen (2008) suggested that companies need to be strategically agile to gain this sustained competitive advantage or even to survive in this environment. This research is based on these

environment characteristics. Specifically, this research involves an investigation on the role of IT to promote firms to be strategically agile in order to survive the business pressures. However, it is important to note that some companies and industries do not operate in the defined business environment, for example, museums and regulated energy industry in some countries. This research is of limited relevance especially to an environment defined by low speed of change and simple nature of change.

3 Development of the strategic agility constructs and related IT capabilities

The main dimensions of strategic agility, illustrated in Figure 1, are strategic sensitivity, strategic response and collect capabilities. Strategic sensitivity is further classified as strategic foresight and strategic insight. Strategic response is viewed from an internal response orientation and external response orientation. Collective capabilities are made up of human resources capabilities, infrastructure resources capabilities and information resources capabilities. These dimensions are defined in Table 1 and elaborated below. These multi-dimensional construct of strategic agility was developed from literature review, for instance, Van Oosterhout (2010), Doz and Kosonen (2008), Overby et al. (2006), Sambamurthy et al. (2003).

Constructs	Sub-constructs and variables	Definition	Literature
Strategic sensitivity		Sensing is the ability of organizations to actively seek out and gather useable data, assimilate this into information (by filtering it for relevancy, timeliness, accuracy and content), interpret and analyze the urgency, causes and impact of the derived information and as such, anticipate or detect opportunities and threats in the business environment.	Dove, 2001, Doz and Kosonen, 2008
	Strategic foresight	A foresight process involves appreciation, learning, anticipation and is intensely dependent on pattern recognition.	Inkinen and Kaivo-oja, 2009
	Strategic insight	An ability to perceive, analyze and make sense of complex strategic situations as they develop and to be ready to take advantage of them.	Doz and Kosonen, 2008
Strategic		Responding is the ability of an organization	Dove, 2001

response		in collaboration with its customers and partners in the business network, to quickly and seamlessly (re)configures combinations of capabilities to shape strategic moves with relative ease.	
	Internal response orientation	The ability of an organization to make use of its resources to quickly and seamlessly (re)configures combinations of capabilities to shape strategic moves with relative ease.	Doz and Kosonen, 2008; Sambamurthy et al., 2003
	External response orientation	The ability of an organization to perform in line with the environment circumstances.	Overby et al., 2006
Collective capabilities		The ability of a organization to benefit from the combined fusion of its resources, for example, information, employees, functions, infrastructure and partners. That is, to thrive on the gains of working together, this is more than, for example, each partner benefits individually summed up.	
	Human resources capabilities	Human resources capabilities include skills, judgment and intelligence of employees to take full advantage of its assets.	Progoulaki and Theotokas (2010)
	Infrastructure resources capabilities	The ability of the company to use main infrastructure, for example, equipment and plant to efficiently and effectively do its core functions.	
	Information resources capabilities	Organization's ability to derive value and successful utilize its information to improve its performance.	

Table 1 Strategic agility constructs definitions

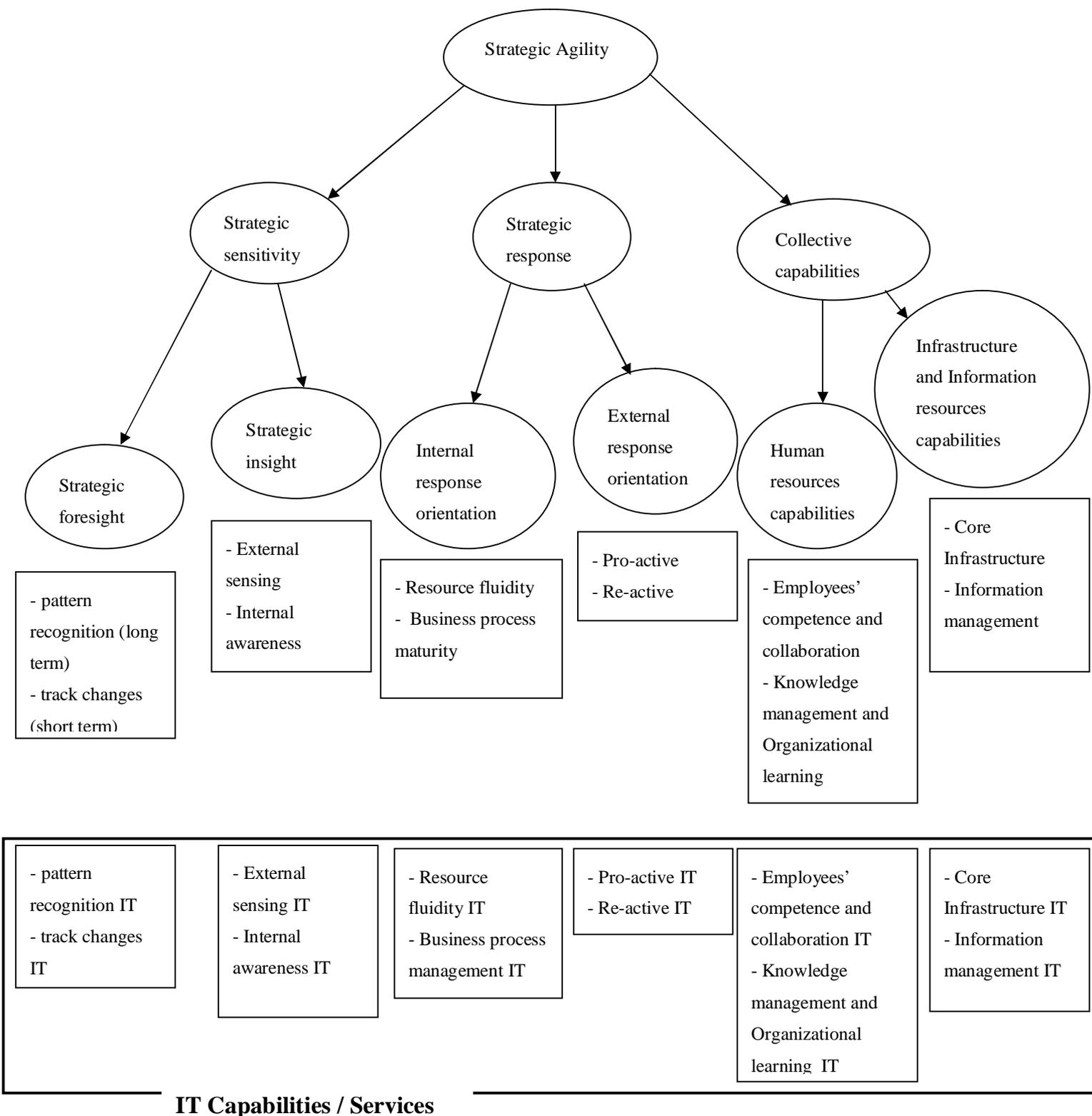


Figure 1 Taxonomy of strategic agility and the required IT capabilities

Strategic sensitivity is further classified into strategic foresight and strategic insight. Strategic foresight is the sub-dimension with specific future view, both in the long term termed pattern recognition and short term termed track changes. Therefore the required IT capabilities for strategic foresight are pattern recognition and track changes IT capabilities. Another sub-dimension of strategic sensitivity, strategic insight is made up of external sensing and internal awareness. Basically, this is taking an intense analysis with two views, outside view (external sensing) and inside view (internal awareness). Internal awareness is essential for highlighting the organization strength and weakness in light of the environment. Hence the required IT capabilities required for strategic insight are external sensing and internal awareness IT capabilities.

External response orientation and internal response orientation make up strategic response. This is basically an internal point of view and an external point of view to an organizational response. This is needed for utter analysis of the response in that it aids in giving the same response different analytical scope. External response orientation is then decomposed into pro-active and re-active to the business environment. Re-active is an act in response to environment changes and pro-active is an attempt to drive or lead the market. Pro-active involves an organization's effort to change the environment, for instance, with new products and services. Hence the required IT capabilities for external response orientation are pro-active and re-active IT capabilities. Internal response orientation is made up of resource fluidity and business process maturity. Resource fluidity involves the reconfiguration of the business systems and redeployment of the resources rapidly after consideration of the internal capabilities (Doz & Kosonen, 2008). Business process maturity is the effectiveness, control and predictability of the series of work activities in an organization. The IT capabilities required for strategic response from an internal orientation are resource fluidity and business process maturity IT capabilities.

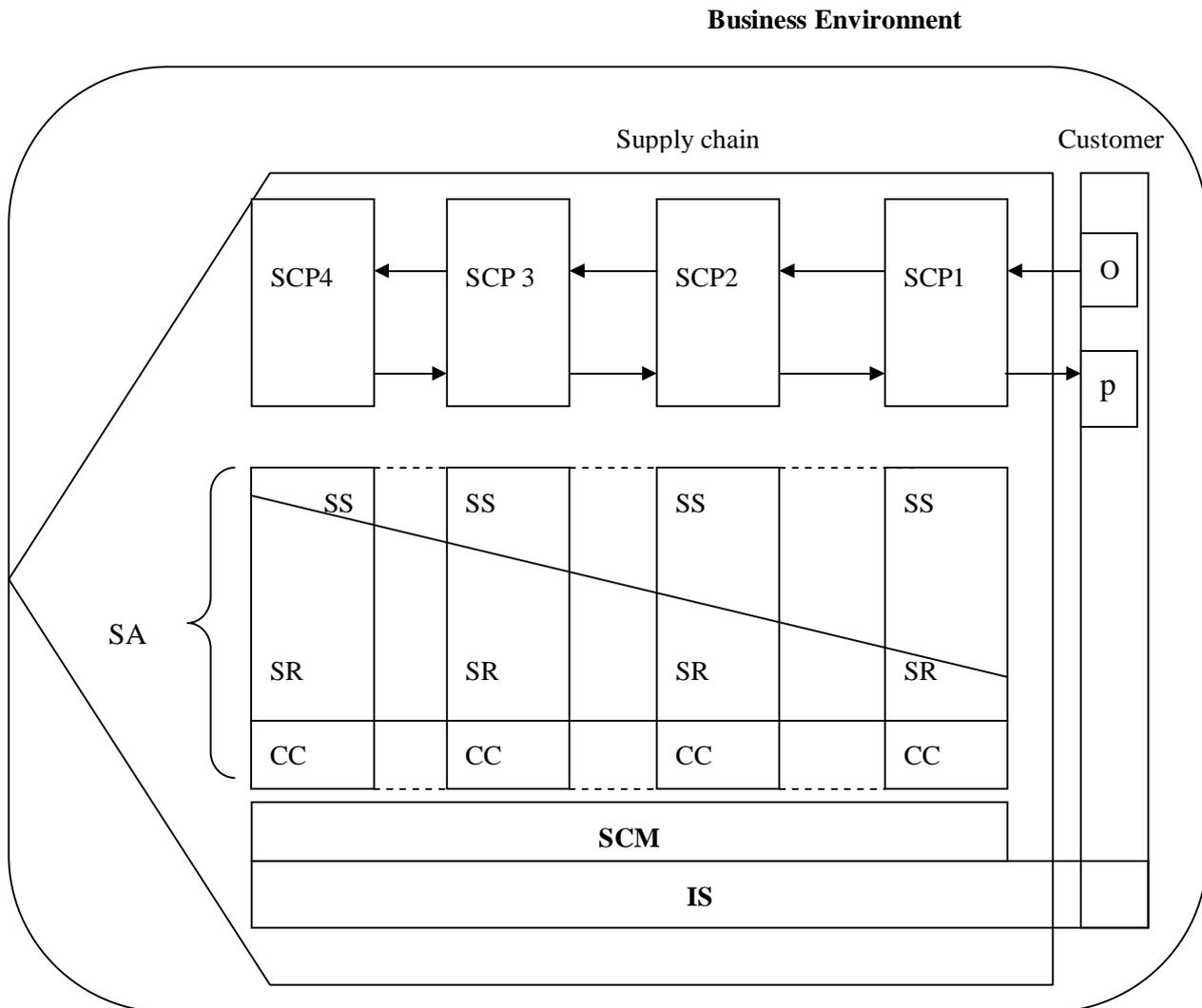
Collective capabilities are an inclusive strategic agility dimension which is made up of all essential organizational capabilities which are not classified in strategic sensitivity and strategic response. Furthermore, the main elements of collective capabilities are human resources capabilities and infrastructure & information resources capabilities (Järvinen, 2001). Human resources capabilities incorporate the competences of all the organization employees in effectively and efficiently carry out their duties. These competences, such as, skills to operate equipments and to speak foreign languages, are of more value or are enhanced by collaborating thereby formulating a multi-skilled and diverse manpower. Competencies can be define as "a set of observable performance dimensions, including individual knowledge, skills, attitudes, and behaviours, as well as collective team, process, and organizational capabilities that are linked to high performance, and provide the organization with sustainable competitive advantage" (Progoulaki and Theotokas, 2010). Therefore, employees' competence and collaboration is one

main attribute of human resource capabilities. IT is of value to both supporting employees' competence and also aiding collaboration hence the need for

Another important attribute of human resources is knowledge management & organizational learning (Alavi and Leidner, 2001; Van Oosterhout, 2010). Hargadon & Sutton (1997) argued the need to derive knowledge from different sources, that is, people, organizations and industries. Knowledge management includes knowledge acquisition, indexing, filtering and linking, distribution and application (Alavi and Leidner 2001). Organizational learning is constantly required and essential especially in a dynamic business environment. And the organization should continuously adapt in line with environment requirements and this is achieved through learning. IT is of value in knowledge management and organizational learning and therefore there is need for knowledge management and organizational learning IT capabilities.

An organization derives significant strategic capabilities if it has the infrastructure & information resources for its core capabilities. Core infrastructure, such as, equipment and facilities are necessary for an organization to effectively and efficiently carry out its core activities. Information is an essential attribute of an organization. Information can be identified in different resources including infrastructure, employees, databases, knowledge bases and computer memory. Information management capabilities are essential for an organization to maximize its use and gains from its information. IT capabilities to promote core infrastructure and information management are essential in a competitive business environment.

4. Strategic agility in a supply chain context



Key

SA	strategic agility	SS	strategic sensitivity	SR	strategic response
CC	collective capabilities	SCM	supply chain management	IS	information systems
SCP	supply chain partner	p	product	O	Order

Figure 2 Strategic agility in a supply chain context conceptual model

Figure 2 is the conceptual model of key features of strategic agility in a supply chain context. The successive players in the supply chain from downstream, for instance, could be retailer, wholesaler, distribution, manufacturer, and supplier-1 until the last-tier supplier. First it is important to note that the proposed strategic agility structure of each supply chain partner is

demonstrated by the rectangle underneath the supply chain partners. It is equally important to stress the fact that though it is possible to microscopically distinguish the different strategic agility requirements of each individual supply chain partner, macroscopically the strategic agility of a supply chain is a single unit. Strategic agility is composed of strategic sensitivity, strategic response and collective capabilities. Collective capabilities are of the same dimension in all the supply chain partners. Strategic sensitivity and strategic response are of varying dimensions depending on the position of the partner in the chain. These strategic agility components are as explained in Section 3 and demonstrated by Figure 1. Supply chain management and information systems provide the foundation of strategic agility in a supply chain context. Information systems extend from the supply chain to the customer, for instance, electronic commerce.

Collective capabilities are shown as the base of all the other strategic agility elements in Figure 3, because it is the factor which determines the size or even the availability of the other strategic agility elements. The same high degree or extent of collective capabilities is required from all the partners in the chain because it is equally important from all the partners.

There is a gradual increase of strategic sensitivity from the supply chain upstream to the downstream, that is, from suppliers to customers. This is because the upstream supply chain partners are the ones who most relate with the customers. The assumption is that the supply chain is customer oriented. That is all the SC operations are focused on meeting the customer requirements. And these requirements are dynamic hence the need for strategic sensitivity to capture the changes in customer taste. This is supported by Sambamurthy et al. (2003) who argued that customers serve three important roles; source of innovation ideas, co-creator of design and development of innovation products and services, and test-user of the products and services.

After sensing the environment, for example, customer taste through “strategic sensitivity” the chain needs to respond. Strategic response is gradually increasing from the downstream to the upstream of the supply chain, that is, from the customer to the suppliers. The assumption is that the downstream of the chain is more involved with the production of products and services. Hence, there is a need for strength or ability to quickly change the products or services as demanded by the environment. Though the customers are significant actors in analyzing the environment it is important to stress that there are other environment pressures such as global economy and competition, ethical issues and technological innovation and obsolescence (Turban et al., 2008). Furthermore, Porter (2008) suggested that competition is from rivalry competitors as well as from customers, suppliers, potential entrants and substitute products. Moreover, technological innovation can also be a strategic response by the supply chain. It is also important to stress that too much emphasis on customers only in analyzing the business environment could lead to disruption as elaborated by Christensen (Tidd et al., 2005). This is about changes brought about by emerging players in the industry through, for instance, new technologies thus toppling

the industry leaders who have an advanced way of operating and fails to make the transition. The advanced way of operating includes focusing on customers and understanding their requirements and developing innovations as defined by the market.

The model incorporates the business environment, as explained in Section 2, because it is an important factor when examining strategic agility of a supply chain. The business environment or business pressures include powerful customers, information overload, compliance with government regulations and deregulations, changing workforce, need for real-time operations and social responsibility (Turban et al., 2008). These are the factors which the supply chain needs to be sensitive to and be able to respond in order to gain competitive advantage or survive.

5. Research hypothesis

Now after defining in depth strategic agility in a SC environment, we would like to elaborate the ways IT can promote strategic agility in this SC setting. We will first clarify IT context in this study then analyse from the whole chain perspective and after that we look at the SC downstream and lastly SC upstream. We would also like to encourage SC and IT managers and academics to evaluate their IT input in order to assess their standings on its value from strategic agility point of view.

Most researchers such as White et al. (2005) and Williamson et al. (2004) refers to IT that transcends organizational boundaries as inter-organizational systems (IOS). In this study IT includes both IT that transcends organizational boundaries and within a single organization. This is because both systems are essential for in depth analysis of how IT supports SC strategic agility from both organizational and whole chain point of view. IT includes SCM systems, ERP systems through extranets that connect different functions within a firm as well as firm's SC partners ensuring information sharing (Coronado and Lyons, 2007). Furthermore, technologies have emergent recently that enable IT integration in SC at an increasingly low cost and also supports strategic agility, for example, web services, electronic trading hubs and business process management systems (White et al., 2005). IT that supports strategic agility includes the following characteristics customized information sources selected to target users, provide assistance for enhancing information seeking and use, excellent ease of learning and use, gather insights from the flow of information sought and used, dynamism in line with changing targeted users intensions (Rouse, 2007).

IT in SC, such as, intranet and extranet, are useful for information sharing and coordination between internal and external partners in the chain (Nagy, 2005), thus aiding collective capabilities. However, White et al. (2005) suggested that high level of integration reduces the ability to quickly make changes to trading relationships. They also noted that there are emergent IT, for example web services, that enables both deep integration and increased flexibility.

Nevertheless, IT offers a channel to promote collective capabilities which have been illustrated as should be high, Figure 4, throughout the SC, for instance, technologies such as the internet, group technologies and communication and collaboration systems. Moreover, Williamson et al. (2004) suggested that IT is increasingly being used within SCM and their role has shifted from a competition weapon to a cooperation enabler. On the other hand, as explained in Section 4 above, collective capabilities promotes strategic agility. However, there is need to research more on how specific IS promote or downgrade collective capabilities from a strategic agility point of view. Thus, stated formally;

Proposition 1: High collective capabilities in SC are positively associated with strategic agility. Therefore IT which enhances collective capabilities is indirectly positively associated with strategic agility.

Further research focus: How does IS's product or service impacts collective capabilities in supply chains?

As demonstrated in the strategic agility in SC context model, Figure 4, high strategic sensitivity in SC downstream promotes strategic agility. Strategic sensitivity is essential for SC to be constantly aware of the dynamic and unpredictable business environment (Galliers, 2007). Coronado and Lyons (2007) argued that the current environment forces organizations to be more attentive to customers' requirements. Therefore, it is important that SC downstream which is mainly in contact with customers (White et al., 2005) be highly strategic sensitive. IT plays a vital role in these sensitivity efforts. For example, in e-commerce IT used to interact with customers is essential to gather insights from the flow of information (Rouse, 2007). There have been efforts to understand how IT enhances strategic sensitivity. For example, Piccoli and Ives (2005) emphasized that IT is a fundamental component as it contributes to firm performance not in isolation but as part of an economic value creation system. However, there is still a gap in understanding how IT promote strategic sensitivity precisely in SC downstream in order to map their overall contribution to SC strategic agility. Furthermore, as noted in Section 4 above, high strategic sensitivity in the SC downstream promotes strategic agility. Formally;

Proposition 2: High strategic sensitivity in the downstream of a supply chain is positively associated with strategic agility. Therefore IT which enables strategic sensitivity in the SC downstream is indirectly positively associated with strategic agility.

Further research focus: How does IS's product or service impacts strategic sensitivity in supply chain downstream?

High strategic response in the SC upstream promotes strategic agility as illustrated in strategic agility in SC model, Figure 4. Response is inevitable after a sensing effort of the environment (Overby et al., 2006). The response (Dove, 2001) has to be strategic in that it should be in relation to the environment constructs, for example competitors, as well as at an appropriate time (Sambamurthy et al., 2003). In SC setting response should be swift and each SC partner is involved though at differing degrees. SC upstream which is more associated with product

formulation should have high levels of strategic response to enhance strategic agility. IT is crucial in strategic response in different ways such as product formulation (manufacturing systems, CAD), inventory coordination (radio frequency identification technology – RFID enabled SC systems) and information dissemination for efficient production (intranet and extranet). There has been attempts to study these technologies in SC setting, for example, RFID (Vance, 2005), CAD/CAM (Gunasekaran and Ngai, 2004), intranet and extranet (Gunasekaran and Ngai, 2004). However, we propose that these systems be further researched to specifically analyse their strategic response input especially in the SC upstream. Formally;

Proposition 3: High strategic response in the upstream of a supply chain is positively associated with strategic agility. Therefore IT which enables strategic response in the SC upstream is indirectly positively associated with strategic agility.

Further research focus: How does IS's product or service impacts strategic response in supply chain upstream?

Successful use of IT in the SC especially in the downstream and upstream as highlighted above enhances strategic agility. Moreover, strategic agility is a business imperative especially in a competitive business environment. It improves business performance (Swafford et al., 2006) in general and critical areas, such as, market growth, innovation and cost control (Tallon and Pinsonneault 2011). Therefore, from both academic and industry perspective, it is essential to understand the SC's IT input from a strategic agility point of view. Therefore, we recommend that a strategic agility evaluation tool be developed to aid in defining how IT can enhance strategic agility. Successful evaluation would aid SC in understanding identify the opportunities in using their IS to improve strategic agility. Formally;

Proposition 4: Strategic agility is positively associated with business performance.

Therefore, IT which enhances strategic agility is indirectly associated with business competitive advantage.

Further research focus: How can a supply chain evaluate their strategic agility to assess IT requirements?

6. Discussion

The strategic agility in a SC context conceptual model, Figure 2 is closely related to the model by Doz and Kosonen (2008). In fact it is an enhancement of this model by considering the SC perspective. This SC dimension is modeled from the Mouritsen et al. (2003), supply chain management model. However, this research considered only the SC components which are of interest in bring out the strategic agility concerns of the SC. The proposed strategic agility in a supply chain context conceptual model also takes into consideration other response factor, termed strategic response in this research. Unlike, the Doz and Kosonen (2008) model which attributes resource fluidity as the only response factor. In addition, there is consideration of the different strategic agility requirements by different members in the SC.

The scientific motivation of this research includes elaborating and clarifying the topic of strategic agility which is relatively new and has not received much attention in research as noted by other researchers such as Swafford et al. (2006). Strategic agility taxonomy, Figure 1, has been proposed and thereby IT capabilities highlighted. Overby et al. (2006) explored the ingredients of enterprise agility and proposed sensing environmental change and responding readily as the key characteristics. This research also adheres to these characteristics but however also incorporates collective capabilities as an important dimension to strategic agility. Furthermore, Doz and Kosonen (2008) suggest that resource fluidity is the response factor. This research proposed strategic response as a more inclusive response factor which includes other factors. Sambamurthy et al. (2003) also emphasized such inclusive response. In addition, they note the important role of information systems in agility which is also emphasized by this research as an integral component in mapping strategic agility of a supply chain.

Moreover, strategic agility in supply chain context has been considered, which a perspective that has not been thoroughly covered in scientific literature, hence we proposed a model to address this. However in developing the model we took into consideration the earlier results in the separate domains of strategic agility and supply chain management, that is, Doz and Kosonen (2008) and Mouritsen et al. (2003) respectively.

The limitation of the proposed strategic agility in SC conceptual model, Figure 2, is that it only covers what Mouritsen et al. (2003) classified as “direct supply chain” and “extended supply chain” but do not consider, if every stakeholder involved in the SC is analyzed that is “ultimate supply chain”. An empirical analysis to the proposed key features of strategic agility in a supply chain context conceptual model is recommended as further research. In addition there is need to research in depth each of the proposed strategic agility characteristics, strategic sensitivity, strategic response and collective capabilities. This has to be done in SC context and evaluate how they individually contribute to the strategic agility of the whole chain.

7. Conclusion

Strategic agility is made of strategic sensitivity, strategic response and leadership unity as the main characteristics. A supply chain needs to incorporate information systems use to enhance their strategic agility. The strategic agility of supply chain partners should be related and act as a unit in addressing the pressures brought by the business environment. Strategic sensitivity should be much more inclined to the downstream of a supply chain as illustrated in Figure 2. This is vital as this is the part which is constantly in touch with the business environment. Strategic response should be inclined to the upstream of a supply chain as illustrated in Figure 2. This is because this is where the products or services are first produced and hence should have the ability to quickly adjust to any changes to the business environment. Collective capabilities

should be consistent within the supply chain and also in the individual supply chain partners. Strategic agility is a continuous process which is always guided by the business environment.

In a competitive environment strategic agility is an imperative business feature. This research defined in depth strategic agility and thereby highlighted the required IT capabilities. Furthermore, a conceptual model of strategic agility in a SC context was proposed. This research also highlighted areas of further study, sub-questions in Section 5, as an in depth analysis of the precise role of IT in supply chains to promote strategic agility.

References

- Alvali and Leidner (2001), Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues, *MIS Quarterly* Vol. 25 No. 1, pp. 107-136
- Brereton, P., Kitchenham, B.A., Budgen, D., Turner, M. and Khalil, M. (2007). Lessons from applying the systematic literature review process within the software engineering domain, *The Journal of Systems and Software*, 80 (4), 571–583.
- Carr N.G (2003), *IT Doesn't Matter*, Harvard Business School Publishing Corporation
- Christopher M (2000), *The Agile Supply Chain Competing in Volatile Markets*, *Industrial Marketing Management*, Vol. 29, pp. 37–44
- Coronado, A.E. and Lyons, A.C. (2007). Investigating the Role of Information Systems in Contributing to the Agility of Modern Supply Chains, In *Agile Information Systems: Conceptualization, Construction and Management*, (Desouza, K.C. Ed.), p. 150, Elsevier, Oxford.
- Dove, R. (2001). *Response Ability: The Language, Structure, and Culture of the Agile Enterprise*, Wiley, New Jersey.
- Doz, Y. and Kosonen, M. (2008). *Fast Strategy: How strategic Agility Will Help You Stay ahead of the Game*, Pearson Education limited, Essex.
- Fawcett, E, Magnan, G.M, McCarter M.W. (2008) Benefits, Barriers, and Bridges to Effective Supply Chain Management, *An International Journal of Supply Chain Management* 13 (1) 35–48.
- Galliers, R.D. (2007). Strategizing for Agility: Confronting Information Systems Inflexibility in Dynamic Environments. In *Agile Information Systems: Conceptualization, Construction and Management*, (Desouza, K.C. Ed.), p. 1, Elsevier, Oxford.
- Gunasekaran, A. and Ngai, E.W.T. (2004). Information systems in supply chain integration and

management *European Journal of Operational Research*, 159 (2), 269–295.

Hargadon A. and Sutton R.I. (1997), Technology brokering and innovation in a product development firm, *Administrative Science Quarterly* 42, No 4, pp.716-749.

Inkinen S., Kaivo-oja J. (2009) *Understanding Innovation Dynamics: Aspects of Creative Processes, Foresight Strategies, Innovation Media, and Innovation Ecosystems*, Finland Futures Research Centre, Turku School of Economics, Turku.

Järvinen, P. (2004). *On research methods*, Opinpajan kirja, Tampere.

Kitchenham, B., O.P. Brereton, D. Budgen, M. Turner, J. Bailey and S. Linkman (2009) Systematic literature reviews in software engineering – A systematic literature review, *Information and Software Technology*, 51 (1), 7-15.

Mentzer, J.T, DeWitt, W, Keebler, J.S, Min S, Nix N.W, Smith C.D, Zacharia Z.G (2001) Defining Supply Chain Management, *Journal of Business Logistics* 22 (2) 1-25.

Mouritsen, J, Skjott-Larsen, T, Kotzab, H. (2003) Exploring the Contours of Supply Chain Management, *Integrated Manufacturing Systems* 14 (8) 686-695.

Nagy, A. (2005). Difficulties in Implementing the Agile Supply Chain: Lessons learned from Inter Organizational Systems Adoption, In *Proceedings of the IFIP TC8 Working Conference on Business Agility and Information technology Diffusion*, (Baskerville, R., Mattiassen, L., Pries-Heje, J. and DeGross, J. Eds.), p. 157, IFIP, Atlanta.

Ordanini A., Rubera G. (2010) How does the Application of an IT Service Innovation Affect Firm Performance? A Theoretical Framework and Empirical Analysis on E-commerce, *Journal of Information & Management*, 47, 1, 60–67.

Overby, E., Bharadwaj, A. and Sambamurthy, V. (2006). Enterprise Agility and the Enabling Role of Information Technology, *European Journal of Information Systems*, 15 (2), 120–131.

Piccoli, C. and Ives, B. (2005). IT-Dependent Strategic Initiatives and Sustained Competitive Advantage: A Review and Synthesis of the Literature, *MIS Quarterly*, 29 (4), 747-776.

Porter, M.E., (2008) *The Five Competitive Forces that Shape Strategy*, Harvard Business Review, (86: 1): 78-93.

Progoulaki M., Theotokas I (2010), Human resource management and competitive advantage: An application of resource-based view in the shipping industry, *Marine Policy* 34 (2010) 575–582

Pun S.S. (2001) *Managing in Turbulent Environments: Igor Ansoff's Strategic Success Model*,

Singapore Institute of Management, available at: <http://www.ansoffasia.com/article002.pdf>
[accessed 24 February 2011].

Rouse, W.B. (2007). Agile Information Systems for Agile Decision Making, In *Agile Information Systems: Conceptualization, Construction and Management*, (Desouza, K.C. Ed.), p. 16, Elsevier, Oxford.

Sahay, B.S. (2003). Supply Chain Collaboration: The Key to Value Creation. *Work Study*, 52 (2), 76-83.

Sambamurthy, V, Bharadwaj, A, Grover, V. (2003) Shaping Agility through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms, *MIS Quarterly*, (27: 2): 237-263.

Spekman, R.E, Kamauff, J, Myhr, N. (1998) An Empirical Investigation into Supply Chain Management: A Perspective on Partnerships, *International Journal of Physical Distribution & Logistics Management* 28 (8) 630-650.

SubbaNarasimha P.N. (2001) Strategy in Turbulent Environments: the Role of Dynamic Competence, *Journal of Managerial and Decision Economics*, 22, 4, 201-212.

Swafford, P.M, Ghosh, S. and Murthy, N. (2008). Achieving Supply Chain Agility through IT Integration and Flexibility, *International Journal Production Economics*, 116 (2), 288–297.

Swafford, P.M, Ghosh, S, Murthy, N. (2006) The Antecedents of Supply Chain Agility of a Firm: Scale Development and Model Testing, *Journal of Operations Management* 24 (2) 170–188.

Tallon P.P. and Pinsonneault A (2011), Competing Perspectives on the Link Between Strategic Information Technology Alignment and Organizational Agility: Insights from a Mediation Model, *MIS Quarterly* Vol. 35 No. 2 pp. 463-486

Tidd, J. Bessant, J, Pavitt, K. (Eds.) (2005) *Managing Innovation: Integrating Technological, Market and Organizational Change*, John Wiley & Sons Ltd, New York.

Turban E., Leidner D., Mclean E. & Wetherbe J. (2008) *Information Technology Management: Transforming Organisations in the Digital Economy*. 6th ed. John Wiley & Sons Ltd, New York.

Van Oosterhout M (2010), *Business Agility and Information Technology in Service Organizations*, Erasmus Research Institute of Management PhD Series in Research in Management, Rotterdam

White, A., Daniel, E.M. and Mohdzain, M. (2005). The role of emergent information technologies and systems in enabling supply chain agility, *International Journal of Information Management*, 25 (5), 396–410.

Williamson, E.A., Harrison D.K. and Jordan, M. (2004). Information systems development within supply chain management, *International Journal of Information Management*, 24 (5), 375-385.

Wirtz W.B., Mathieu A. & Schilke O. (2007) Strategy in High-Velocity Environments, *Long Range Planning*, 40, 3, 295-313.

How can information systems contribute to construction informatics? A review of research on Building Information Modelling

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Abstract. This article seeks to draw the attention of the IS community towards Building Information Modelling (BIM) as a potential area of interest for IS research. The Architecture, Engineering and Construction industry has recently become subject to major IT-generated change processes affecting their ways of doing business. The traditional, paper based and two-dimensional Computer Aided Design tools are gradually being replaced by three-dimensional technologies. This paper presents a review of research on BIM and 3D technologies in the construction context. The findings allowed concluding that the nature of research to date is largely techno-centric. This is echoed by the identified research gaps which are largely of socio-technical nature. These are BIM and inter-organizational knowledge management, inter-organizational IS/IT-infrastructure, human-computer interaction and interfaces and software-software interaction. It is argued that IS knowledge can help closing this breach.

Keywords: Information Systems; 3D Modelling; Building Information Modelling; Architecture, Engineering and Construction; Literature Review

Introduction

In recent years, many corporations within the Architecture, Engineering and Construction (AEC) industry have realized major IT-generated change processes [1] within their operations. The traditional, paper based and two-dimensional Computer Aided Design (CAD) tools are gradually being replaced by three-dimensional technologies. These technologies, commonly referred to as Building Information Modeling (BIM) are emerging IT-based information systems which promote collaborative and integrated design, assembly and operation of buildings. BIM can be best described as a myriad of IT-tools employed to design virtual models seeking to present all physical and functional characteristics of a building. Moreover, these models are utilized as vehicles to enhance inter-organizational collaboration [2]. An integrated construction approach, with all stakeholders editing or retrieving information from commonly shared models requires many changes to well established processes, working routines, information infrastructures, organizational roles, contractual practices and collaboration practices. Additionally, corporations are forced to change their traditional mindsets and to “...*overcome the tension between their distinct backgrounds...*”[[3]:290].

With all the aforementioned social and technical challenges at hand “BIM” and “three-dimensional modeling” have become issues of central importance to the AEC

field. Thus, these topics have become widely debated both by researchers and practitioners within the AEC community.

The interdisciplinary field of Construction Informatics (CI) seeks to bridge the gap between computer science and construction [4, 5]. Thus, the main research work produced on “BIM” and “three-dimensional modeling” is likely to be found within this domain. Previous research work seeking to map the foci, topics and agendas of the CI domain identified several shortcomings and under-researched areas. For instance, Amor [6] and Björk [4] state that much research produced within the CI domain is focused on technological advancements rather than on implementation issues and the use of IT in practice. Amor [6] claims that absence of behavioral and people-oriented research is evident. Furthermore, Turk [7] states that the topics “human-computer interaction” and “business process reengineering” are currently under-researched within CI.

Assuming their statements hold true, “BIM” and “three-dimensional modeling” research could benefit from ideas and paradigms originating within the Information systems (IS) discipline. Few IS scholars have yet contributed to the discussion on “BIM” and “three-dimensional modeling (3DM)” related topics. The work of Lyytinen and his colleagues on IT-generated inter-organizational issues [3, 8-10] published both in relevant IS and construction journals, is a good example for IS scholars seeking to bridge the gap between IS and Construction Informatics (CI) research. The intended contribution of this paper is to draw the attention of the Information Systems community to the potential role of BIM and 3DM as relevant and interesting topic areas for IS research.

Based on Turk’s [7] “Topic Map of Construction Informatics”, the first objective of this paper is to generate an understanding of the main themes addressed within “BIM” and “three-dimensional modeling” literature. Secondly, this paper seeks to identify which research disciplines contribute to the debate and whether IS literature addresses these topics. Lastly, the main goal of this paper is to identify which topics have been neglected in previous research and how the distinct knowledge of the IS field could be utilized to close some of these gaps.

In what follows, firstly, the technology subject to this review and CI as research field are briefly introduced to set the stage for this review. Secondly, related work e.g. former classifications of research within CI, BIM and 3DM are concisely revisited. Thirdly, the methodology underlying the literature review is clarified, including the proposed definitions and classifications. Fourthly, the identified patterns and trends are presented. Lastly, the paper concludes with a discussion of the main findings and suggests ideas for further research.

Introducing the review setting

BIM: from 2D to 3D based construction

Traditionally, the AEC industry designs projects utilizing two dimensional paper based drawing technologies. All parties involved in a construction project prepare their respective set of paper drawings. Design services to construction projects are provided by multiple organizations including architects, structural engineers, electrical engineers, plumbing and ventilation engineers, construction firms and specialized subcontractors, among others. This practice implies that for simple

construction projects hundreds of paper drawings are produced. These paper drawings are traditionally managed and distributed by the respective contractor's site management (left in Figure 1).

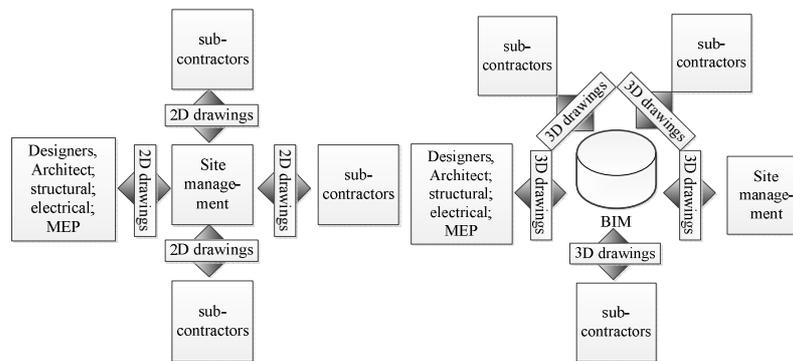


Figure 1. 2D vs. 3D based construction (adapted from Gal et al. [3])

Virtual modeling technologies became applicable for the AEC industry in the late 1990s. At that time, the term building information modeling (BIM) was coined to describe these technologies [11]. BIM technologies have a significant impact on existing inter-organizational information infrastructures and practices (right in Figure 1). Bew and Underwood [12] compare the introduction of BIM with moving from old accounting packages to ERP, as BIM includes the formal management of processes within and across organizations on a consistent repeatable basis. Product vendors add to the complexity of this problem by releasing a myriad of applications while common data exchange standards still evolve.

The field of Construction Informatics

According to Turk [13], Construction Informatics is a research discipline in its own right with chairs and departments established in universities around the world. The domain of interest to the CI field, as defined by Turk [13], are IT oriented topics that span over several AEC disciplines, such as integration, product modeling, construction documentation, engineering design cycles, concurrent engineering and so forth. Additionally, the IT-generated implications for the life cycle phases of construction projects are of interest to the field. Therefore, CI is an interdisciplinary field related to both IT and construction [7]. However, the CI discipline as an emerging, young science is frequently subject to criticism due to its ill-defined scope, vocabulary and methodologies [13]. According to Turk [5], CI researchers deal predominantly with practical problems whilst pure science and theory building is frequently left to others. Historically, several wordings have been used to name the discipline, for example: "computer integrated construction," "computing in civil engineering," "information technology in construction," and "Information and communication technology in construction" [7]. Some of the most influential CI journals are: *Automation in Construction*, *Journal of Computing in Civil Engineering*, *Advanced Engineering Informatics*, *Journal of Information Technology in Construction*, *Computer-Aided Civil and Infrastructure Engineering* and the *Journal of Construction Innovation*.

Related Work

IT/IS related topics have been on the agenda for the AEC industry since the 1960s [5], when AEC corporations first started using computers. CI as a field of applied science evolved in response to the IT/IS-related ‘construction specific’ issues and unique requirements of the AEC industry [5]. Past ontological research on stances and topics in the CI field has been sparse. Nevertheless, some work can be identified. Scholars contributing to this debate are for example Amor et al. [6], Björk [4], Turk [5, 7], Fischer [14], Boddy et al. [15] and Isikdag & Underwood [11]. Additionally, scholars like Froese et al. [16] analyzed the CI discipline in the light of construction management issues.

The authors utilized multiple data sources in their research; Amor [6] supports his arguments by analyzing conference proceedings of an annual CI conference¹, Turk [5, 7] utilized a single-step Delphi methodology, Björk [4] and Boddy et al. [15] contributed by analyzing selected seminal papers to construct their findings. Other earlier work contributed foremost by analyzing seminal work in the area [6].

Several CI scholars have developed ontology grounded frameworks to classify the research produced within their field. In what follows, two different frameworks are introduced and discussed to provide an understanding of the nature of previous work.

The ‘BIM Research Compass’ developed by Isikdag and Underwood [11] (Figure 2) is a classification model reflecting current research directions concerning the BIM paradigm. Their work summarizes a book edited by 50 leading CI experts seeking to map the scope of BIM research. Thus, their framework provides valuable insight on the major streams of research produced on the topic area of BIM and 3DM within the CI community. In their article, Isikdag and Underwood [11] provide a detailed discussion on the choice of topics for their framework. To understand the categories it is considered valuable to briefly revisit their definitions. Isikdag and Underwood [11] identify (Figure 2) twelve research directions for BIM:

- *conceptual boundaries*; includes research exploring the scope and limitations of the BIM paradigm.
- *organizational adoption*; includes research work on the organizational adoption of BIM together with the AEC industry’s approach to contracts and education.
- *maturity*; includes research on the organizational readiness in terms of processes, technologies and methodologies to enable BIM.
- *standardization*; covers topics on data level interoperability such as IFC (Industry Foundation Classes).
- *lean and green*; includes research on the effects of BIM on sustainability and productivity within construction operations.
- *process simulation and monitoring*; includes research on construction process visualization.
- *building information services*; includes research on BIM interoperability over web servers.
- *building geo-information integration*; covers research on the integration between geospatial information systems and BIM.
- *emergency response*; includes research work to enable BIM as a fire simulation model.
- *industry wide adoption*; includes research work measuring and benchmarking BIM uptake on a national industry-wide level.

¹ CIB W78 - International Council for Innovation and Research in Construction (CIB) working commission 78 (annual meetings of leading CI scholars)

- *education and training*; includes research work related to BIM education.
- *real-life cases*; includes BIM case studies within an industry setting.

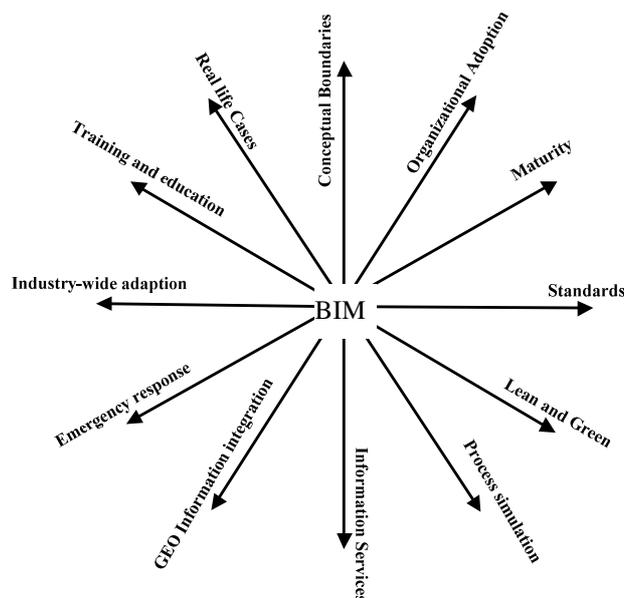


Figure 2. BIM Research Compass (adapted from Isikdag and Underwood [11])

The ontological framework chosen to support the classification within this literature review is Turk's [7] "Research Themes in Construction Informatics". The topics in this framework are arranged by function and purpose rather than technical solutions, which suits the purpose of this study well (see Figure 3). Turk's "Topic Map of Construction Informatics" [5, 7] is an ontology-grounded framework and has been developed based on a single-step Delphi method approach supported by a questionnaire directed at a representative amount of researchers within the European CI community with the intention to study itself. Turk's framework allows for identifying a large variety of topics and research streams which adds to the quality of the review within this paper since it is intended to understand the scope of the CI research.

In his article, Turk [4] provides a detailed discussion on the choice of topics for his framework. To understand the basic categories it is considered valuable to briefly revisit his definitions. Turk [4] differentiates (Figure 3) between core themes and support themes within CI research. He argues that core themes for the CI field should be topics where original and construction specific knowledge is created while support themes are topics where knowledge could be transferred from other research disciplines. The first core topic, *common infrastructures* (Type I), includes research on shared portals, online applications, mobile computing, internet applications and legal considerations of IT. The second research theme, *communication* (Type II), includes all forms of IT-enabled communication, from software-machine robotics to human-human communication topics (e.g. e-mail). Thirdly, Turk's category *processing* (Type III) includes all research topics related to the creation, management, publishing and retrieval of data. When articles address a combination of topic areas they will be classified according to Figure 3 into the subcategories Types V-VII. Turk's definition of *support topics* (Type VIII) seems to be rather inclusive, as he includes software development, the socio-economic implications of software and IT-

strategies within one group. A more detailed description of the themes and categories can be found in Turk [5]. Table 1 and Figure 3 provide an overview on the aforementioned categories and the classifications utilized.

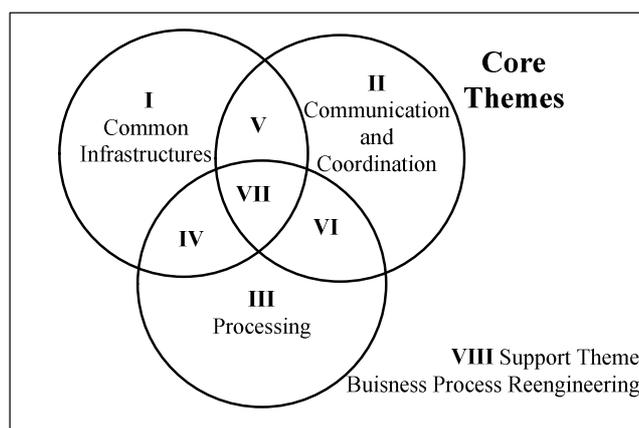


Figure 3. Themes in Construction Informatics Research (adapted from Turk [5])

Table 1. Research Themes in Construction Informatics (Turk [5]:195)

Core and support themes	Category	Themes
core theme (Type I)	common infrastructures	collaboration, concurrent engineering infrastructures e-business infrastructures electronic legal infrastructures
core theme (Type II)	communication and coordination	person-person communication technologies software interoperability and integration human-computer interaction machine-computer interaction
core theme (Type III)	processing	Computationally intensive applications Knowledge intensive applications 3D modeling and drafting databases, information retrieval knowledge management
support themes (Type VIII)	deployment	business process reengineering
	impact	economic environmental social
	needs	roadmaps
	transfer	best practice education software development standards

Methodology

A well-structured and solid literature review enables researchers to identify under-researched topics and research gaps. Knowledge about previous work is essential to make informed choices about directions for further research work [17]. The review

within this study can be considered to be a scoping study seeking to examine the extent, range and nature of the research activity on “BIM” and “3DM” topics [18]. *“However, it is important to note that identifying gaps in the literature through a scoping study will not necessarily identify research gaps where the research itself is of poor quality since quality assessment does not form part of the scoping study remit.”* [[18]:7]

“BIM” and “3DM” are topics of interdisciplinary nature at the crossroads of IS/IT and construction [5]. Thus, the literature review needs to be designed to cover the breadth of available literature, allowing for the identification of journal articles across several research disciplines. Previous work has largely been focused on journal articles or conference proceedings originating within the CI field. To accomplish the aforementioned intentions, the literature review was conducted in several systematic steps.

Literature Search

The systematic approach to identify a relevant and representative subset of articles on “BIM” and “3DM” included the following steps:

- (1) The SciVers Scopus database was considered to be a good fit to support the search within this literature review. Scopus is an abstract and citation database of peer reviewed literature including over 41 million records, it is the largest of its kind in the world (as comparison: Science Direct has 10 million full-text files). Therefore, the articles returned should perform well to scope the nature of the field under study.
- (2) It was decided to conduct this review on journal articles only, as this is considered to be representative of the main research conducted in this area.
- (3) Keywords, search criteria and return of articles can be found within Table 2.
- (4) All articles including abstracts were exported to an EndNote X4 library.
- (5) The initial screening for relevance, removal of double occurrences, removal of editorials for special issues and exclusion of irrelevant articles to the purpose of the study e.g. biochemistry, medical imaging and construction ICT topics other than BIM and 3DM left a total sample of 273 articles
- (6) Based on the topics and abstract the articles were categorized according to the classification model provided within the next section of the paper. The search functions in the EndNote X4 library were utilized as tool to support the classification.

Classification of the Papers

Bem [19] stresses the importance to design and support reviews by a “..., *guiding theory...*” “...,*or a point of view about the phenomenon under discussion.*” [[19]: 172]. Thus, systematic classifying and conceptual structuring of the material under study adds to the quality of a literature review.

The purpose of this review is to explore which topic areas are debated within “BIM” and “3DM” related research. Additionally, the study seeks to identify the academic fields contributing to the debate. Thus the classification within this review is twofold, first the research categories are analysed according to Turk’s framework (Table 1), second the outlet channels e.g. journals are analysed resulting in a classification of contributing engineering disciplines. The classification and coding was supported by a coding scheme based on Turk [5] which can be found in the appendix.

Table 2. Design of the literature search

Literature search design			
keywords	[a] 3D Modeling AND construction [b] 3D Modelling AND construction [c] BIM AND construction [d] ICT AND construction		
database and date assessed	[a] Elsevier SciVerse Scopus assessed 14.03.2011 [b] Elsevier SciVerse Scopus assessed 20.03.2011 [c] Elsevier SciVerse Scopus assessed 14.03.2011 [d] Elsevier SciVerse Scopus assessed 20.03.2011	return	[a] 288 [b] 265 [c] 133 [d] 204
Scopus search details:	[a] (TITLE-ABS-KEY(3d modeling) AND TITLE-ABS-KEY(construction)) AND DOCTYPE(ar) [b] (TITLE-ABS-KEY(3d modelling) AND TITLE-ABS-KEY(construction)) AND DOCTYPE(ar) [c] (TITLE-ABS-KEY(bim) AND TITLE-ABS-KEY(construction)) AND DOCTYPE(ar) [d] (TITLE-ABS-KEY(ict) AND TITLE-ABS-KEY(construction)) AND DOCTYPE(ar)		
relevant	273 articles		

The first dimension of this classification is the research category. First, the articles are classified according to the CI themes they address. Second, they are grouped into categories. Table 1 and Figure 3 provide an overview on the aforementioned categories and the classifications utilized. The second dimension is to identify the academic fields contributing to the debate on “BIM” and “3DM” related topics. The methodology applied is a frequency analysis classifying the articles by contributing journal, resulting in an overview table listing output frequency per journal within this sample. Furthermore, the scopes of the contributing journals are revisited to identify their respective area of research.

Limitations

The methodology utilized has several limitations. The first limitation is that the review within this paper was solely conducted on journal articles, leaving potentially relevant conference proceedings, book chapters, and other literature sources aside. Furthermore, the research is limited to one database which only includes only English language publications, therefore relevant literature in other languages is excluded from this study.

Furthermore, the literature review was conducted with the intention to scope a variety of BIM and 3DM related research topics within a construction setting. While the journal frequency analysis serves to give an overview of the relative focus on the different topics, this quantitative approach reflects neither on the influence of the respective outlet channels nor on the influence of single articles within this field.

An additional limitation is the breath of the study due to its scoping nature, including a considerably large sample in the review implies that the literature review strategy chosen prioritizes general understanding of the field under study over in-depth understanding of single research subtopics. The very nature of this literature review is therefore a scoping study.

Findings

This section reports the findings of the analysis conducted on the 273 articles under study. Moreover, the findings are related to conclusions drawn within previous literature. Figure 4 illustrates how research interest in this topic area in terms of number of articles published has risen almost exponentially from 1996-2010, implying that BIM and 3DM are very timely topics. This observation seems to align with the rapid development of BIM technology in recent years. However, the proposed timeline analysis might be subject to criticism as it was only conducted on journal publications. Arguably, journal publications are often delayed with regards to the time of study, nevertheless the results were regarded as sufficient to indicate a growing research interest in this field of study.

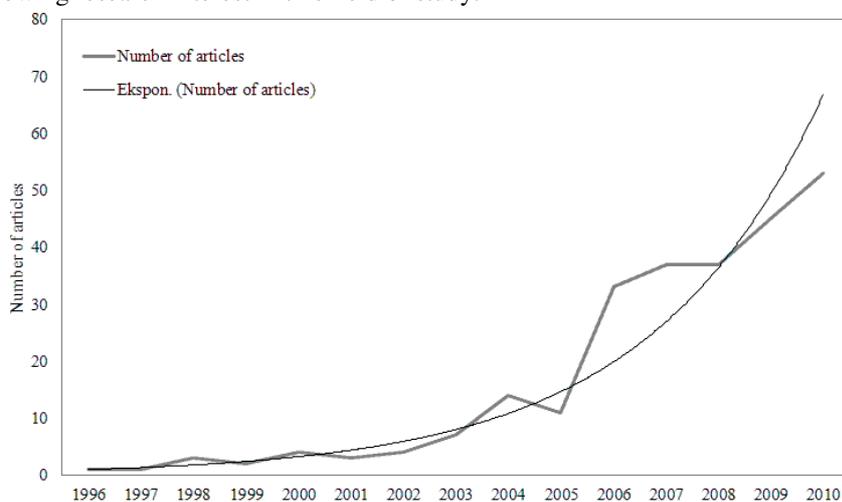


Figure 4. Article output per year in the area of construction informatics

Categories of BIM and 3DM research

The articles on BIM and 3DM topics were classified into subcategories of construction informatics by using Turk's framework (Table 1 & Figure 3). If an article covered more than one topic it was classified into the category perceived as predominant. Table 2 shows the result of classifying the articles into the themes. Most articles focus on processing topics. This finding aligns with Amor [6] and Björk [4] and their statements that research within CI is largely focused on technological advancements. In what follows the main characteristics of the research work found within the topic areas are addressed. Types IV-VII will not be addressed here since they are combinations of Types I-III.

Type I research – Common infrastructures

The research classified within this topic area focuses on physical information infrastructures required to interconnect computers and users to enable BIM, with legal infrastructures as a subtopic. There is a wide range of infrastructure related problems addressed within the articles classified. Some examples of studies in this category include:

Ahuja et al. [20] discussing about physical ICT infrastructures within the Indian construction industry and their future challenges to enable BIM, and Fruchter et. al [21] addressing the challenges within global AEC projects and the need for infrastructures enabling synchronous and asynchronous collaboration to support planning. Further, Kazi [22] addresses the limited capability of ICT infrastructures to meet the need of inter-enterprise information exchange”. An example for the subtopic legal infrastructures is Ku`s article discussing about “*a lack of contractual standards around the 3D model. Process complexities that are deeply embedded in practice conventions, along with legal constraints and risk allocation, pose challenges to the establishment of standard agreements*”[[23]:366]

Overall, it can be concluded that physical and legal infrastructure issues are widely debated and thus persistent topics within BIM and 3DM research.

Table 2. Classification of research themes in Construction Informatics (Turk [4])

Core and support	Category	Articles ²	No of articles	percentage
Type I	Common infrastructures	[1, 4, 6, 8, 10, 14-18, 20-23, 25-27, 31-33, 35-37, 43-47, 49-52]	32	11,7 %
Type II	Communication and coordination	[55-56, 60, 65, 67, 70-84, 89]	21	7,7 %
Type III	Processing	[90-172, 174-205]	115	42,1 %
Type IV	Relationship between Common infrastructures + Processing	[3, 5,19,28-30,38-42]	11	4,0 %
Type V	Relationship between Common infrastructures + Communication and coordination	[7, 12, 34]	3	1,1 %
Type VI	Relationship between Communication and coordination + Processing	[54, 57-59, 61-64, 66, 68-69, 85-88]	15	5,5 %
Type VII	Relationship between Common infrastructures + Communication and coordination + Processing	[2, 11, 24, 48]	4	1,5 %
Type VIII (Support themes)	Deployment	[9,206-210, 212-215]	10	3,7 %
	Impact	[216-242, 244-250]	34	12,5 %
	Needs	[13,53, 173,211, 243]	5	1,8 %
	Transfer	[251-273]	23	8,4 %
Total number of publications			273	1

² Full reference list available at: <http://ict-trehausproduksjonen.wikispaces.com/>

Type II research – Communication and coordination

Turk defines four themes within this category, but no articles were identified in this review on the themes of person-person communication technologies and human-computer interaction. In the following we present examples of research related to the two remaining themes in this category.

Software-software interoperability - Researchers contributing to this discussion addressed a variety of topics. Babič et al. [24] reported how BIM could be linked to an enterprise resource planning (ERP) information system, and Carroll [25] discussed the interoperability between BIM and a database of project cost information. Jardim-Goncalves and Grilo [26] discuss the implementation of BIM under the Cloud Computing paradigm. This list could be continued by a range of articles addressing the interoperability and data-exchange of BIM applications.

Machine-computer interaction – Few contributions within this area could be identified. Nevertheless, Makkonen et al. [27] contribute to the debate by presenting an experiment where they utilize a 3D Model to control an excavator. Motamedi and Hammad [28] contributed on the topic of wireless sensors and RFID and how BIM information could be integrated in those chips.

Type III Research - Processing

Computationally and knowledge intensive Applications

The work on this topic area is largely contributed by the various engineering disciplines involved in the AEC industry. Geotechnical engineers, structural engineers, electrical engineers, heating ventilation and air-condition (HVAC) engineers and plumbing engineers discuss the 3D applications relevant for their field of expertise. The articles report advancement in engineering knowledge related to 3D technologies. The majority of articles identified within this topic area are of techno-centric nature. Within this subcategory we find the following main research streams:

1. Geographical Information Systems (GIS) - The research is largely contributed by researchers originating in geology or geotechnical engineering disciplines. Their work is directed at the integration of geo information in BIM. Furthermore, their work contributes to advancement of GIS technologies. The work by De Rienzo et. al [29] on "subsurface geological-geotechnical modelling to sustain underground civil planning" is a typical example for contributions within this topic area.

2. Finite elements and structural engineering - This research work is largely contributed by structural engineers. This topic area is research combining BIM technologies and finite elements techniques to simulate movements of buildings and bridges and other structures. The applications try to model earthquakes scenarios and other dynamic movements of structures. The work of Casolo [30] on "seismic analysis and strengthening design of a masonry monument by a rigid body spring model" is a typical example of a contribution within this area.

3. Tunneling applications - The third largest topic area within this field discusses 3D technologies and their use for tunneling. The articles deal predominantly with simulating ground surface movements resulting from tunnel excavation [31].

In addition, there are further engineering disciplines discussing their respective 3D BIM related applications in a techno-centric manner.

3D Modelling and Drafting

Many articles address common data models as support for integrated BIM design. Industry Foundation Classes (IFC), STEP and XML are among the most debated topics in this research area. These topics are of critical importance to the BIM field as these data models and file format enable the exchange between concurrent design tools and formats.

Databases and Knowledge Management

There is limited research discussing BIM related knowledge management in construction organizations., One example is Bigliardi et al. [32] who discuss knowledge creation and transfer in project-based organizations, emphasizing the importance of the information and communication technology (ICT) in this context.

Type VIII Research – Support Themes

Deployment

Few articles focusing on the organizational and inter-organizational deployment of BIM could be identified. A good example for the work produced is delivered by Lyytinen and colleagues [3] [8]. Their articles address the inter-organizational aspects of BIM enabled design through an information infrastructure lens. They argue that their work bridges three major research disciplines namely IS, construction and organizational science.

Impact

Many articles addressing the economic, environmental and social impact of BIM technologies have been identified. Construction safety and how it benefits from BIM technologies is a frequently addressed topic within this field. Furthermore, many articles address the prospects of BIM technologies for construction scheduling. Additionally, a series of articles discussing the use of BIM technologies for lean, green and sustainable building has been found.

Few studies address the social impact of BIM technologies. However, some articles discuss the possibilities of virtual prototyping (VP) technology to enhance effective communication of designs and ideas before execution [33].

Needs

Five articles establishing roadmaps for further BIM and 3DM research were identified within this category.

Transfer

Five of the articles classified within this group discuss how BIM related techniques should be taught in civil engineering education and what curricula should look like.

Two articles classified within this group address technology readiness of construction executives. Several articles included in this group report lessons learned from practice. Others report on software development.

Frequency analysis

The top ten list of journals contributing to the 3DM and BIM discussion is presented in Table 3. As expected, CI journals are in the lead and populate the top three positions.

Automation in construction has by far the largest publishing volume of the journals studied. This has also been recognized by Björk and Turk [35] in their study on the publishing practice in the CI field. Automation in construction addresses foremost readers interested in design computing topics. However, also construction management and the engineering disciplines contribute actively to the debate. Of the 237 articles included in this review, the only identified contribution published in an IS journal was the article by Gal et al. [2]. This contributes a model to understand BIM from an IS point of view. Thus, this cross-fertilization among IS and CI adds a new dimension of understanding to the ongoing discussion.

Table 3. Journal Frequency analysis

Rank	Journal title (Publisher)	Frequency
1	Automation in Construction (Elsevier)	48
2	Journal of Information Technology in Construction (CIB)	35
3	Journal of Computing in Civil Engineering (ASCE)	9
4	Journal of Construction Engineering & Management (ASCE)	9
5	Cadalyst	8
6	Military Engineer (SAME)	8
7	EC and M: Electrical Construction and Maintenance	6
8	Tunnelling and Underground Space Technology (Elsevier)	6
9	Computers and Geosciences (Elsevier)	5
10	Engineering, Construction and Architectural Management (Emerald)	5
35	European Journal of Information Systems (Palgrave)	1

Discussion and Implications

By analyzing the articles in this review, four main areas where there is a gap in CI research could be identified.

The first gap identified is *BIM and inter-organizational knowledge management*. Little work could be identified addressing the challenges of inter-organizational knowledge management in BIM-enabled construction design. Integrated, boundary-spanning knowledge creation raises new questions about how the created knowledge is to be managed. Furthermore, in inter-organizational relationships questions about the ownership of the knowledge could arise. Additionally, questions about how to enable inter-organizational learning seem to be challenging to answer. It can be concluded that 3DM and BIM require the AEC industry to rethink their approaches to knowledge management.

The second gap identified is BIM and inter-organizational IS/IT-infrastructure. As of today many construction corporations, especially SMEs, have deficient IS/IT infrastructures, poor IT-departments and deficient IT-functions setting thresholds to BIM adoption. Within current research the focus lay either on the industry wide or the organization wide uptake of BIM technologies. However, BIM is a technology overarching organizational boundaries and therefore research needs to address the alignment of IT-infrastructures across organizations. Providing research from an inter-organizational perspective through an information-infrastructure lens could add to the quality of the current discussion.

The third gap identified is BIM and human-computer interaction and interfaces. Human-computer interaction is a neglected topic within current BIM 3DM research. This research gap has also been reported in previous work [6]. However, the successful deployment of BIM technologies will, amongst other things, be dependent on whether users adopt and actually use these technologies or not. Previous research on other complex IT/IS artifacts like ERP has proved the essential role of user involvement for successful IT implementation. Given the relevance of this topic area research needs to be produced here.

The fourth gap identified is software-software interaction (e.g. BIM and ERP, BIM and cloud computing). In general, BIM-software interaction is a sparsely addressed topic within current BIM research. However, since BIM technologies are still in their infancy and only early adopters are confronted with advanced problems like the integration of BIM and enterprise systems this observation does not come by surprise. However, BIM and ERP integrations are likely to be large and demanding IT-projects to undertake. This research stream could benefit from experiences and knowledge residing within the IS field.

At this stage the BIM Research Compass by Isikdag and Underwood [11] (Figure 2) is revisited to identify whether the identified research gaps are part of the current agenda for BIM research. This framework was published in 2010, and they claim to have identified existing directions in BIM research. Figure 5 maps the research gaps identified in this paper in the research compass, to identify whether they can be classified into current research streams. No overlap for the topics *Human-computer interaction and interfaces*, *Software-software interaction* and *inter-organizational knowledge management* could be identified and therefore these research directions may add new dimensions to the discussion. The topic of *BIM and Inter-organizational IS/IT-infrastructure* seems to be related to the maturity topic suggested by Isikdag and Underwood, so this topic could possibly be identified on the agenda for BIM research already. However not many contributions could be identified on this topic yet..

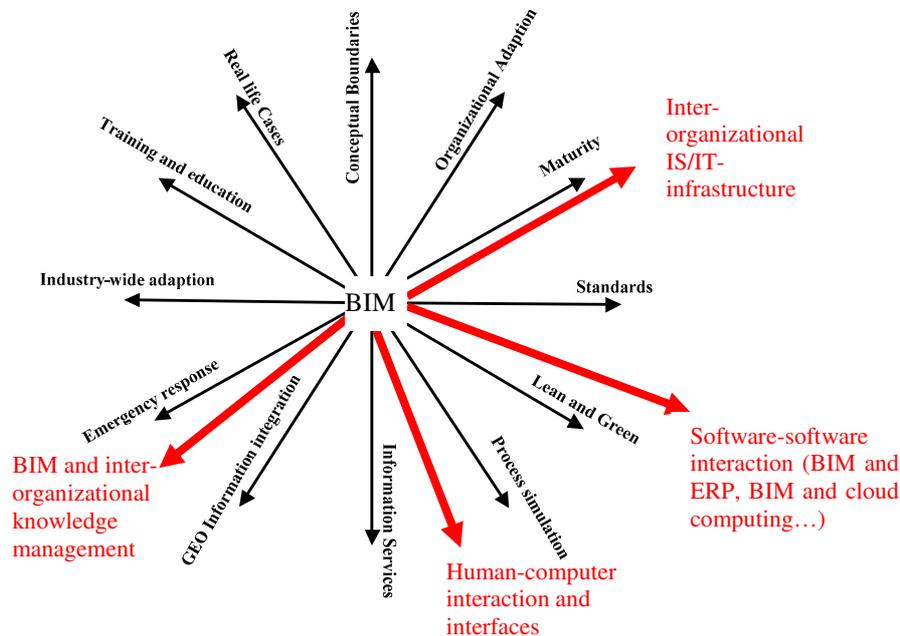


Figure 5. Mapping of the identified research gaps in the BIM Research Compass (adapted from Isikdag and Underwood [11])

Conclusions

By analyzing publications on 3DM and BIM in a structured way, it was possible to understand the scope and nature of the research conducted on this topic in the area of construction informatics. Additionally, the engineering disciplines contributing to the debate have been identified. The analysis helped to understand that the strength of the CI discipline is to foster technological advancements, and its weaknesses are deployment issues and human-computer related issues. This has also been confirmed in previous research [3]. [5] However, the weakness of CI is the strength of the IS discipline as IS is considered to emphasise the application of technology and the interaction between people, organisations and technology [34].

Several under researched areas have been identified within this paper. These are BIM and inter-organizational knowledge management, Inter-organizational IS/IT-infrastructure, Human-computer interaction and interfaces and Software-software interaction. Through highlighting these research gaps within CI, the paper intends to draw the attention of the IS community to the opportunity to close this breach. Lyytinen and colleagues [3, 8-10] showcased how IS could add a new dimension of understanding to the ongoing debate. However, to date few IS contributions have been made. Given the many interesting challenges of BIM and 3DM, and multiple opportunities for IS to contribute, this paper recommends further IS research within this topic area.

References

1. Gal, U., Jensen, T.: Organisational Identity and the Appropriation of Information Systems. ICIS 2008 Proceedings 181 (2008)
2. Shen, W., Hao, Q., Mak, H., Neelamkavil, J., Xie, H., Dickinson, J., Thomas, R., Pardasani, A., Xue, H.: Systems integration and collaboration in architecture, engineering, construction, and facilities management: A review. *Advanced Engineering Informatics* 24, 196-207 (2010)
3. Gal, U., Lyytinen, K., Youngjin, Y.: The dynamics of IT boundary objects, information infrastructures, and organisational identities: the introduction of 3D modelling technologies into the architecture, engineering, and construction industry. *European Journal of Information Systems* 17, 290-304 (2008)
4. Björk, B.C.: Information Technology in Construction—domain definition and research issues. *International Journal* 1, 3-16 (1999)
5. Turk, Z.: Construction informatics: definition and ontology. *Advanced Engineering Informatics* 20, 187-199 (2006)
6. Amor R, B.M., Coetzee G, M, S.: *Information Technology for Construction: Recent Work and Future Directions* (2002)
7. Turk, Ž.: Construction Informatics in European Research: Topics and Agendas. *J Comput Civil Eng* 21, 211-219 (2007)
8. Lyytinen, K., Damsgaard, J.: Inter-organizational information systems adoption - a configuration analysis approach. *European Journal of Information Systems* (2011)
9. Berente, N., Baxter, R., Lyytinen, K.: Dynamics of inter-organizational knowledge creation and information technology use across object worlds: the case of an innovative construction project. *Construction Management & Economics* 28, 569-588 (2010)
10. Boland, R.J., Lyytinen, K., Yoo, Y.: Wakes of innovation in project networks: the case of digital 3-D representations in architecture, engineering, and construction. *Organization Science* 18, 631-647 (2007)
11. Isikdag, U., Underwood, J.: A Synopsis of the Handbook of Research on Building Information Modelling. In: 18th CIB World Building Congress May 2010 pp. 84. (2010)
12. Bew, M., Underwood, J.: Delivering BIM to the UK Market. *Handbook of Research on Building Information Modeling and Construction Informatics: Concepts and Technologies* 30 (2009)
13. Turk, Z.: Paradigmatic Framework for Construction Information Technology. *Construction Information Technology* 9979-9174 (2000)
14. Fischer, M., Kunz, J.: The scope and role of information technology in construction. pp. 1-32. DOTOKU GAKKAI, (2004)
15. Boddy, S., Rezgui, Y., Cooper, G., Wetherill, M.: Computer integrated construction: A review and proposals for future direction. *Advances in Engineering Software* 38, 677-687 (2007)
16. Froese, T.M.: The impact of emerging information technology on project management for construction. *Automation in Construction* 19, 531-538 (2010)
17. Webster, J., Watson, R.T.: Analyzing the past to prepare for the future: Writing a literature review. *Mis Quarterly* 26, 13-23 (2002)
18. Arksey, H., O'Malley, L.: Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology* 8, 19-32 (2005)
19. Bem, D.J.: Writing a review article for *Psychological Bulletin*. *Psychological Bulletin* 118, 172-172 (1995)

20. Ahuja, V., Yang, J., Shankar, R.: Study of ICT adoption for building project management in the Indian construction industry. *Automation in Construction* 18, 415-423 (2009)
21. Fruchter, R., Swaminathan, S., Matsumura, N., Ohsawa, Y.: Interaction Dynamics in AEC Global Teamwork. *Tsinghua Science and Technology* 13, 145-150 (2008)
22. Kazi, A.S., Charoenngam, C.: Facilitating inter-enterprise information exchange in one-of-a-kind settings. *Electronic Journal of Information Technology in Construction* 8, 319-340 (2003)
23. Ku, K., Pollalis, S.N.: Contractual standards for enhanced geometry control in model-based collaboration. *Electronic Journal of Information Technology in Construction* 14, 366-384 (2009)
24. Babič, N.C., Podbreznik, P., Rebolj, D.: Integrating resource production and construction using BIM. *Automation in Construction* 19, 539-543 (2010)
25. Carroll, S.: BIM's early warning system. *Construction Specifier* 60, 16-17 (2007)
26. Jardim-Goncalves, R., Grilo, A.: SOA4BIM: Putting the building and construction industry in the Single European Information Space. *Automation in Construction* 19, 388-397 (2010)
27. Makkonen, T., Nevala, K., Heikkilä, R.: A 3D model based control of an excavator. *Automation in Construction* 15, 571-577 (2006)
28. Motamedi, A., Hammad, A.: Lifecycle management of facilities components using radio frequency identification and building information model. *Electronic Journal of Information Technology in Construction* 14, 238-262 (2009)
29. de Rienzo, F., Oreste, P., Pelizza, S.: Subsurface geological-geotechnical modelling to sustain underground civil planning. *Engineering Geology* 96, 187-204 (2008)
30. Casolo, S., Sanjust, C.A.: Seismic analysis and strengthening design of a masonry monument by a rigid body spring model: The "Maniace Castle" of Syracuse. *Engineering Structures* 31, 1447-1459 (2009)
31. Franzius, J.N., Potts, D.M., Burland, J.B.: The influence of soil anisotropy and Ko on ground surface movements resulting from tunnel excavation. *Geotechnique* 55, 189-199 (2005)
32. Bigliardi, B., Dormio, A.I., Galati, F.: ICTs and knowledge management: An Italian case study of a construction company. *Measuring Business Excellence* 14, 16-29 (2010)
33. Huang, T., Kong, C.W., Guo, H.L., Baldwin, A., Li, H.: A virtual prototyping system for simulating construction processes. *Automation in Construction* 16, 576-585 (2007)
34. Avison, D., Elliot, S.: Scoping the discipline of information systems. *Information Systems: The State of the Field* 3-18 (2006)

Themes	Turk's definitions		Coding scheme (based on Turk [6])	Article citations & number of occurrence		
Core Theme I	Common Infrastructures	Collaboration, concurrent engineering infrastructures	<i>Collaboration Infrastructures</i>	[1-8, 10-34] 33		
			<i>Collaboration, users, adoption</i>	[1, 5, 10, 21, 28, 33, 35-51] 23		
		Electronic legal infrastructures	<i>Legal infrastructures</i>	[14, 18, 52, 53] 4		
Core Theme II	Communication and coordination	Person-person communication technologies	<i>na.</i>	na. -		
			Software interoperability and integration	<i>Corba</i>	[54] 1	
		<i>interoperability</i>		[2, 11, 13, 55-64] 13		
		<i>Data exchange</i>		[7, 12, 63, 65-68][34, 48, 69-73] 13		
		Human-computer interaction	<i>Human computer interfaces</i>	-	-	
			<i>robotics</i>	[74-77] 4		
		Machine-computer interaction	<i>sensor</i>	[24, 71, 77-82] 8		
			<i>RFID</i>	[24, 83, 84] 3		
			<i>Machine integration</i>	[59, 74, 75, 84-89] 9		
			<i>Finite elements</i>	[63, 86, 88, 90-118] 30		
Core Theme III	Processing	Computationally intensive applications	<i>Electrical engineering</i>	[5, 59, 119-130] 13		
			<i>Structural Analysis</i>	[63, 68, 98, 131-135] 8		
			<i>HVAC</i>	[2, 123] 2		
			<i>GIS</i>	[11, 24, 28-30, 69, 87, 136-159] 31		
			<i>Tunneling</i>	[87, 88, 91, 96, 100, 103-105, 115, 122, 145, 160-172] 24		
		3D modeling and drafting	<i>IFC</i>	[54, 57, 58, 61, 63, 64, 66, 132, 173-178] 14		
			<i>ontology</i>	[66, 179, 180] 3		
			<i>STEP</i>	[62, 86, 114, 134, 151, 157, 163, 173, 177, 180-194] 24		
			<i>schema</i>	[3, 9, 19, 38-42] 8		
			<i>XML</i>	[63, 66, 195-197] 5		
	Databases, information, retrieval, Knowledge management	<i>Data Management</i>	[66, 102, 147, 150, 158, 177, 198-200] 9			
		<i>Product library</i>	[54, 85, 123, 147, 167, 201] 6			
		<i>Knowledge management</i>	[48, 53, 62, 64, 67, 148, 202-205] 10			
		Support Themes VII	Deployment	Business process reengineering	<i>BPR</i>	[206] 1
					<i>Business process</i>	[7, 16, 79, 201, 206, 207] 6
<i>Organizational integration</i>	[9, 21, 33, 136, 181, 205, 207-214] 14					
<i>Inter organizational</i>	[9, 16, 215],[210] 4					
Impact	Economic/ Management		<i>4D-nD management</i>	[12, 14, 21, 23-26, 28, 38, 45, 84, 102, 135, 137, 138, 147, 174, 198, 199, 207, 212, 216-226] 32		
			<i>Lean</i>	[26, 33, 38, 84, 126, 127, 218, 227-232] 13		
	Environmental		<i>Sustainability</i>	[4, 22, 38, 67, 119, 189, 196, 233-236] 11		
			<i>Green</i>	[159, 189, 196, 233-235, 237-241] 11		
			<i>Social</i>	[4, 32, 34, 48, 69, 135, 136, 211, 242, 243] 10		
	social		<i>Construction safety</i>	[5, 71, 79, 80, 99, 111, 133, 135, 137-139, 160, 166, 169, 172, 183, 217, 223, 226, 230, 231, 244-250] 28		
			Needs	Roadmaps	<i>Roadmaps</i>	[13, 53, 173, 211, 243] 5
Transfer	Best practice		<i>Best Practice</i>	[38, 198] 2		
			<i>Lessons learned</i>	[14, 45, 128, 136, 137, 192, 205, 208, 251-253] 11		
	education		<i>Training and education</i>	[183, 233, 254, 255] 4		
			<i>E-readiness</i>	[41, 254] 2		
	Software development		<i>Software development</i>	[21, 63, 66, 75, 102, 107, 147, 150, 156, 158, 169, 175, 178, 224, 225, 239, 243, 256-265] 27		
	Common standards		<i>standards</i>	[18, 25, 32, 33, 54, 56-58, 64, 65, 68, 81, 83, 121, 123, 132, 151, 173, 174, 176-178, 186, 194, 195, 199, 214, 216, 218, 225, 235, 238, 246, 253, 258, 260, 266-273] 44		

What factors influence to software and IS development in practice: a case study based on software supplier experiences

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Abstract. This paper investigates what factors influence to software and information system (IS) development in practice. Four theme-based interviews were used in this case study from one large Finnish software supplier company developing software and information systems for a specific customer. We discovered eleven factors influencing development. Both the positive and negative correlations between the factors were found out which gave us a better understanding of how different factors are related with each other. Other factors except that IT staff of the customers was absent had either negative or positive correlations between the other factors. Customer's lack of experience had the highest number of the positive/negative correlations between the factors of management commitment by the customer during the project, customer dominance over the supplier, continuous need for changes introduced by the customer, and financial resources available. We also found out that the interviewees differed by the factors they use.

Keywords: Software development, Information system development, Empirical research, Factor.

1 Introduction

The customer has been seen as one of the main software project challenges in some studies [1], [2], and more generally customer participation has been identified as the main reason for the software project or IS project failures in more than 8000 projects [3]. It has been claimed [4] that the communication failures between the customer and the supplier's development team is the base for five out of six factors for software project failure. It has also been noted that even though requirements misunderstanding or change management are both critical issues in IS and software projects, they can be controlled by the project manager [1]. Factors influencing development, however, cannot be controlled by a project manager since the influence of the customer is related to the customer's behaviour [1]. Therefore, it is of utmost importance for the

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project manager to forecast customer influence to achieve success in project implementation.

In this paper we represent the results of an empirical case study that investigated the factors that influenced on software and information system (IS) development. The objective of our study is to contribute towards an understanding how these factors influence on development in practice. In our study the counterpart was a large Finnish software supplier organisation developing software and information systems for a specific customer. We apply the past studies on software and IS development for identifying the potential factors that influence development when both customers and suppliers are taking part to the development work. In our study the main context is the software and IS development, which refers to the sole process of developing a certain software or information system for the customer by the software or IS supplier.

This study gives more explanation of the phenomena for academics and for practitioners as it has advised about the possible difficulties that a supplier organisation can expect when developing systems with their customers.

The practical implication of this research is significant for project managers of tailored software projects. The results enable project managers to forecast the factors influencing development in projects. By knowing such factors, one can be better prepared for their appearance and create strategies for overcoming them. For the researchers our study provides also evidence of the importance of customer and software supplier relationship. In particular our data provides evidence of the negative effect a customer can have on a software project through dominance.

The rest of the paper is structured as follows. Section two first describes the past studies of the factors influencing on development. Section three presents the research methodology and process, and section four outlines the results. Finally, section five presents the paper with conclusions and discussion.

2 Earlier research on factors influencing on software and IS development

Software development projects today have often an additional task of combining the forces of separate organisations, the customer and software supplier organisations [5]. The customer participation on software and IS development projects is mainly affected by the communications and knowledge transfer difficulties between the customer and supplier organisations [6], but also by the change management during the software and IS projects which can cause difficulties between the customer and supplier [7], [8]. Customer involvement improves the quality of the software being developed [9]. Prior literature further states that customer participation provides a more accurate and complete assessment of software and IS or software requirements and affects positively to development phases [10]. Customer participation and system success, such as time for development, enough financial resources available and customer participation in complex projects enjoys a positive relationship [11].

The communications and knowledge transfer difficulties can be insufficient application domain knowledge, incompatible terminology, and language barrier. Knowledge transfer is described as an exchange process of information and skills

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between entities in a systematic manner [12]. Application domain knowledge has been defined as the knowledge about customer's business process, business rules, activities, needs and the customer's business objectives for the software business [13]. Communication plays a vital role, e.g. in requirements gathering [14]. It has been illustrated how the application domain knowledge forms the basis for requirements of a software project [15]. Too much communication will result in depravity of developer's performance [16], but if there is not enough communication or the communication fails then developers may produce wrong kind of software [6].

In knowledge transfer and communication in general language barrier can cause incomplete knowledge about the requirements and may also lead to the wrong requirements as the development team will not understand them. Incompatible terminology creates misunderstandings in the requirements phase and ultimately causes requirements dissatisfaction [17]. Language barrier refers to the issues that are caused by the limited knowledge in the used language, and for example, it has been stated [18] that a rational and an obvious response to the language barrier is to employ external resources, such as translators and interpreters. Thus, insufficient domain knowledge, incompatible terminology, and language barrier can cause lack of information to the supplier and may result in misunderstanding requirements and inability to deliver useful software to the customer.

The requirements that are given in the beginning of the project are often subjects to change which causes a problem as changes require extra resources and time which are seldom given by the customer. It has been claimed [19] that customer specific additions are always a source of hassle for the developers. It has been also stated [20], that changes that are brought in requirements pose as a problem to developers, and project managers. Technical problems like bugs and low software quality as consequences of such changes has been reported [7], [8]. Literature includes the following suggestions on how to manage changes. It has been emphasized [1] that one way to manage changes is to educate customer about their impact on financial matters and schedules, and customer should also know what will not be included in the project. It has been also said [21] that all the organisations need to have a version control scheme to identify and manage changes efficiently. Suggestion has been made [1] that the project should be led by the customer community.

One important issue is the change management during the projects causing possible difficulties between the customer and software supplier. Customer dominance on process is a situation where the customer dominates the software and IS development process selection and creates a situation where the supplier is not able to follow a process of its own. In other words, customer forces alignment of development processes on the supplier team and the software and IS development process gets disturbed. This issue has also been identified [22] and reported that customer participating in software development may be limited due to their own behaviour. Customer practices may delay schedules and since the supplier is forced to do what the customer wants with methods controlled by the customer, the quality of the final product may suffer.

It is clear that the phenomenon of factors affecting software and IS development in practice requires more research due to its complex nature even if there are several well established past studies on factors affecting development. We did not find out,

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however, studies that focused on several factors involving a supplier perspective to software and IS development. Past studies have paid attention to one specific factor in each of the study, but ignored how the factors are related with each other in the software and IS development context. Only two studies have covered many factors in their studies [11], [1].

3 Research methodology and process

The importance of empirical studies is to authenticate the relative value of results within a field of study which will contribute to the advancement of that field [23], [24]. Empirical studies in software engineering include qualitative and quantitative research approach. Qualitative research is said to be useful for examining certain phenomenon, developing insights, and reporting those insights to others. It involves the studied use and collection of empirical data resources such as case studies, personal experience, interviews, and surveys [25]. To understand the complex phenomena of the factors influence to IS and software development, a qualitative strategy was used, and the overall research methodology was the case study approach [25]. For the past few years research on factors affecting on software and IS development has been done also through surveys or other forms of quantitative research methods [26], [27], and therefore we also use quantitative research approach in our study.

The fact that the factors influencing development have not received much attention in the software development research before makes the topic well suited for qualitative research approach [5]. It has been claimed that [25] qualitative research approach are best suited to areas that lack previous theories, and they have been found suitable for in-depth study in a given organisational setting [28]. In our study the process of building theory from case study research was adapted [29], and its implementation example for information systems science and software engineering was used [30]. Furthermore, the empirical data was collected using grounded theory approach [31], [32].

In this study the data collected from one software company including the four interviewees helped us to understand how factors influence often arise in the requirements engineering and communication domains. Based on a set of in-depth interviews this study describes what factors influence to software and IS and its development. The data collection perspective, however, is from the software supplier point of view. According to the four interviewees in this study, the difference between a customer and user is dependent on the customer organisation and interviewee's own intuition. The first interviewee in the studied software organisation defines the customer as the contact with whom the interviewee is making the contract and to whom he/she is making the deliverables. Thus, the customer is defined as the end user of the system. The second interviewee sees the end-users also as their customers. The buyer of the software development and information system is the IT department or the business department in the customer organisation, and the end-users from the customer organisation use the final system. The third interviewee understands the end-user and customer as different from each other, and the customer is the one to

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whom the software department is selling their services. Finally, the fourth interviewee claims that there is a difference between the work of a customer and an end-user, and that the end-user takes place in the testing phase and when taking the software solution into use. The customer has its own IS or software project group, and the end users belong to the group. From our understanding and based on the data we have collected, the supplier sees the corporate organisation representatives as the customer, although he or she may or may not be the end user of the system. Hence, customer can be defined as the representative of the customer organisation who may or may not be the end user of the system. The customer can be the buyer of the software development, and he or she belongs to the customer's IT or IS department. The end-user on the other hand is from the customer organisation and his/her responsibility is to use the IS.

Initially for data collection the research plan was sent to the department manager of a large Finnish software company, who further forwarded the plan to the company's vice president. The software company is an operative system for a forest industry employing more than 800 people. After acquiring the permission to go ahead with the research we were given the list of the top manager, the middle managers, and the project managers for the interviews (See Table 1). All the interviewees were having an experience of over 15 years in managing the tailored software development and information systems projects and they were participants of the department steering groups. The data was collected using theme-based interviews during the beginning of March 2008 and April 2008. The interviews covered four themes: Background information; Customer and user participation and the factors influence on software and IS development projects and process; Phases of customer and user participation and level of following agreements; and Customer – supplier relationship management. The interviews were carried out with the upper manager, the middle manager, and the two project managers. The interviews included frequent elaboration and clarification of the meaning, and after the interviews they were audio recorded, and transcribed to text yielding 90 pages of transcripts. Table 1 represents the detailed data gathered from the interviews about the factors influencing software and IS development.

Table 1. Interviewee details.

Interviewee	Role of the interviewee	Length of the interview (minutes)
1	Vice President	38
2	Department manager	65
3	Project manager	84
4	Project manager	44
1	Vice President	38

We then searched the data for factors influencing development, and found out eleven different factors affecting development. The reason for choosing these eleven specific factors was that they were supported both by our empirical data and the past studies (See Table 2).

6 Erja Mustonen-Ollila¹, Aparna Pasi² and Jukka Heikkonen³,**Table 2.** Factors influencing software development (SD) and information system (IS) development in practice.

Factor	Definition	Source	Evidence from the data
Management commitment by the customer	Top management commitment is needed to allocate needed resources and funding to improve software quality.	[9]	Top management of the case company was committed to participate to improve the system quality.
Customer participation to the development phases	Impact and influence of the customer varies in scope during the SD phases.	[10]	Participation occurred in the requirements, technical specification and testing phases.
Customer's lack of experience	Customers lack of experience in processes and project management will affect the quality of participation.	[5]	Customer's lack of experience in managing the projects delayed the project schedule as they were not aware of their duties and development process.
IT staff of the customers was absent	The customer representatives who were present did not know the needs of the development.	[1]	Absence of IT staff lead to changes that were introduced by the customer IT staff in the late stages of the project.
Customer dominance over the supplier	Power asymmetry in customer-supplier relationship	[22]	Power asymmetry affected the participation negatively as supplier was bind to agree upon all customers requests. Supplier was afraid of losing business.
Continuous need for the changes introduced by the customer	Customers' constant demands for changes due to business changes causes turbulence	[19], [20], [7], [8], [21]	Demand for changes from customers was leading to decreased interest on supplier side for customer participation.
Communication and knowledge transfer	Communications and knowledge transfer are language barrier, incompatible terminology, and insufficient domain knowledge.	[12], [16], [6], [13], [15], [17]	Language difficulties and incompatible terminology were discovered.
Time for development	Time constraint affects customer participation.	[11], [1]	The customer did not allocate time for the development, and that caused time schedule problems.
Financial resources available	Customer participation increases the project budget.	[11], [1]	None of the projects had allocated money for the customer participation.
Project complexity	Complex projects need for customer participation.	[11]	For the complex projects customer participation was mandatory.
Degree of complexity in the technology	Customer is able to understand the technology.	[1]	Customers were not comfortable with the design tools.

In the context of software and IS development we introduce our research question “*What factors influence to software development and IS development in practice?*” The question is based on the past studies and the data we collected from the software supplier.

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4 Research findings and analysis

At the data categorisation stage, the factors were divided according to the four interviewees each representing a different department (dep. 1-4) inside the software supplier company (see Table 3).

Table 3. The factors influencing software and IS development in practice.

Factor	Interviewee 1 (dep. 1)	Interviewee 2 (dep. 2)	Interviewee 3 (dep. 3)	Interviewee 4 (dep. 4)	Total number
F1: Management commitment by the customer	1	3	4	3	11
F2: Customer participation to the development phases	6	6	15	5	32
F3: Customer's lack of experience	0	2	3	1	6
F4: IT staff the customers was absent	0	0	5	0	5
F5: Customer dominance over the supplier	2	1	3	3	9
F6: Continuous need for the changes introduced by the customer	3	0	1	2	5
F7: Communication and knowledge transfer	4	4	2	3	13
F8: Time for development	0	0	3	6	9
F9: Financial resources available	2	0	2	3	7
F10: Project complexity	0	0	0	3	3

The four interviewees in the case software company had each participated in different projects, and each of them presented a different department. Each of the interviewee's business unit offered large projects for the forest industry in the Nordic area of Scandinavia and Finland, such as SAP projects, product services, order handling information systems, etc. The final end users of the systems from the customer side cover over 4000 people. The projects worked in separate teams in the same software company, each of which was independent from each other. The teams are called customer service desks.

We wanted to study if the interviewees differ by the factors they use. The chi-square statistics was applied for testing their independence with respect of distribution of their factors. To get the factor distribution for each interviewee, the factor's occurrence count was divided by the total number of factors of each corresponding interviewee. Table 4 shows the p-values obtained. The results show that only the interviewees 1 and 2 were statistically dependent with the p value $p=0.04$, i.e., there is a slight evidence at the 95% confidence level interviewees 1 and 2 may use same

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factor distributions. However, the total number of factors for both of these interviewees is relative low considering the degree of freedom of the data (10). Hence the results should be taken with care but could show some dependency between the interviewees 1 and 2 in their use of factors.

Table 4. Chi-square statistics p-values for testing the independence of the interviewees based on their factor distributions.

	Interviewee 2	Interviewee 3	Interviewee 4
Interviewee 1	0.04	0.17	0.61
Interviewee 2		0.44	0.39
Interviewee 3			0.29

When looking the correlation coefficients between the interviewees based on their factor distributions we observed similar type of results than in Table 4, which also validates the results of chi-square test. The correlation results are given in the Table 5.

Table 5. Correlation coefficients between the interviewees counted on their factor distributions.

	Interviewee 2	Interviewee 3	Interviewee 4
Interviewee 1	0.74	0.61	0.37
Interviewee 2		0.73	0.32
Interviewee 3			0.33

We then examined the correlations between the factors based on their normalised counts we got the following correlation matrix shown in Table 6. A positive correlation means that as the value of one variable decreases, the other variable also decreases and vice versa; in statistics value 1 represents a perfect positive correlation while -1 indicates a perfect negative one and 0 corresponds to no correlation. The highest positive (>0.9) and negative (<-0.9) correlations were colored as red (bold) and blue (underlined), respectively. Note that the matrix is symmetrical. It can be observed that all the other factors except factor 4 (4= IT staff of the customers was absent) had either negative or positive correlations between the other factors. Factor 3 (3= customer's lack of experience) has the highest number of the positive/negative correlations between the other factors (1, 5, 6, and 9, in other words 1= management commitment by the customer, 5= customer dominance over the supplier, 6= continuous need for changes introduced by the customer, and 9= financial resources available). Factors 8, 10 and 11 (8= time for development, 10= project complexity, and 11= degree of complexity in the technology) have positive correlations. However, it should be noticed that when working with rather small number of occurrences the results should be taken as an insight about the real situation.

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Table 6. Correlation coefficients between the normalised factor counts.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11
Factor 1		0.30	0.94	-0.12	-0.89	-0.83	0.34	-0.22	<u>-0.93</u>	-0.16	-0.24
Factor 2	0.30		0.48	0.42	-0.49	-0.20	0.32	-0.87	-0.58	<u>-0.98</u>	-0.63
Factor 3	0.94	0.48		0.21	<u>-0.99</u>	<u>-0.92</u>	0.14	-0.25	<u>-0.99</u>	-0.32	-0.15
Factor 4	-0.12	0.42	0.21		-0.35	-0.35	-0.72	0.06	-0.19	-0.33	0.42
Factor 5	-0.89	-0.49	<u>-0.99</u>	-0.35		0.94	-0.00	0.20	0.97	0.32	0.05
Factor 6	-0.83	-0.20	-0.92	-0.35	0.94		0.23	-0.14	0.86	0.00	-0.26
Factor 7	0.34	0.32	0.14	-0.72	-0.00	0.23		-0.72	-0.23	-0.40	<u>-0.92</u>
Factor 8	-0.22	-0.87	-0.25	0.06	0.20	-0.14	-0.72		0.37	0.92	0.93
Factor 9	<u>-0.93</u>	-0.58	<u>-0.99</u>	-0.19	0.97	0.86	-0.23	0.37		0.43	0.27
Factor 10	-0.16	<u>-0.98</u>	-0.32	-0.33	0.32	0.00	-0.40	0.92	0.43		0.71
Factor 11	-0.24	-0.63	-0.15	0.42	0.05	-0.26	<u>-0.92</u>	0.93	0.27	0.71	

5 Conclusions and discussion

Our research focused exclusively on factors on software and IS development when both the customer and supplier are participating in the development process. Based on the empirical data of the software and IS development projects eleven factors were discovered to affect to the development. We discovered both positive and negative correlations between the factors, which mean that different factors were related with each other. We also found out that interviewees used different factors.

Each of the four interviewees in the study presented a different department inside the software supplier organisation, and our analysis showed that there was a dependency between the interviewer one and two in their use of factors. Furthermore, the department one and two used similar factors. Departments three and four (interviewees three and four) used different factors than one and two. The conclusion is that the interviewees differed by the factors they use. The only mutual factor that was mentioned by all the interviewees was that in the development phases the requirements should be very clear.

Our analysis showed the highest positive correlations between the following factors: management commitment by the customer and customer's lack of experience; customer dominance over the supplier and continuous need for changes introduced by the customer; customer dominance over the supplier and financial resources available; time for development and project complexity; and time for development and degree of complexity in the technology.

The highest negative correlations were between the following factors: customer's lack of experience and customer dominance over supplier; customer's lack of experience and continuous need for changes introduced by the customer; customer's

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lack of experience and financial resources available; customer participation to the development phases and project complexity, and management commitment by the customer and financial resources available.

Time for development, project complexity, and degree of complexity in the technology had positive correlation. However, it should be noticed that when working with rather small number of occurrences the results should be taken as an insight about the real situation.

In summary, other factors except IT staff of the customers was absent had either negative or positive correlations between the other factors. Customer's lack of experience had the highest number of the positive/negative correlations between the factors of management commitment by the customer, customer dominance over the supplier, continuous need for changes introduced by the customer, and financial resources available.

This study has given more explanation of the phenomena for academics and for practitioners as it has advised about the possible difficulties that a supplier organisation can expect when developing systems with their customers. The knowledge of English of customer varied a lot. In some situations the customer was not able to clarify the development team's questions of the requirements because of the language barrier and, consequently, the development team was left without accurate interpretation of the requirements. This was found a common problem in the development of complex systems in a multi-national context. In the studied software supplier organisation it was the management's policy to have customer participating in their software and IS development projects, and it was a part of their software project activities and was more a norm than exception. Difficulties were caused also by insufficient commitment from customer's IT staff, lack of time for participation from customer's team, and inexperience of customer's project team in participation and project activities. Therefore this case study has added more dimensions to factors influencing development.

Limited application domain knowledge was found out as an important factor affecting development. The limitations in the customer side were caused by their business needs and the goals were one of the reasons for having deficient application domain knowledge. The application domain knowledge was unobtainable by the development team which eventually results in customer dissatisfaction as the development team can not address the customer's real need. Limited access to domain knowledge as such is a very understandable constraint and can be caused by, for example, confidentiality issues in business or the nature of customer's business. The issue of change management exerted influence on the final outcome of the development process. In spite of having customer representatives involved in the project it was observed that changes were often introduced in the late phases of the project. Though customers were active during requirements and specification phase problems arose in the implementation phase. Customers did not spend enough time with specification documents which introduced changes in the software only after the implementation was done or when the code being written.

In our study we found out that unobtainable knowledge of customer's business and knowledge transfer difficulties lead to insufficient requirements and lack information on customer's business needs. Changes introduced during the project results in poor quality and delays in the project. Customer dominance also introduced changes as the

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development team often cannot refuse the customer's requests. By influencing the way software is developed, the customer was dominating and dictating the development processes and it is questionable how beneficial this was to the customer.

We noticed that the system developers did not have the knowledge of the application domain terms, and at the same time the customers did not have the all the needed technical knowledge due to their different backgrounds. Incompatible terminology caused requirements misunderstandings and lead to the development of software that did not meet the customer's expectations.

The results showed that when changes are introduced in the projects all the time they cause both the quality and schedule problems. As customer cannot influence the development team during implementation it was only after the implementation that they started introducing changes by saying that "this is not what we want". Reasons for changes might vary from customer's lack of time to customer's lack of experience in development and project works but the affect of such changes have always been problems with quality, schedule and budget. Although all tailored made projects were developed with the cooperation of customers, projects encounter customer- related obstacles prior to operation and use.

A customer also delayed the projects with their way of working by not performing their work on time and in schedule. The customer did not necessarily realize the importance of working in similar terms with the supplier. The projects tended to get delayed if responsibilities were not fulfilled within the schedule. The changes were sometimes introduced by the customer in a phase which has already been completed. By dictating the development process the control lied with the customer and this lead to delayed and poor quality projects, because the supplier had to wait for the customer feedback on every step and work with methods and practices that it may not be accustomed to. One of the important factors was the customer's lack of experience in managing the software projects, and this caused unnecessary turbulence in the projects and delayed the project schedule. The customers usually delayed the acceptance phase of the developed software product. Also the factor that IT staff of the customers was absent in the development groups lead to changes that were introduced by the customer IT staff in the late stages of the project. The other form of customer dominance is business induced power asymmetry with which we refer to the supplier's fear of losing business. We found in many occasions that a project team accepted customer demands as such because they were afraid of losing the customer. It was also observed in our study that accepting customer demands can cause delays and low quality outcomes.

The practical implication of this research would be significant for project managers of tailored software projects. The results enable project managers to forecast the factors influencing development in projects. By knowing such factors, one can be better prepared for their appearance and create strategies for overcoming them. For the researchers our study provides also evidence of the importance of customer and software supplier relationship. In particular our data provides evidence of the negative effect a customer can have on a software project through dominance. These indications are still in pre stage, and thus further work is needed. Future study can concentrate on comparing these issues in other kinds of software organisations. To saturate fully these findings, one can include observations for example from a

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subcontractor, a software product development company, and an end-user software developer organisation.

This study explained what factors influence on software and IS development in practice. However, like any other study this study also have its limitations. One of the limitations is that all the results are from one organisation and they may not applicable to the other organisations.

Other limitation is that the studied organisation does not have any specified participatory model but customer participation is merged with their processes. All the four studied departments in the software supplier organisation were developing tailored software and therefore similar kind of observations can be expected primarily in tailored development. Product-oriented development may have its specific issues, but it is possible that many of the issues mentioned here are common. One major limitation is that this study has the supplier viewpoint only. Though we tried to get the customer viewpoint it was not possible due to the restrictions that we had from the supplier organisations who were the participants in the study. The customer and supplier side participants views may differ a lot from each other, and the research findings could be very different from each other [33].

References

1. Keil, M., Cule, P.E., Lyytinen, K., Schmidt, R.C.: A Framework Identifying Software Project Risks. *Communications of the ACM* 41 (11), pp. 76-83 (1998)
2. Wallace, L., Keil, M.: Software Project Risks and their Effect on Outcomes. *Communications of the ACM* 47(4), pp. 68-73 (2004)
3. Johnson, J.: Turning Chaos into Success. *Software Magazine* 19(3), pp. 30-39 (1999)
4. Boehm, B.: Get ready for agile methods, with care. *Computer* 35 (1), pp. 64-69 (2002)
5. Pasi, A., Smolander, K., Nikula, U.: Customer-Supplier Issues in Software Development. *Proceedings of the 16th European Conference on Information Systems (ECIS'2008)*, Galway, Ireland 9-11 June, pp. 1-10 (2008)
6. Boehm, B.: Software engineering is a value-based contact sport. *IEEE Software* 19(5), pp. 85-96 (2002)
7. Boehm, B.W., Ross, R.: Theory-W software project management principles and examples. *IEEE Transactions on Software Engineering* 15(7), pp. 902-916 (1989)
8. Powell, A.L.: A literature review on the quantification of software change. Department of Computer Science, University of York, Heslington (1996)
9. Butler, T., Fitzgerald, B.: The relationship between user participation and the management of change surrounding the development of information systems: a European perspective. *Journal of End User Computing* 13(1), pp. 12-25 (2001)
10. McKeen, J.D., Guimaraes, T.: Successful strategies for user participation in systems development. *Management Information Systems* 14(2), pp. 133-150 (1997)
11. Winston, T. and Benjamin, B.M.: The relationship between user participation and system success: a simultaneous contingency approach. *Information & Management* 37(6), pp. 283-295 (2000)
12. Wanga, P. Tongb, T.W., Koh, C.P.: An integrated model of knowledge transfer from MNC parent to China subsidiary. *Journal of World Business* 39, pp. 168-182 (2003)
13. Rus, I., Lindvall, M.: Knowledge management in software engineering. *Software IEEE* 19(3), pp. 26-38 (2002)

What factors influence to software and IS development in practice: a case study based on software supplier experiences 13

14. Holtzblatt, K., Beyer, H.R.: Requirements Engineering: the human factor. *Communications of the ACM* 38(5), pp. 31-32 (1995)
15. Tiwana, A.: An empirical study of the effect of knowledge integration on software development performance. *Information and Software Technology* 46(17), pp. 899-906 (2004)
16. Hanssen, G.K., Faegri, T.E.: Agile Customer Engagement: A Longitudinal Qualitative Case Study. *Proceedings of the 2006 ACM/IEEE international symposium on empirical software engineering ISESE '06*. Rio de Janeiro: ACM Press, pp. 164-173 (2006)
17. Stiller, E., Leblanc, C.: *Project-based software engineering*. Addison-Wesley (2002)
18. Feely, A.J., Harzing, A-W.: Language Management in Multinational Companies. *Cross Cultural Management: An International Journal* 10(2), pp. 37-52 (2003)
19. Manhart, P., Schneider, K.: Breaking the ice for agile development embedded software: an industry experience report. *Proceedings of the 26th International Conference on Software Engineering, ICSE 2004*, pp. 378-386 (2004)
20. Ramzan, S., Ikram, N.: Making Decision in Requirement Change Management. *First International Conference on Information and Communication Technologies ICICT, Pakistan, August 27-28*, pp. 309-312 (2005)
21. Wiegers, K.E.: *Software Requirements*. Microsoft Press (2003)
22. Heinbokel, T., Sonnentag, S., Frese, M., Stolte, W., Brodbeck, F.C.: Don't underestimate the problems of user centredness in software development projects- there are many! *Behaviour and Information Technology* 15(4), pp. 226-236 (1996)
23. Seaman, C.B.: Qualitative methods in empirical studies of software engineering. *IEEE Transactions on Software Engineering* 25(4), pp. 557-572 (1999)
24. Wasson, K.S.: Requirements metrics: Scaling up. *Proceedings of the 2nd International Workshop on Comparative Evaluation in Requirements Engineering (CERE '04)*, Kyoto, Japan, pp. 51-55 (2004)
25. Yin, R.K.: *Case study research: design and methods*. Sage Publications (2003)
26. Ives, B., Olson, M.H.: User involvement and MIS success. *Management Science* 30 (5), pp. 586-603 (1984)
27. Barki, H., Hartwick, J.: Measuring User Participation, User Involvement, and User Attitude. *MIS Quarterly* 18 (1), pp. 59-82 (1994)
28. Benbasat, I., Goldstein, D.K., Mead, M.: The case study research strategy in studies of information systems. *MIS Quarterly* 11(3), pp. 369-386 (1987)
29. Cavaye, A.L.M.: User participation in systems development revisited. *Information & Management* 28 (5), pp. 311-323 (1995)
30. Ives, B., Olson, M.H.: User involvement and MIS success. *Management Science* 30 (5), pp. 586-603 (1984)
31. Glaser, B. G., Strauss, A. L.: *The discovery of grounded theory: strategies for qualitative research*. Aldine De Gruyter (1967)
32. Strauss, A. L., Corbin, J.: *Basics of Qualitative Research: Grounded Theory Procedures and Applications*. Sage Publications (1990)
33. Foster, S.T., Franz, C.R.: User Involvement during Information Systems Development: A Comparison of Analyst and User Perceptions of System Acceptance. *Journal of Engineering Technology Management*, 16, pp. 329-348 (1999)

Analysing IT-crimes by Applying Criminological Theories

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Abstract

While the emergence of the World Wide Web has enabled unprecedented access to information, it has also created unprecedented opportunities to attack information assets. Scientific study in this research area is scarce and further studies are required.

The purpose of my literature review is to answer to following questions:

RQ1: Which criminological theories have been used in IT-crime?

RQ2: What are the implications for future research?

The systematic literature review -approach introduced by Kitchenham et al. guides for this study. Conceptual analysis was used as a method. The findings of my literature review are following:

A1: All modern and established criminological theories have been applied in analysing IT-crimes. Approximately 40 articles fit into this category.

A2: There is a need for further studies on this subject because the current research is scarce. The articles are presented in chronological order.

Keywords: computer crime(s), computer abuse, cyber crime, criminological theories

1. Introduction

While the emergence of World Wide Web has enabled unprecedented access to information, it has also created unprecedented opportunities to attack information assets. (Galbreth and Shor 2010). Scientific study in this research area is scarce and further studies are required. Criminological theories have not been used to their full potential in explaining IT-crimes.

My literature review aims to fill the gap in the current research; is there a (systematic) literature review where IT-crimes have been analysed by applying all criminological theories. The purpose of my literature review is to contribute to science by giving a wide and comprehensive overview of the subject: Analysing IT-crimes by applying criminological theories. My literature review aims to answer to following questions:

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RQ1: Which criminological theories have been used in IT-crime?

RQ2: What are the implications for future research?

The systematic literature review- approach introduced by Kitchenham et al. (2009) guides for this study. Conceptual analysis has been used as a method.

We shall show that:

A1: All modern and established criminological theories have been applied in analysing IT-crimes. Approximately 40 articles fit into this category. The popularity of theory is given by number of occurrence in scientific publications. General deterrence theory has been the dominant criminological theory in explaining IT-crimes.

A2: There is a need for further studies on this subject because the current research is scarce. The articles are presented in chronological order.

In comparison with the best literature review conducted by Siponen and Vance (2010) my literature review is the most comprehensive on this subject because it comprises all criminological theories and the major types of IT-crimes.

The paper is divided into following sections: Section 1 Introduction. Section 2 Conducting the review describes the process. Section 3 Reporting the review presents the articles in chronological order. Section 4 Conclusion and Discussion describes the outcome of this literature review, implications for research, limitations for this study, and proposals for future research.

2. Conducting the review

The literature review was conducted according to the guidelines presented by Kitchenham et al. (2009) consisting of following steps: Defining the research question, conducting the search process, defining the inclusion and exclusion criteria, performing the data collection and performing data analysis. Conceptual analysis was used as a method.

Research question

The purpose of this literature review is to find out the answers to following questions related to the subject: Analysing IT-crimes by applying criminological theories

RQ 1: Which criminological theories have been used in IT-crime?

RQ 2: What are the implications for future research?

Search process

The aim of my literature review was to find as many primary studies relating the research question as possible. To achieve this aim, the following process was conducted to determine the source of material for the review. First, IS journals were explored through the aid of databases (ACM Digital Library, EBSCO, Elsevier Science Direct, Emerald Library, Jstor) and also scanning the journals' tables of contents. In addition, conference proceedings were examined directly. Multidisciplinary research approach makes literature review a very challenging task.

Following concepts were used as "search words" in this study: computer crime, computer abuse, computer misuse, cyber crime, Internet crime

and

Criminological theories: general deterrence theory, neutralisation theory (neutralisation techniques), social learning theory, social bonding theory, control theory, rational choice theory, routine activity theory, situational crime prevention (SCP), anomie theory, differential association, environmental criminology, lifestyle theory

Inclusion and exclusion criteria

All articles where IT-crimes have been analysed by applying criminological theories were included in this literature review. Duplicate reports of the same study (when several reports of a study exist in different journals the most complete version of the study was included in the review).

Data collection

The data extracted from each study were:

The source (journal or conference) and full reference

Main topic area

Which criminological theory was used

The author(s)

Summary of the study including the main research questions and the answers

Data analysis

The results were reported in chronological order. The popularity of the theory was given by number of occurrence in scientific publications.

3. Reporting the review

The findings of my literature review are following:

A1: All modern and established criminological theories have been applied in analysing IT-crimes. Approximately 40 articles fit into this category.

A2: There is need for further studies on this subject because the current research is scarce. The articles are presented in chronological order because this is an emergent research area.

Table 1 Analysing IT-crimes by applying criminological theories by author/year

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Straub	1990 Deterrence theory
Straub et al.	1993 Deterrence theory
Sherizen	1995 Neutralisation theory
Harrington	1996 Deterrence theory
Gopal and Sanders	1997 Deterrence theory
Skinner and Fream	1997 Social learning theory, Differential association
Straub and Welke	1998 Deterrence theory
Willison	2000 Situational crime prevention.
Grabosky	2000 Routine activity theory
Lee and Lee	2002 Deterrence theory, Social bonding theory, Social learning theory
Lim	2002 Neutralisation theory
Smith and Rupp	2002 Social learning theory
Higgins et al.	2003 Deterrence theory
Kankanhalli et al.	2003 Deterrence theory
Mirchandani and Motwani	2003 Deterrence theory
Peace et al.	2003 Deterrence theory
Higgins and Makin	2004 Control theory, Social learning theory
Lee et al.	2004 Deterrence theory, Social control theory
Beebe and Rao	2005 Situational crime prevention
Higgins	2005 Control theory, Social learning theory
Jones	2005 Situational crime prevention
Smith	2005 Anomie theory
Theoharidou et al.	2005 Deterrence theory, Social bonding theory, Social learning theory, SCP
Wiant	2005 Deterrence theory
Yar	2005 Neutralisation theory, Differential association
Willison and Backhouse	2006 Situational crime prevention, Rational choice theory, Environmental criminology, Routine activity theory, Lifestyle theory
Willison	2006 Rational choice theory, Situational crime prevention
Willison	2006 Routine activity theory, Environmental criminology, Rat.choice theory
Hinduja	2007 Neutralisation theory
Higgins et al.	2007 Social learning theory, Control theory
Pahnila et al.	2007 Deterrence theory
Siponen et al.	2007 Deterrence theory
Workman and Gathegi	2007 Deterrence theory
Chen et al.	2008 Control theory
Willison and Siponen	2008 Neutralisation theory, Differential association
D'Arcy et al.	2009 Deterrence theory
D'Arcy and Hovav	2009 Deterrence theory
Herath and Rao	2009 Deterrence theory
Higgins et al.	2009 Social learning theory
Liao et al.	2009 Deterrence theory
Willison and Siponen	2009 Situational crime prevention
Li et al.	2010 Situational crime prevention
Morris and Higgins	2010 Social learning theory
Siponen and Vance	2010 Neutralisation theory, Deterrence theory

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The findings of this literature review are presented in chronological order. The purpose of this report is to give answer to RQ1: Which criminological theories have been used in IT-crime? A1: All established and modern criminological theories have been applied in analysing IT-crimes.

Straub (1990) has investigated whether management decisions to invest in IS security result in more effective control of computer abuse. This study is based on the criminological theory of general deterrence theory. Data gathered through a survey of 1211 randomly selected organisations indicates that security countermeasures that include deterrent administrative procedures and preventive security software will result in significantly lower computer abuse. Knowledge about these relationship is useful for making key decisions about security function.

According to Straub et al. (1993) classroom cheating has been the subject of numerous studies, but controlling cheating on assignments outside the classroom has not often been addressed. The applied criminological theory is general deterrence theory. This paper presents the results of a field experiment designed to test how student cheating on computer programming assignments can be deterred. The results suggest that instructors who engage in efforts to detect student cheating on unsupervised homework assignments. The study also finds that there may be effective ways to detect student cheating prior to labour intensive methods like source code to source code comparison.

Sherizen (1995) argues that deterrence is an essential element in the control of criminal behaviours. This paper focuses on computer crimes. Some employees legitimise or neutralise their crimes e.g., by using the five major types of neutralisation suggested by Sykes and Matza (1957). Sherizen (1995) also points out that it is important that the information security community, working with legislations and prosecutors, determine effective deterrent measures that can protect information.

Harrington (1996) studied the effect of codes of ethics on computer abuse judgements and intentions on information systems (IS) employees (n=219). Codes of ethics examined include both company codes of ethics and those written specifically to deal with IS issues. Unlike company codes, IS-specific codes of ethics had direct effect on computer sabotage judgement and intentions, but had no differential effect on those high in responsibility denial. General deterrence theory, which has effectively guided this study, suggests that one reason for the sporadic effect of codes may be the perception that there is low probability of being caught.

According to Gopal and Sanders (1997) software publishers have employed a number of preventive and deterrent controls to counter software piracy in an attempt to protect the intellectual property. Gopal and Sanders (1997) have developed an analytical model to test the implications of antipiracy measures on publishers profits. The purpose of this model is to determine the effect of software protection strategies on software piracy and firm performance. The results suggest that preventive controls decrease profits and deterrent controls potentially increase profits. Empirical results (n=130) also support the proposition on the impact of deterrent controls.

Skinner and Fream (1997) have analysed computer crime among students by applying social learning theory (n=581). The multivariate analysis showed strong support for social learning theory as a conceptual framework for understanding computer crime in general.

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Straub and Welke (1998) have conducted study on system risks. Results of comparative qualitative studies in two information services Fortune 500 firms identify an approach that can effectively deal with the problem. The theory-based security program includes (1) use of a security risk planning model, (2) education/training in security awareness, and (3) countermeasure matrix analysis.

Criminologist Grabosky (2000) has applied routine activity theory in explaining IT-crimes.

In this paper Willison (2000) examines the criminal opportunity within an IS context and the threat posed by dishonest staff. The author argues that the approach taken by SCP in terms of addressing opportunity distinguishes not only from the majority of other criminological approaches, but also other IS security approaches. Developing opportunity structures for specific computer crimes allows for an appreciation of how IS security and the areas it addresses interact and better preventive programmes can be created.

Lee and Lee (2002) have developed a new model to analyse computer abuse. The new model covers social criminology theories, social bond theory (Hirschi 1969) and social learning theory (Akers 1985, 1997). Lee and Lee (2002) propose that social bond factors, social learning factors, and general deterrence factors can affect attitude, subjective norms, and perceived behavioural controls respectively.

According to Lim (2002) the advent of technology has also opened up new avenues and opportunities for individuals for misbehave. Using the theoretical frameworks offered by social exchange, organisational justice and neutralisation, Lim (2002) examined the often neglected dark side of the Internet and the role that neutralisation techniques play in facilitating this misbehaviour at the workplace. The findings of this study (n=188) suggest that when organisations are unjust in their treatment of employees, these employees are more likely to invoke the neutralisation technique to legitimize their subsequent engagement in the act of cyberloafing.

Smith and Rupp (2002) have explored the fairly recent but well socially established phenomena of computer crime, that is, hacking/cracking. More subgroups for hackers need to be developed and defined before a better understanding of this criminal activity and behaviour can be defined. Social learning theory gets confirmation in analysing hacking. According to social learning theory, criminal behaviour is acquired through observational learning. The learning takes place in three contexts, the family, subculture and social environment.

Higgins et al. (2003) have studied software piracy. According to the authors research on software piracy is growing, but criminologists have not examined the role of deterrence in software piracy. The study examined the role of deterrence in reducing instances of software piracy using a factorial design. The findings from the analysis (n= 318) showed that certainty and not severity was important in reducing software piracy. Policy implications of these findings for three specific areas a) law enforcement b) legislative, and c) organisational are discussed.

Kankanhalli et al. (2003) have conducted a study of information systems security effectiveness. On basis of the current literature on security practices and organisational factors, the authors developed an integrative model of IS security effectiveness. The model was tested empirically. The findings of this study were following. By simultaneously testing relationship between organisational factors and security measures, and relationships between security measures and IS security

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effectiveness, this study assesses the adequacy and usefulness of security measures undertaken by different types of organisations and offers suggestions how organisations may improve their IS security effectiveness.

Mirchandani and Motwani (2003) have analysed Internet abuse at the workplace by applying the criminological theory general deterrence theory (GDT). The empirical research confirms that companies do indeed use deterrent and remedial techniques to counter Internet abuse. General deterrence theory can be applied to Internet abuse though its predictions are not entirely supported.

Peace et al. (2003) developed a model to analyse software piracy conducted by individuals in the workplace. The model was developed from the results of prior research into software piracy and the reference disciplines of the theory of planned behaviour, expected utility theory and deterrence theory. The results (n= 201) indicate that individual attitudes, subjective norms and perceived behavioural control are significant precursors to the intention to illegally copy software.

According to Higgins and Makin (2004) it is still not clear whether low self-control has an effect on software piracy and if social learning theory can condition the effect that low self-control has on college students' software piracy. Using data collected from 318 students, this study examines the effect that low self-control has on software piracy and whether social learning measures condition this effect. The results show that low self-control does have an effect on software piracy and that social learning theory measures condition this effect.

Lee et al. (2004) have developed an integrative model for analysing computer abuse by combining general deterrence theory (GDT) and social control theory (SCT). This study integrated GDT and SCT into the existing theory of planned behaviour (TPB) and assessed a degree to which the integrated model explained computer abuse. The results of the empirical survey (Korea) show that the factors of social control theory aimed at preventing insider computer abuse. The enhancement of social bonds through organisational trust was another mechanism that could help in preventing computer abuse in organisations.

Beebe and Rao (2005) have conducted conceptual analysis on electronic crime. The authors suggest that situational crime prevention theory (SCP) may offer new insights into improving IS security effectiveness by reducing the criminal's anticipated rewards from the crime.

According to Higgins (2005) computer crime, specifically software piracy is growing and no research in criminology examines whether low self-control can help us understand the behaviour. The non-random sample consisted of college students. Low self-control, software pirating peers, software pirating attitudes, and moral beliefs towards software piracy were measured. The findings show that low self-control has a link with software piracy. Results also suggest that social learning theory is an important theory in explaining piracy.

In his article Jones (2005) outlines some of the main types of file-sharing systems and summarises survey findings relating to file-sharing use. Three related theoretical models of compliance seeking through the use of technology are discussed, namely Lessig's (involving 'code' and 'architecture'), Bottoms' (involving 'constraint-based compliance') and Clarke and others' work on 'situational crime prevention' and each is then applied to the specific topic of illegal and legal distribution of music and films on the Internet.

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Smith (2005) has analysed employee fraud committed through the use of EDI systems by applying anomie theory. Smith (2005) argues on the basis of anomie theory that some employees might attempt to commit fraud through the use of an EDI system because of their inability to accomplish success in a moral and legal way. Many of the needed accounting and security controls are not present in more traditional non-EDI business transactional systems, and internal auditing practices may need to be changed to ensure a controlled EDI system.

Theoharidou et al. (2005) have investigated the insider threat and the effectiveness of ISO17799. The authors unfold general deterrence theory and explore the possible enhancements to the standard that could result from the study of more recent criminology theories, social bond theory, social learning theory, theory of planned behaviour and situational crime prevention. The authors came into the conclusion by analysing ISO17799 that it follows the general deterrence theory. Consequently this theory emphasises on measures such as posing sanctions, reinforcing access control, and implementing training and awareness programmes.

Wiant (2005) writes in his article that in USA it is illegal for healthcare providers and insurers to release a patient's medical records without the individuals consents. The purpose of the study was to gather information about the reporting of computer abuse incidents and their seriousness level to determine if an information security policy is effective in influencing the reporting of each (n=2500). The underlying theory was general deterrence theory. The outcome of the study was following: Data analysis found support for the deterrence theory hypothesis.

Yar (2005) concentrates in his article on hacking. The criminological perspective was chosen. Analyst stress that crime and delinquency are situated in the context of social group membership: the groups to which "delinquent" individuals belong will have distinctive shared beliefs, attitudes and values, and it is distinctive "subculture" that both licences and rewards behaviour that may be at odds with mainstream social norms and rules. Similarly, differential association theory views crime and delinquency as socially learned behaviour. Through association with others, individuals will learn not only the techniques for carrying out crimes, but also the attitudes and values that support such behaviour. (Sutherland and Cressey 1974).

Willison and Backhouse (2006) offer a new perspective to the current discussion on IS security; the offender perspective. If the systems risk entails the likelihood that an IS is inadequately protected, this article considers those conditions, within the organisational context, which offer a criminal opportunity for the offender. The authors present a Crime Specific Opportunity model to tackle the problem. The model comprises of following criminological theories; situational crime prevention, rational choice perspective, environmental criminology, routine activity theory, lifestyle theory.

Willison (2006) has been studying the offender/environment dynamic among employers who commit computer crimes. There is a lack of insight into how the offender interacts with the criminal context both prior to and during commission. The theory testing case study was conducted by applying routine activity theory, environmental criminology and the rational choice perspective which focus on the criminal act. The conclusion of this study is that environmental criminology and rational choice perspective are suitable for explaining the case Barings Bank.

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According to Willison (2006) the problem posed by employee computer crime should not be underestimated. There has been a lack of insight into the relationship between offender and the context, during the commission process. To address this deficiency, two criminological theories are advanced. This paper illustrates how the theories, entitled the Rational Choice Perspective and Situational Crime Prevention, can be applied to the IS domain, thereby offering a theoretical basis by which to analyse the offender/context relationship during perpetration.

Higgins et al. (2007) have studied whether social learning theory conditioned the link between low-self control and movie piracy. Using cross-sectional data from college students (n=338), the findings revealed that the link between low self-control and movie piracy is exacerbated by substantial association with movie-pirating peers and positive attitudes toward software piracy. The results of this show that low self-control, associating with deviant peers, previous movie piracy, and positive definitions have important relative impacts on movie pirating likelihood among college students.

Hinduja (2007) has analysed online software piracy by applying neutralisation theory. The empirical study was conducted in USA. Neutralisation was found to be weakly related to experience with online software piracy; other elements are suggested and discussed.

Pahnila et al. (2007) have studied IS security policy compliance among employees. This study proposes a theoretical model that contains the factors that explain employees' IS security compliance. The theoretical model for the study combines General Deterrence Theory, Protection Motivation Theory, The Theory of Reasoned Action, Information Systems Success, and Triandis' Behavioral Framework and Rewards. Data (n=245) from a Finnish company provide empirical support for this model.

Siponen et al. (2007) have developed a model to explain employees' adherence to information security policies. In this model, they extend the Protection Motivation Theory (PMT) by integrating the General Deterrence Theory (GDT) and the Theory of Reasoned Action (TRA) with PMT. Results from empirical study (n=917) show that threat appraisal, self-efficacy and response efficacy have a significant impact on intention to comply with information security policies. The findings also show that sanctions have a significant impact on actual compliance with information security policies.

Drawing from deterrence theory and using the theory of planned behaviour as a general framework, Workman and Gathegi (2007) have conducted empirical field study to investigate the effects of punishment and ethics training on behaviour related to contravention of IS security measures. The results show that both punishment and ethics training can be effective in mitigating the threat of software and information security, but that these depend on certain underlying motivational factors of individuals.

Chen et al. (2008) have studied Internet abuse and addiction at the workplace. This paper seeks to synthesize theories from communication, psychology and criminology to examine the factors that influence the two most popular topics in industry. The results of the study (n=277) show that personality factors such as locus of control and self-esteem significantly influence employees' Internet addictions and Internet addiction significantly impacts employees' Internet abuse at the workplace.

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Willison and Siponen (2008) have studied software piracy. This paper presents a novel theoretical model which consists of two criminological theories, techniques of neutralisation and differential association theory. Neutralisation techniques help to explain how individuals are able to rationalise their criminal behaviour in a manner which absolves them of pressures from social norms and internal controls such as feelings of guilt and shame. Differential association theory explains how criminology is developed through a learning process which usually takes place in personal groups. The authors write that empirical research is needed to test the model further.

D'Arcy et al. (2009) present an extended deterrence theory model that combines work from criminology, social psychology and information systems. The model posits that user awareness of security countermeasures directly influences the perceived certainty and severity of organisational sanctions associated with IS misuse, which leads to reduces IS misuse intention. The model was empirically tested (n=269) and the results show that perceived severity of sanctions is more effective in reducing IS misuse than certainty of sanctions.

D'Arcy and Hovav (2009) argue that research from the fields of criminology and social psychology suggests that the deterrent effect of security countermeasures is not uniform across individuals. In this study D'Arcy and Hovav (2009) examine whether certain individual characteristics or work arrangement moderate the influence of security policies, security education, training, and awareness (SETA) program in information systems misuse. The results suggest that individuals are less deterred by SETA programs and computer monitoring while these countermeasures are less influential on employees that spend more working days outside the office.

Herath and Rao (2009) have conducted study on compliance of computer security policies. According to Herath and Rao (2009) organisational, environmental and behavioural factors affect to the adoption of information security practices. The authors developed a model called Integrated Protection Motivation and Deterrence model to test security policy compliance. The purpose of this study is to evaluate the security compliance intentions of employees. The findings in this sample (n=312) suggest that the employees underestimate the probability of security breaches.

According to Higgins et. al (2009) digital piracy is increasing and additional research that uses new approaches is necessary. The present study explores actual digital piracy and intention to perform piracy using latent class analysis, develops profiles of these individuals, and provides an analysis of the differences between intentions and actual digital piracy. Social learning theory was applied. Policy implications are discussed from these findings (n=353).

Liao et al (2009) write that Internet misuse has raised increasing concern for organisations. The authors propose an integrated research model applying Theory of Planned Behavior, Deterrence Theory and Theory of Ethics to examine the impact of punishment related policy on employees' Internet misuse intentions. The results show that there is no support for the influence of punishment severity and punishment certainty.

Willison and Siponen (2009) argue that insider threat of employee computer crime is a severe problem. The authors suggest that SCP, Situational Crime Prevention can enhance information security practices. Willison and Siponen (2009) point out that there is a need to find out how the insider crimes are actually committed.

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SCP techniques will prove insights and tools for understanding and addressing this problem.

Li et al. (2010) have applied rational choice theory to examine how employees' intention to comply with Internet use policy is driven by cost-benefit assessments, personal norms and organisational context factors. The results indicate that employees' compliance intention is the result of competing influences of perceived benefits, formal sanctions, and security risks.

Morris and Higgins (2010) have explored the ability of Aker's social learning theory in explaining the likelihood of engaging in digital piracy (n=585). The findings were modestly supportive of social learning theory as it may apply to digital piracy. The findings are discussed in the context of existing theories of crime to account for contemporary technology driven crimes, such as digital piracy.

Siponen and Vance (2010) argue that employees' failure to comply with information systems security policies is a major concern for information security managers. In this article Siponen and Vance (2010) show that neutralisation theory provides a compelling explanation for IS security violations and offers new insights into how employees rationalize this behaviour.

The authors propose a theoretical model in which the effects of neutralization techniques are tested alongside those of sanctions described by deterrence theory.

4. Conclusion and Discussion

4.1 Findings of the study

The purpose of my study was to find out the answers to following questions:

RQ1: Which criminological theories have been used in IT-crime

RQ2: What are the implications for future research

The findings of my literature review are following:

A1: All modern and established criminological theories have been applied in analysing IT-crimes. Approximately 40 articles fit into this category.

A2: There is a need for further studies on this subject because the current research is scarce.

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Table 2 Popularity of Theory

Name of theory	Number of occurrence in scientific publications
Deterrence theory	21
Social learning theory	9
Situational crime prevention (SCP)	7
Neutralisation theory	6
Rational choice theory	4
Differential association	3
Routine activity theory	3
Social bonding theory	2
Environmental criminology	2
Lifestyle theory	1
Anomie theory	1
	59

Table 2 shows that deterrence theory has been the leading criminological theory in explaining IT-crimes. All modern and established criminological theories have been applied in analysing IT-crimes. The reasons for the need of further research are: the current research is scarce, and criminological theories have not been used to their full potential in explaining IT-crimes. Chronological order was chosen, because this is an emergent research area.

4.2 Implications for research

My literature review contributes to science by giving a wide and comprehensive overview of the subject: Analysing IT-crimes by applying criminological theories. In comparison with the best literature review conducted by Siponen and Vance (2010) my literature review is the most comprehensive on this subject because it comprises all criminological theories and the major types of IT-crimes. The literature review of Siponen and Vance (2010) was chosen because it is fresh (2010) and published in a high class journal (MIS Quarterly). Siponen and Vance (2010) have conducted a literature review on deterrence theory, neutralisation theory and security behaviour in IS.

The literature review by Siponen and Vance (2010) covered past literature on application of deterrence theory and neutralisation theory on analysing IT-crimes, and past literature on IS security behaviour (no criminological theories applied). My literature review covers all such literature where the major types of IT-crimes have been analysed by applying all modern and established criminological theories. Approximately 40 articles which fit into this category. Siponen and Vance (2010) have applied only 2 criminological theories, my literature review covers all established criminological theories.

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The findings of my study show that that criminological theories have not been used to their full potential in explaining IT-crimes. The current research is scarce. The results of this study show that criminological theories are important in explaining IT-crimes. General deterrence theory has been the dominant theory so far.

4.3 Limitations for this study

Multidisciplinary made this literature review very challenging because the databases and search words had to be selected very carefully and still the outcome was not always favourable. There were duplicates of the articles and some of the articles had to be searched manually, by reading journals and conference proceedings. Criminological theories could not be described in this study because the text cannot exceed 6000 words.

4.4 Proposals for future research

Further empirical study is required because the current research is scarce. Criminological theories have not been used to their full potential in explaining IT-crimes.

References

1. Akers R. L.: *Deviant Behavior: A Social Learning Approach*, Wadsworth, Belmont, CA. (1985)
2. Akers R. L.: *Criminological Theories: Introduction and Evaluation*, 2nd ed., Roxbury Publishing, Los Angeles, C.A. (1997)
3. Beebe, N.L., Rao, S.V.: Using Situational Crime Prevention Theory to Explain the Effectiveness of Information Systems Security. *Proceedings of the 2005 SoftWars Conference*, Las Vegas, NV, Dec 2005 (2005)
4. Chen, J. V., Chen, C. C., Yang, H.H.: An empirical evaluation of key factors contributing to internet abuse in workplace. *Industrial Management & Data Systems* Vol. 108, No. 1, 2008, pp. 87-106 (2008)
5. D'Arcy, J., Hovav, A., Galletta, D.F.: User Awareness of Security Countermeasures and its Impact on Information Systems Misuse: A Deterrence Approach. *Information Systems Research* (20:1), pp. 78-98 (2009)
6. D'Arcy, J., & Hovav, A.: Does one size fit all? examining the differential effects of IS security countermeasures. *Journal of Business Ethics*, 89, 59-71 (2009)
7. Galbreth, M.R., Shor, M.: The Impact of Malicious Agents on the Enterprise Software Industry MIS Quarterly Vol. 34 No. 3, pp. 595-612/September 2010
8. Gopal, R. D., Sanders, G. L.: Preventive and Deterrent Controls for Software Piracy. *Journal of Management Information Systems / Spring 1997*, Vol. 13, No. 4, pp. 29-47 (1997)
9. Grabosky, P. *Cyber Crime and Information Warfare*. Transnational Crime Conference, Canberra, 9-10 March 2000
10. Harrington, S. J.: The Effect of Codes of Ethics and Personal Denial of Responsibility on Computer Abuse Judgements and Intentions MIS Quarterly/September 1996, 257-278 (1996)
11. Herath, T., Rao H.R.: Protection motivation and deterrence: a framework for security policy compliance in organisations. *European Journal of Information Systems* (2009) 18, 106-125 (2009)
12. Higgins, G.E., Wolfe, Scott E., Ricketts, Melissa L.: Digital Piracy, *Social Science Computer Review*, vol. 27, no. 1. (2009)
13. Higgins, G.E.: Can low self-control help with the understanding of software piracy problem? *Deviant Behavior*, 26: 1-24 (2005)
14. Higgins, G.E., Fell, B.D., Wilson, A.L.: Low Self-Control and Social Learning in Understanding Students' Intentions to Pirate Movies in the United States. *Social Science Computer Review* Volume 25 Number 3, Fall 2007, pp. 339-357 (2007)
15. Higgins, G. E., Makin, D. A.: Does Social Learning Theory Condition the Effects of Low Self-Control on College Students' Software Piracy? *Journal of Economic Crime Management (JECM)* Spring 2004, Vol. 2, Issue 2, p. 1-22 (2004)
16. Higgins, G. E., Wilson, A. L., Fell, B. D.: An Application of Deterrence Theory to Software Piracy. *Journal of Criminal Justice and Popular Culture*, 12 (3), 166-184 (2003)

Analysing IT-crimes by Applying Criminological Theories 16

17. Hinduja, S.: Neutralization theory and online software piracy: An empirical analysis. *Ethics and Information Technology*. Vol. 9, no. 3, pp. 187-204. July 2007 (2007)
18. Hirschi T.: *Causes of Delinquency*, University of California Press, Berkley, CA. (1969)
19. Jones, R.: Entertaining Code: File Sharing, Digital Rights Management Regimes, and Criminological Theories of Compliance. *International Review of Law Computers & Technology*, Volume 19, No. 3, Pages 287-303, November 2005 (2005)
20. Kankanhalli, A., Teo, H.H., Tan, B.C.Y, Wei, K.K.: An integrative study of information systems security effectiveness. *International Journal of Information Management* 23 (2003) pp. 139-154 (2003)
21. Kitchenham B., Brereton O.P., Budgen D., Turner M., Bailey J. Linkman S.: Systematic Literature Reviews in Software Engineering – A Systematic Literature Review. *Information and Software Technology* 51, No 1, 7-15 (2009)
22. Lee, J., Lee, Y.: A holistic model of computer abuse within organizations. *Information Management & Computer Security* 10/2 (2002) pp. 57-63 (2002)
23. Lee, S. M., Lee, S.G., Yoo, S.: An integrative model of computer abuse based on social control and general deterrence theories. *Information & Management* 41 (2004), 707-718 (2004)
24. Li, H., Zhang, J. & Sarathy, R.: Understanding compliance with internet use policy from the perspective of rational choice theory, *Decision Support Systems*, vol. 48, no. 4, pp. 635-645. (2010)
25. Liao, Q., Luo, X., Gurung, A. & Li, L.: Workplace Management and Employee Misuse: does Punishment Matter?. *Journal of Computer Information Systems*, vol. 50, no. 2, pp. 49-59. (2009)
26. Lim, V.K.G.: The IT way of loafing on the job: cyberloafing, neutralizing and organizational justice. *Journal of Organizational Behavior* 23, 675-694 (2002)
27. Mirchandani, D., Motwani, J.: Reducing Internet Abuse in the Workplace, *SAM Advanced Management Journal*, Winter 2003, pp. 22-55 (2003)
28. Morris, R. G., & Higgins, G. E.: Criminological theory in the digital age: The case of social learning theory and digital piracy. *Journal of Criminal Justice*, 38(4), 470-480. (2010)
29. Pahlila, S., Siponen, M., Mahmood, A.: Employees' Behavior towards IS Security Policy Compliance. *Proceedings of the 40th Hawaii International Conference on System Sciences* (2007)
30. Peace, A. G., Galletta, D.F., Thong, J.Y.L.: Software Piracy in the Workplace: A Model and Empirical Test. *Journal of Management Information Systems / Summer 2003*, Vol. 20, No. 1, pp. 153-177 (2003)
31. Sherizen, S.: Can computer crime be deterred. *Security Journal* 6 (1995) 177-181 (1995)
32. Siponen, M., Pahlila, S., Mahmood, A.: Employees' Adherence to Information Security Policies: An Empirical Study, in *Proceedings of the IFIP SEC 2007*, Sandton, Gauteng, South Africa, pp. 133-144, 2007
33. Siponen, M., Vance, A.: Neutralization: New insight into the problem of employee information systems security policy violations. *MIS Quarterly* Vol. 34 No 3, pp. 487-502/September 2010 (2010)
34. Skinner, W.E., Fream, A.M.: A social learning theory analysis of computer crime among college students. *Journal of Research in Crime and Delinquency*, Vol. 34, No. 4, November 1997, pp. 495-518 (1997)
35. Smith, A.D.: Accountability in Edi systems to prevent employee fraud. *EDPACS: Jun 2005*; 32, 12 (2005)
36. Smith, A.D., Rupp, W.T.: Issues in cybersecurity: understanding the potential risks associated with hackers/crackers. *Information Management & Computer Security* 10/4 (2002) 178-183 (2002)
37. Straub, D.W.: Effective IS Security: An Empirical Study. *Information Systems Research: Sep90*, Vol. 1 Issue 3, p. 255-276 (1990)

Analysing IT-crimes by Applying Criminological Theories 17

38. Straub, D.W., Carlson, P.J., Jones, E.H.: Deterring Cheating by Student Programmers: A Field Experiment in Computer Security. *Journal of Management Systems* (5:1), 1993, pp. 33-48 (1993)
39. Straub, D.W., Welke, R.J.: Coping With System Risk: Security Planning Models for Management Decision Making. *MIS Quarterly/December* 1998, pp. 441-469 (1998)
40. Sutherland E. and Cressey D. (1974) Techniques of neutralization: a theory of delinquency, *American Sociological Review*, 22, 664-670.
41. Sykes, G., Matza, D.: Techniques of Neutralization: A Theory of Delinquency. *American Sociological Review*, pp. 664-670 (1957)
42. Theoharidou, M., Kokolakis, S., Karyda, M., Kiountouzis, E.: The insider threat to information systems and effectiveness of ISO17799. *Computers & Security* (2005) 24, 472 – 484 (2005)
43. Workman, M., Gathegi J.: Punishment and ethics deterrents: A study of insider security contravention, *Journal of the American Society for Information Science and Technology*, vol. 58, no. 2. (2007)
44. Wiant, T.L.: Information security policy's impact on reporting security incidents. *Computers & Security* (2005) 24, 448-459 (2005)
45. Willison, R.: Understanding and Addressing Criminal Opportunity: The Application of Situational Crime Prevention to IS Security. *Journal of Financial Crime*, Vol. 7, No.3, 2000 pp. 201-210 (2000)
46. Willison, R.: Understanding the offender/environment dynamic for computer crimes. *Information Technology & People*, Vol. 19, No. 2, 2006 pp. 170-186 (2006)
47. Willison, R.: Understanding the perpetration of employee computer crime in the organisational context. *Information and Organization* 16 (2006) 304-324 (2006)
48. Willison, R., Backhouse, J.: Opportunities for computer crime: considering the systems risk from a criminological perspective. *European Journal of Information Systems* (2006) 15, 403-414 (2006)
49. Willison, R., Siponen, M. (2008) Software Piracy: Original Insights from a Criminological Perspective. *Proceedings of the 41st Hawaii International Conference on System Sciences – 2008*.
50. Willison, R., Siponen, M.: Overcoming the insider: reducing employee computer crime through Situational Crime Prevention. *Communications of the ACM*. September 2009, Vol. 52, No. 9 pp. 133-137 (2009)
51. Yar, M.: Computer Hacking: Just Another Case of Juvenile Delinquency? *The Howard Journal* Vol. 44, No. 4, September 2005, pp. 387-399 (2005)

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Information Classification on University Websites: A Cross-Country Card Sort Study

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Abstract. Websites are increasingly used as a medium for providing information to university students. The quality of a university website depends on how well the students' information classification fits with the structure of the information on the website. This paper investigates the information classification of 14 Danish and 14 Pakistani students and compares it with the information classification of their university website. Brainstorming, card sorting and task exploration activities were used to discover similarities and differences in the participating students' classification of website information and their ability to navigate the websites. The results of the study indicated group differences in user classification and related task performances differences. The main implications of the study were that (a) the edit distance appears a useful measure in cross-country HCI research and practice and (b) the comparative approach of thematic and taxonomic analysis can be used to understand classification and website structure.

Keywords: website structure, information architecture, classification, categorization, card sorting,

1 Introduction

It is often a challenge to retrieve information from large complex websites such as university websites. The challenge may, however, not be the same in different countries. A key issue in good website design is the classification of the information on the website [1-3]. If the website information is classified in a manner that fits well with the user's perception of the topics, then information retrieval on the website is efficient, and may even be experienced as satisfying [4, 5]. Most of the cross-cultural studies of websites have focused on the usability, language biases, and structure of Asian and Western websites. Little work appears to have been done investigating the structure of the websites in communities that have recently joined the global Internet community [6]. In this study we compare two websites – a Danish university website and a Pakistani university website – to investigate differences in their structure, and whether these differences match the way in which the local users of the websites classify information.

In the existing website studies, the content holders are usually seen as the ones who determine how the information is structured [7]. It is, however, well-known that designers' decisions about the structure of a system may not match how users think about the system [8]. This problem intensifies in cross-cultural settings where designers with one cultural background make websites for users with another cultural background. Two ways of improving our understanding of the interrelation between cultural background and website structure are to (a) compare across countries the structure of websites developed locally and used locally and (b) study how well the structure of such websites matches the way in which the target users classify the information that is accessible on the website. In this study we do both, by having Danish and Pakistani university students make card sorts of the information on their respective university websites and find information on the websites. We chose university websites as our object of study because university websites in different countries must provide support for a similar set of activities (e.g., information about available study programmes, about class schedules for current courses, and about access to resources such as libraries). We chose Danish and Pakistani university websites for this study because there are sizeable cultural differences between these two countries and because website structure and use in Pakistan has not received much research attention.

Previous studies of websites and cultural background have suggested that culture is visible in websites through so-called cultural markers [9, 10]. These studies find that users' cultural background has an impact on their understanding and perception of the website. Our study adds to the existing knowledge about the structure of websites by showing how the two university websites differ in their information structure, in spite of similarities in the activities they support. The paper is organized as follows: In the next section we describe literature relevant to the classification of information, particularly website information. Then, we explain the method of our empirical work, which comprises brainstorming, card sorting, and information-retrieval tasks, and we present our results. Finally, we discuss implications of the results and possible extensions of this study.

2 Relevant Literature

2.1 Information Classification

In website design, the classification explains how the information is distributed across different hierarchical levels of website pages and what labelling is used to group information on a webpage. Websites use different classification and navigation structures such as network, linear, global, local, contextual, and embedded [11, 12]. Barber and Badre [9] identified the localized elements of an interface and termed them *cultural markers*, which are specific to a given culture. But *cultural markers* emphasize only the interface elements that are preferred within a particular cultural group and do not talk about the information classified on the website. Different countries may display profound differences in the structure of website information. Isa et al. [10] explored the relationship between culture and website structure. The

study found that users have their own understanding of the structure of the information on a website, and that this understanding differs systematically across groups of users [10].

Information classification is understood as the placement of information at different levels of a website and it affects the findability of the information. Allen [13] investigated the effect of information depth on the response time and error rate at each hierarchical level of a website. The study found that response times became longer for searches deeper into the website. The study participants made more errors when the information to be retrieved were at deeper levels [13]. Rau et al. [14] compared the knowledge representation of students in US, mainland China and Taiwan on four websites. For participants from Taiwan and mainland China, the study showed advantages of a thematic structure with respect to error rate on information-retrieval tasks [14]. Kralisch and Yeo [15] investigated the impact of culture, language and medical knowledge on users' information categorization. The study suggests that culture influences the users' preferences in information categorization, their attitudes, and their behaviour, whereas language predominantly affects the users' beliefs about ease of use and usefulness. All these studies consider the users' cultural background as an important factor in conceptualising the information structure of websites but mainly emphasize the user interface and language use on websites.

2.2 Mental Model and Classification of website

The classification of information is important to human-computer interaction (HCI), information science, the psychology of interaction, and cognitive anthropology. A mental model is a cognitive structure of concepts and procedures that users apply when selecting the relevant goals, choosing and executing appropriate actions, and understanding what happens when they interact with a computer system [16]. The concepts of classification and categorization are interchangeably used in the literature of information management, HCI and Information Systems. A classification is a clustering of information that shares a common property [3, 17]. It is a set of metaphorical boxes which contain the information that has common themes [3]. In addition to information classification and navigation on the websites, culture is an important aspect of website structure. In this study we explain culture as information classification tendencies shared by a particular group of people with same nationality, and we describe their mental model using card sorting.

2.3 Thematic and taxonomic classification

The information classification of a website may be different for different participants. Most importantly, each participant can classify the items in a thematic or taxonomic structure.

A thematic classification classifies items into groups according themes, each of which includes all the elements that relate to the category name of all grouped items in that category. The items in a thematic classification are related to each other through a coherent story or situation. The items in a thematic structure are related to

each other on the lower level [14]. In a thematic classification of banana, monkey and panda, the two items banana and monkey go together. Banana and monkey provide a thematic classification based on eating habits and a coherent story of the situation that monkey eats banana.

A taxonomic structure classifies items into groups according to the function or inferences drawn from the items in the group [14]. The study of Rau et.al (2004) used the notion of 'functional' to explain taxonomic classification. The items are related to each other through higher level abstraction, the group name of the categories.

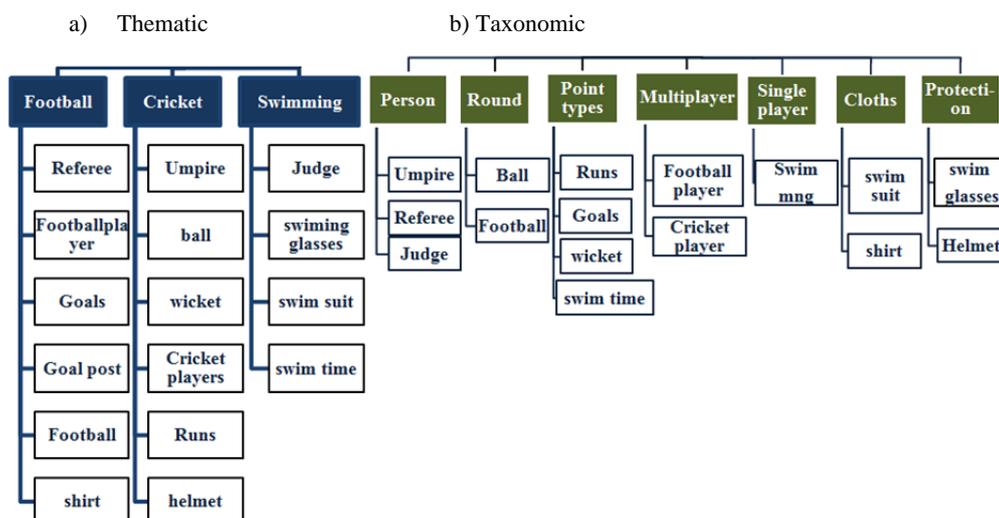


Fig. 1. Classification structure of Thematic and Taxonomic categorization

In a taxonomic classification, panda and monkey are grouped together because they are similar at a higher level of abstraction. The higher level abstraction is the common property of panda and monkey that they are both *mammals*. Smiley and Brown (1979) examined the conceptual preference of people and found that young and old individuals preferred thematic classification while school age and college adults preferred taxonomic classification [18]. Rau and Choong (2004) explained classification from an example that cleaning liquids such as *dishwash liquid*, *bathub cleaner*, *toilet bowl cleaner* and *detergent* are usually grouped together as cleaning products in supermarkets, because of their cleaning function. These cleaning liquids are not grouped together according to their relations. *Dishwash liquid* is grouped with other kitchen items according to their relation with other kitchen items [14].

Fig. 1 presents a more complex example that is closer to a website structure. Fig. 1(a) is a taxonomic classification with seven groups. The items in each group of the taxonomic classification are related to each other through higher levels of abstraction. It also explains that classified items in a group inherit properties from the group name. Fig. 1(b) is a thematic classification of items into three groups. The items in each group of the thematic classification are related to each other and can be explained without the group names 'football', 'cricket' and 'swimming'. The classified items in the thematic classification have a coherent story of the situation for each group.

3 Method

To investigate the match between the structure of university websites and their users' classification of the information accessible on the websites, we performed a card-sorting study with students from two universities. A cross-case analysis [19] was performed of the two university websites. The study was conducted in the usability laboratory at the University of Management and Technology (UMT) in Lahore, Pakistan, and the usability laboratory at Copenhagen Business School (CBS) in Copenhagen, Denmark.

3.1 Card sorting

Card sorting is a technique aligned with Kelly's personal construct theory [20]. It assumes that people make sense of the world through classification and that people can describe their own classification of the world with reasonable validity and reliability [20, 21]. Card sorting provides insight into how users classify information and, thereby, how they construe their world, illuminating the otherwise often tacit ways in which they group, sort, and label information and objects [21-23]. The general idea of card sorting is to ask participants in interviews or workshops to sort labelled paper cards into piles. The analyst then compares the different participants' sorting of the cards. Card sorting has been used in multiple studies of knowledge organization and information classification. For example, Chen and Occena [24] used card sorting to investigate domain experts' ways of organizing their knowledge, Martine and Rugg [25] measured the perceived similarity of webpages using card sorting, and McLaughlin and Mandin [26] used card sorting to assess the clinical curriculum and medical students' knowledge organization.

3.2 Participants

A total of 14 Danish university students at CBS and 14 Pakistani university students at UMT participated in the study. Nielsen [27] reports that for practical purposes approximately 15 users are enough to reach a correlation of 0.90 in a card sort but recommends twice as many for a big project.

To recruit participants, a message was posted on a Facebook page of the university. The message contained a link to a document that explained the purpose of the study, the criteria for participation, and the activities and duration of the experiment. The message and document were posted in English and in the local language (Danish in Denmark and Urdu in Pakistan). In Denmark, we also applied snowball sampling by asking each recruited participant to point out a possible future participant among their acquaintances. We required that all participants should be 20-35 years of age, hold citizenship in the country, be residents of the country, have been born and raised in their country, have attended primary school in the country, and have lived in their country for most of their lives but they may have been abroad for part of their later education. We aimed for an equal number of male and female participants. All participants should have at least 5 years of experience using computers and the

Internet. We excluded participants with experience as software or hardware developers – including analysts, designers, programmers, and testers.

Table 1. Participants' demographics

<i>N</i> = 28	Danish	Pakistani
Years of age (<i>M</i> ± <i>SD</i>)	22.6 ± 1.3	21.3 ± 3.3
Number of study years (<i>M</i> ± <i>SD</i>)	16.07 ± 0.9	15.0 ± 1.7
University-website use in minutes/week (<i>M</i> ± <i>SD</i>)	108.2 ± 131.6	12.2 ± 11.1
Male (%)	50	50
Female (%)	50	50

Table 1 shows demographic information about the participants. There was no age difference between Danish and Pakistani participants, $t(26) = 1.34$, $p = 0.2$, but a significant difference in number of years of study, $t(26) = 2.07$, $p < 0.05$. There was also a significant difference in weekly use of the university website, $t(26) = 2.7$, $p < 0.05$. The Pakistani participants explained in interviews that they mainly used other sources for information about their university. We attained a balanced gender distribution in both groups.

3.3 Procedure

All the sessions were conducted individually. The participants were welcomed in the usability lab and signed an informed consent form. Then, the test leader introduced the participants to card sorting, and asked them to fill in a questionnaire with questions about their, age, study years, internet use, and time spent on the university website during the last week. The experimental part of the sessions comprised three activities, to be described below: brainstorming, card sorting, and information-retrieval tasks. Each participant received a gift voucher of 200 DKK.

Brainstorming. Once the participants had filled in the questionnaire, they were provided with a set of, 5 x 5 cm blank index cards in two colours. Participants were asked to indicate elements of website content on cards of one colour and names of groups of website content on cards of the other colour. And, participants were asked to sort their element cards into the groups defined by their group cards in such a way as to create a site map for a university website. The participants were told that they did not have to make a grouping similar to that of their own university website. As recommended in previous studies, participants were requested to justify the created website structure orally [28, 29]. The intension of this brainstorming activity was to elicit the participants' understanding of what information to include on a university website and how to structure it. Participants were provided 15 minutes for this brainstorming activity.

Card sort. For the card sort, the participants were provided with 50 index cards. They were also provided with six category names, each representing a page on their

local university website (CBS^{1,2} and UMT³). The Danish and Pakistani participants received separate sets of cards. The selection of web pages for the cards was done by two researchers [29]. Both sets of 50 cards were in English because both university websites were in English. We used a semi-closed card sort, in which participants begin with predefined cards and groups but are allowed to rename groups, add new groups, and remove groups [30, 31]. The participants were asked to sort the cards into groups that constituted what they would consider a natural classification of the website content. Participants were provided 15 minutes for this activity. Fig. 2 shows brainstorming and the card sorting materials.

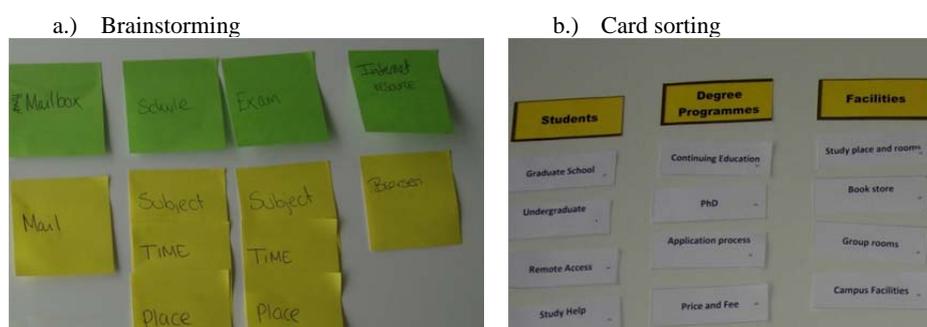


Fig.2. Part of the brainstorming and card-sorting data

Information-retrieval tasks. The participants were asked to solve five information-retrieval tasks on the website of their local university. The tasks involved the participants' routine information retrieval from the website. As an example, one of the tasks was: *Please find the contact information of the person/secretary who can provide you further information about Hostels. Please notify the instructor when you finish.* Due to the differences between the Danish and Pakistani websites, Danish and Pakistani participants received tasks that were pair-wise similar, but not identical. Participants were provided three minutes for each task.

The university websites of CBS and UMT (Fig. 3) that were used as material for the study were selected because we had full access to these sites and because they were considered representative for the class of university websites in the respective regions.

3.4 Data analysis

The *brainstorming* data were analyzed by characterizing the type of classification that was present in the categories and subcategories created by the participants. Three independent coders (i.e., the authors) analyzed the brainstorming data by coding each group as *thematic* categorization, *taxonomic* categorization, or *other*. The coders first

¹ <http://uk.cbs.dk/>

² <https://e-campus.dk/>

³ <http://www.umt.edu.pk/>

coded about one fifth of the data as an individual training exercise and then collectively discussed their coding. As a result of the training it was decided that when participants made multi-level groups that involved *taxonomic* classification at one level and *thematic* classification at another then that group was coded as *other*. Then the coders individually coded the remaining brainstorming data. Table 2 shows the pair-wise agreement between the coders and the kappa values (a statistical measure of the inter-rater agreement of categorical items). The kappa values are fairly moderate, according to the interpretation given by Altman [32]. The agreement varies between 59 and 68 percent with the kappa value varying between 0.39 and 0.52.

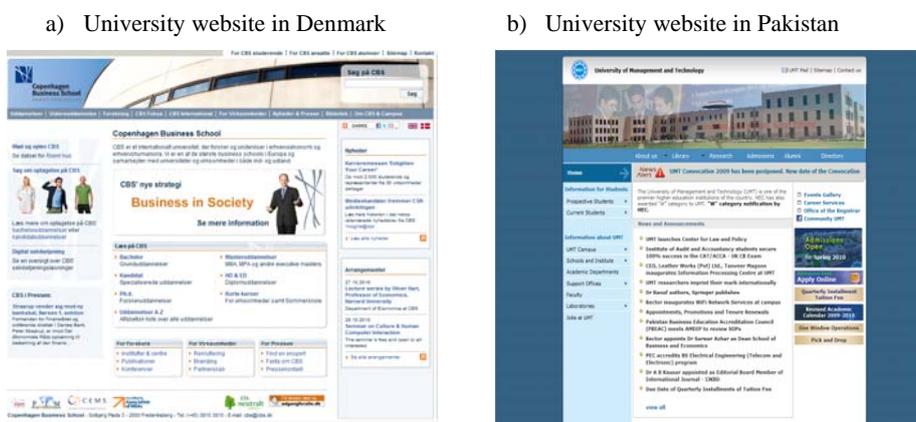


Fig. 3. Screenshots of the two university websites

To analyze the *card sort* data we calculated, for each participant, the distance between the structure of the information on the website and the participant's classification of the information as represented in the participant's card sort. The distance between two classifications is the number of disagreements between them. That is, a distance of one means that a single card is placed differently by a participant compared to how the information is structured on the university website [23, 33]. This resulted in an average distance between the Danish university website and the Danish participants' card sorts and an average distance between the Pakistani university website and the Pakistani participants' card sorts. We also calculated the average distance between all pairs of Danish participants' card sorts and the average distance between all pairs of Pakistani participants' card sorts. To calculate the distances, we used the UW Card Sort Analyzer⁴.

The data from the *information-retrieval tasks* were analyzed by determining how long participants took to answer the tasks and how many tasks participants answered correctly. Tasks not solved within the allocated three minutes were treated as incorrect. The answers to the information-retrieval tasks were at different depths in the website structure. That is, the answers were a different number of clicks away from the position at which participants started solving each task. The depth was

⁴ <http://www.cs.washington.edu/research/edtech/CardSorts/>

determined for each task and labelled low, medium, or high. We contend that higher depth corresponds to higher task complexity.

Table 2: Inter-rater reliability of coders

		All categories
Coder No. 1 vs. Coder No. 2	Number of agreement	115
	Number of disagreement	79
Coder No. 2	Proportion of agreement	59%
	Consensus (Kappa)	0.39
Coder No. 1 vs. Coder No. 3	Number of agreement	132
	Number of disagreement	61
Coder No. 3	Proportion of agreement	68%
	Consensus (Kappa)	0.524
Coder No. 2 vs. Coder No. 3	Number of agreement	127
	Number of disagreement	66
Coder No. 3	Proportion of agreement	65%
	Consensus (Kappa)	0.472

4 Results

Below we first analyze the brainstorming data, then the card-sort data, and finally the information-retrieval tasks.

4.1 Brainstorming

Table 3 shows that the Danish participants made 7.1 first-level categories during the brainstorming session, whereas the Pakistani participants made 6.7 first-level categories. There was no effect of participant group on the number of categories, $t(26) = 0.58$, $p = 0.6$. Seven (50%) of the Danish participants made second-level categories during their brainstorming session, whereas only three (21%) of the Pakistani participants made second-level categories. There was no effect, $t(26) = 1.59$, $p = 0.1$, of participant group on the number of second-level categories.

There was a significant difference between the two groups in the percentage of *taxonomic* categories, $t(26) = -4.26$, $p < 0.001$, and *other* categories, $t(26) = 3.42$, $p < 0.01$. There was no significant difference, $t(26) = 0.36$, $p = 0.7$, between the two groups in the percentage of *thematic* categories.

Table 3. Card-based brainstorming

N = 28	Danish	Pakistani
Number of Categories in brainstorming (M \pm SD)	7.1 \pm 2.0	6.7 \pm 1.0

Number of participants who made sub-categories	7	3
Percentage of Taxonomic categories (M ± SD)	30.8 ± 9.9	51.2 ± 15.0
Percentage of Thematic categories (M ± SD)	34.2 ± 12.7	32.2 ± 15.5
Percentage of Other categories (M ± SD)	32.8 ± 16.1	13.6 ± 13.6

Danish participants used a mixture of taxonomic and thematic categories and therefore many of the Danish participants' categories ended up being coded as *other*, whereas Pakistani participants made more use of taxonomic classification and did not group information into many categories. The brainstorming data showed some differences between the participants in their classification of university-website information. This suggests that the information on such websites should be structured differently to match how Danish and Pakistani students classify information.

4.2 Card sort

To investigate the quality of the structure of the information on the two university websites, we analyzed how well this structure matched the way participants classified the same information. Table 4 shows the average distance between the structure of the website content and the participants' card sorts of the website information. The Danish participants had an average distance of 22.4 from the website, the Pakistani participants had a distance of 26.1. There was a significant difference in distance for Danish and Pakistani participants, $t(26) = -4.7$, $p < 0.01$, indicating that the two websites match their users' classification of the website content to different extents.

Table 4. Distance between website structure and participants' card sorts

N = 28	Danish	Pakistani
Distance from website to card sort of all cards (M + SD)	22.4 ± 2.1	26.± 2.6
Number of cards on which a majority of participants agree	34	19

For each card we determined the number of participants who classified the card in the same way – that is, placed it in the same group. We then selected the subset of cards classified in the same way by a majority (50% or more) of the participants. This was done separately for Danish and Pakistani participants. A majority of the Danish and Pakistani participants agreed about the classification of subsets of 34 and 19 cards, respectively.

4.3 Information-retrieval tasks

Finally we analyzed whether the task completion times and success rates of the information-retrieval tasks were affected by the depth at which answers to the tasks were located. For Danish participants the average task completion time for tasks at low, medium, and high depth was 62 seconds ($SD = 56$), 67 seconds ($SD = 53$) and 82

seconds ($SD = 62$). The Danish participants' average success rate for tasks at low, medium and high depth was 85% ($SD = 36$), 92% ($SD = 27$) and 82% ($SD = 62$) respectively. For Pakistani participants the average task completion time for tasks at low, medium and high depth was 58 seconds ($SD = 39$), 88 seconds ($SD = 59$) and 134 seconds ($SD = 51$), respectively. The Pakistani participants' average success rate for tasks at low, medium and high depth was 92% ($SD = 26$), 86% ($SD = 36$) and 50% ($SD = 38$), respectively.

Fig. 4 shows the relationship between task completion time and the depth at which the answers to the tasks were located. Compared to the Pakistani participants, the task completion time for the Danish participants did not increase across depths. The Pakistani and Danish participants spent about the same time on low-depth tasks but the time for Pakistani participants increased as depth increased.

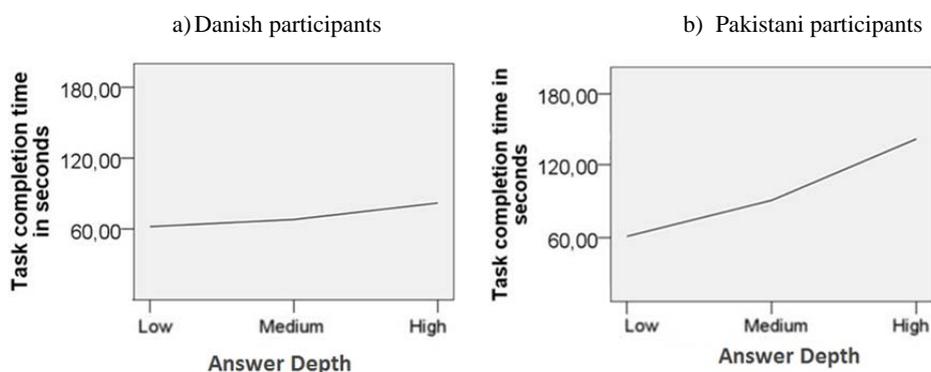


Fig. 4. Relationship between task completion time and information depth

Fig. 4 shows the relationship between success rate and the depth at which the answers to the tasks were located. For Pakistani participants we found a decrease in success rate as answer depth increased. For Danish participants we found no relationship between success rate and answer depth. Both of these analyses suggest that the website structure affected participants' information retrieval.

5 Discussion

This cross-case study of university websites uses card-based brainstorming, card sorting, and information-retrieval tasks to investigate the participants' ways of organizing website information. We find both disagreement and similarities between the Danish and Pakistani participants. The differences can be interpreted as cultural differences in cognitive sorting style and as country-specific conditions related to the use of the internet by each group of participants.

b) Danish participants

b) Pakistani participants

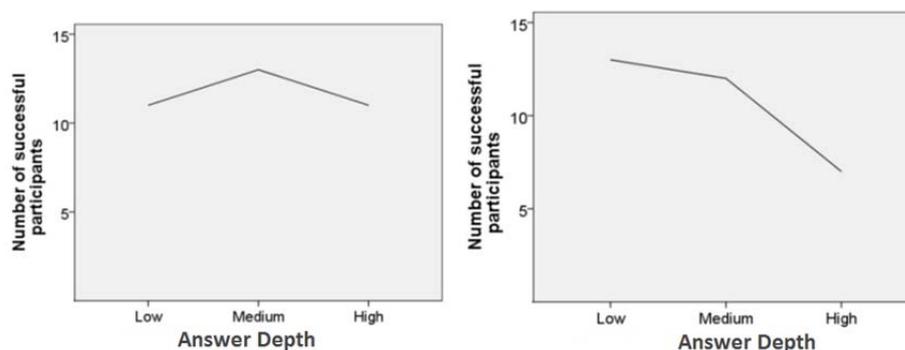


Fig. 5. Relationship between success rate and information depth

For the card-based brainstorming, the analysis of *taxonomic* and *thematic* categorization shows that the Pakistani participants tend to use *taxonomic* classification more than the Danish participants. The Pakistani participants classify information in categories where information can mostly be related to higher levels of abstraction. The Pakistani participants' shallow classification may be explained by a study in South Africa on culture, literacy and web dimensions which states that more communication practice on web enhances users' experience to categorize information in different ways. Danish participants made multilevel classification during brainstorming. Due to the spread of the contents in multiple sub-categories, Danish participants used a mixture of taxonomic and thematic categorisation at different levels. For the brainstorming, the Danish and Pakistani participants were provided with the same scenario and can therefore be compared,

The difference in Danish and Pakistani participants' card sorts was measured using the edit distance. Previous work suggests that for websites an edit distance of 4 to 5 for comparisons of 20 website elements indicates closely related contents [23]. On this basis the participants in our study were far from each other in their categorization of the 50 cards with website content. The web content may be categorized differently for numerous reasons. The information may, for example, fit in multiple categories. Content such as 'Contact us' can be placed in either of the main categories including 'Facilities', 'Library', and 'Admission'. Another reason for the high edit distance may be that the contents on some cards, e.g., 'alumni', were not understood by the participants and their different interpretations of these cards would then result in placing the cards in different categories.

For the agreement within a group about the placement of cards of web contents, the majority of the Danish participants agreed about the placement of 76% of the contents. Conversely, the majority of the Pakistani participants agreed about the placement of only 38% of the contents. This difference may indicate that the Danish website provides convenient services to facilitate on-line activities for Danish participants [34]. Another reason for this difference may be that due to the convenient services, the Danish participants make more use of their university website.

Regarding the relationship between task completion time and answer depth, Pakistani participants find it difficult to locate high-depth answers. Also, Pakistani participants' success rate decreases with increasing answer depth. A possible reason

for this decrease may be that Pakistani participants spent less time on their university website compared to Danish participants.

Methodologically, this study provides an initial investigation of an approach that can be used in cross-country comparisons of website content and structure. We used taxonomic and thematic categorisation to compare and contrast the participants across countries. This method can provide insight into users' classification criteria. To minimise the impact of having two different websites in the experiment, we chose the same genre for both websites. We measured the usability of the websites to ensure that there were no important differences in the usability of the two websites. Furthermore, since both websites concern major, urban universities, we expected them to be at equal levels of quality.

6 Conclusion

This card-sort study offers an approach to the study of cross-country differences in the structure of university websites and user classification of website contents. Pakistani students tend to use more taxonomic classification, but fewer levels of categories, as compared to Danish students. The study also finds similarities between Pakistani and Danish users, for example in the retrieval of website content that is not located deep in the website hierarchy. The edit distance appears to be a useful measure in cross-country analyses of website structure. Furthermore, comparing websites developed locally and used locally can be a valuable comparative approach in cross-country HCI research and practice. The current study is limited by its focus on two websites and by the moderate number of participants from each of the two countries. Another limitation of study is that only one genre of website was researched. In this study we conducted the analysis of thematic and taxonomic classification on the basis of the card-based brainstorming data. In a forthcoming study we will apply the analysis of taxonomic and thematic classification to card sorts of actual website content.

References

1. Dumais, S. and H. Chen. *Hierarchical classification of Web content*. in *Proceedings of the 23rd annual international ACM SIGIR conference on Research and development in information 2000*. Athens, Greece ACM.
2. Parsons, J. and Y. Wand, *Using cognitive principles to guide classification in information systems modeling*. *Mis Quarterly*, 2008. **32**(4): p. 839-868.
3. Lakoff, G., *Women, fire, and dangerous things*1990: Univ. of Chicago Press.
4. Cole, C., et al., *A classification of mental models of undergraduates seeking information for a course essay in history and psychology: Preliminary investigations into aligning their mental models with online thesauri*. *Journal of the American Society for Information Science and Technology*, 2007. **58**(13): p. 2092-2104.
5. Bernard, M., *Constructing user-centered websites: The early design phases of small to medium sites*. *Usability News*, 2000. **2**: p. 2000.

6. El Said, G. and K. Hone. *Cross-Cultural Web Usability: An Exploration of the Experiences of Egyptians Users*. in *International Workshop on Internationalisation of Products and Systems (IWIPS 2001)*. 2001. Milton Keynes.
7. Bachiochi, D., et al., *Usability studies and designing navigational aids for the World Wide Web*. *Computer networks and ISDN systems*, 1997. **29**(8-13): p. 1489-1496.
8. Norman, D.A., *User centered system design*1986: Erlbaum.
9. Barber, W. and A. Badre. *Culturability: The merging of culture and usability*. in *The Fourth Conference on Human Factors and the Web*. 1998. Basking Ridge, NJ.
10. Isa, W., N.L.M. Noor, and S. Aidid, *Culture Influences to Website Information Architecture: An Empirical Investigation*. *International Symposium of Information Technology 2008, Vols 1-4, Proceedings - Cognitive Informatics: Bridging Natural and Artificial Knowledge*, ed. H.B. Zaman, et al.2008, New York: Ieee. 671-678.
11. Morville, P. and L. Rosenfeld, *Information architecture for the world wide web*2006: O'Reilly Media, Inc.
12. Broughton, V., *Faceted classification as a basis for knowledge organization in a digital environment: the bliss bibliographic classification as a model for vocabulary management and the creation of multidimensional knowledge structures*. *The New Review of Hypermedia and Multimedia*, 2002. **7**(1): p. 67-102.
13. Allen, R., *Cognitive factors in the use of menus and trees: An experiment*. *Selected Areas in Communications, IEEE Journal on*, 2002. **1**(2): p. 333-336.
14. Rau, P.L.P., Y.Y. Choong, and G. Salvendy, *A cross cultural study on knowledge representation and structure in human computer interfaces*. *International journal of industrial ergonomics*, 2004. **34**(2): p. 117-129.
15. Kralisch, A., A. Yeo, and N. Jali. *Linguistic and cultural differences in information categorization and their impact on website use*. 2006. IEEE.
16. Carroll, J., *HCI models, theories, and frameworks: Toward a multidisciplinary science*2003: Morgan Kaufmann Pub.
17. Bowker, G. and S. Star, *Sorting Thing Out*. *How to think like a knowledge worker: a guide to the mindset needed to perform competent knowledge work*, 2008: p. 28.
18. Smiley, S. and A. Brown, *Conceptual preference for thematic or taxonomic relations: A nonmonotonic age trend from preschool to old age* 1*. *Journal of Experimental Child Psychology*, 1979. **28**(2): p. 249-257.
19. Yin, R., *Case study research: Design and methods*2009: Sage Publications, Inc.
20. Kelly, G., *The psychology of personal constructs (Vol. 2)*. *Clinical diagnosis and psychotherapy*, 1991.
21. Rugg, G. and P. McGeorge, *The sorting techniques: a tutorial paper on card sorts, picture sorts and item sorts*. *Expert Systems*, 1997. **14**(2): p. 80-93.
22. Donna Spencer, T.W. *Card sorting: a definitive guide*. 2009 December 1, 2009]; Available from: http://www.boxesandarrows.com/view/card_sorting_a_definitive_guide.

23. Deibel, K. and R. Anderson, *Using edit distance to analyze card sorts*. Expert Systems, 2005. **22**(3): p. 129-138.
24. Chen, C. and L. Occenã, *A knowledge sorting process for a product design expert system*. Expert Systems, 1999. **16**(3): p. 170-182.
25. Martine, G. and G. Rugg, *That site looks 88.46% familiar: quantifying similarity of Web page design*. Expert Systems, 2005. **22**(3): p. 115-120.
26. McLaughlin, K. and H. Mandin, *Using "concept sorting" to study learning processes and outcomes*. Academic Medicine, 2002. **77**(8): p. 831.
27. Nielsen, J., *Card sorting: How many users to test*. Jakob Nielsen's Alertbox, 2004.
28. Medin, D., et al., *Categorization and Reasoning among Tree Experts: Do All Roads Lead to Rome?** 1. Cognitive Psychology, 1997. **32**(1): p. 49-96.
29. Ross, N., *Culture & cognition: implications for theory and method* 2004: Sage Publications, Inc.
30. Geven, A., et al. *Always-on information: services and applications on the mobile desktop*. 2008. ACM.
31. Lewis, K. and P. Hepburn, *Open card sorting and factor analysis: a usability case study*. Electronic Library, The, 2010. **28**(3): p. 401-416.
32. Altman, D., *Practical statistics for medical research* 1991: Chapman & Hall/CRC.
33. Nawaz, A. and T. Clemmensen. *Cultural differences in the structure of categories among users of clipart in Denmark and China*. in *7th Danish HCI Research Symposium*. 2007. Copenhagen, Denmark.
34. Tung, L., Y. Xu, and F. Tan, *Attributes of Web Site Usability: A Study of Web Users with the Repertory Grid Technique*. International Journal of Electronic Commerce, 2009. **13**(4): p. 97-126.

Web 2.0 for social learning in higher education

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Abstract. The use of Web 2.0 in higher education provides for a number of different possibilities. In this paper we look into the use of Web 2.0 as a platform for social learning supplementing traditional teaching methods such as lectures and on place group work. The findings are astonishing revealing challenges such as the unknown genre of Web 2.0 for learning and changed behaviors with relevance for the identity creation and perception of others. The insight points to a number of issues of relevance when Web 2.0 is integrated in design for learning.

Introduction

Web 2.0 is becoming increasingly popular in both business life and educational environments. The area is huge and focus is needed to create detailed insight. In this paper it is especially the promise of active participation through involvement that is in focus. The study digs into understanding what is at stake using Web 2.0 for social learning seen from the perspective of the students. The results reveal that the use of Web 2.0 for social learning by no means is straightforward and requires quite some understanding and developments in design to become an integrated and valuable method in higher education. The use of Web 2.0 in higher education and especially the use of Web 2.0 discussions as a supplement to lectures and more traditional group work in higher education is found to challenge the students in a number of different ways especially regarding the students existing qualifications using Web 2.0 technologies, changes in roles as well as dealing with transparent resources and stress. Inherent in these challenges is the blurring of the existing borders between the personal and educational spheres and communication genres.

In this article the promises and challenges of using Web 2.0 discussion as part of a course in higher education are investigated. The theme is the use of Web 2.0 discussions as a supplement to the more traditional and well-known teaching methods such as lectures and onsite group work. The

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intentions of the Web 2.0 discussions is to provide an opportunity for the students to become more active learners finding and bringing in relevant theory and real life examples and discuss these on a Web 2.0 platform. The use of Web 2.0 technologies is seen as platforms to support an emerging and ongoing social learning process and at the same time building an accumulated base of knowledge representing different perspectives and insights on the student chosen themes.

The research questions are *how may the use of Web 2.0 discussions as a supplement in coursework support active student participation and learning? What are the challenges using Web 2.0 discussions for student involvement informed from the experiences of the students?* Here an insight is created to better understand what is at stake, insight that may lead to considerations of how best to design for student involvement when using Web 2.0. as learning tools.

Web 2.0 e-learning for student activation

The use of Web 2.0 in educational settings presents many different possibilities and likewise many challenges. Often the use of E-learning and in particular social media such as Web 2.0 technologies is associated with social learning through networked learning activities with active student participation. Especially the active student participation is often argued for as an important and valuable element in learning across learning paradigms such as eg. within the cognitive approach as a reflection tool or within the social construction of learning as a tool for social participation (Conole & Alevizou, 2010). In newer approaches to learning knowledge as a fixed entity is of less importance whereas participation (Wenger, 1998) and networking (Siemens, 2006) receives greater attention as what is important this however, creates a clash with the existing practices in education such as individual product evaluations (Dohn, 2009). Cochrane (2008) argues that Web 2.0 technologies have facilitated a shift from instructivist pedagogies to social constructivist pedagogies. This disruption is argued to be enabled by the evolution of the Web now as it has become more open, personalized, participative and social along with the accessibility regarding both time and people (Ravenscroft, 2010). The shift in the practice of what learning and education is, can be argued to be quite a shift in paradigm which may make paradigms clash when shifting between traditional educational approaches and newer understandings. Ryberg et al (2010) argues that if this is not seen as a shift of paradigm then at least we need to talk about a

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“disturbance of the traditional ways of thinking about technologies for sharing, collaborating, participating and learning, which raises new challenges and opportunities in education”. The use of Web 2.0 technologies does however, not in themselves grant for any particular or innovative pedagogy (Ryberg et al., 2010) nor involvement of students. The Web 2.0 technologies may be used for linear and one-way communication in courses and learning designs as when used to provide for easy access to learning resources without emphasis on student involving interactions. The role of Web 2.0 learning thus depends on a negotiation process between the technology, the qualifications and attitudes of the students and the teachers and the pedagogic designed for. The Web 2.0 technologies are themselves numerous and different relating to the functionalities and open for interpretation and thus design-in-use. Grisseck (2009) has made an extensive list of different Web 2.0 technologies and their many current and different uses found in higher education. Selwyn (2009) moves beyond the technologies and their potentials as he calls for a more nuanced view of e-learning and Web 2.0 discussing the many power relations it presents regarding participation, equality etc. Dohn (2009) argues that “Web 2.0” denotes certain characteristics such as collaboration/distributed authorship; active open access, bottom up; distributed ownership; open endedness of the activity and web mediation. Any activity can be more or less “Web 2.0” as it is a matter of the degree regarding the different qualities.

Regarding the new generations of students a lot of discussion surrounds their interest and qualifications using new media and especially social media. Some argue that Web 2.0 is a way to meet the need for pace or to make learning more interesting by wrapping it into these fun technologies, which are commonly use by many young people in their everyday life. An often-mentioned argument is that the use of social software should raise relevance, motivation and engage students however the results are mixed (Ravenscroft, 2010). Selway (2009) argues along the “trendiness” raising the need for authenticity, arguing unauthentic attempts will create resistance. It is also argued that preferences and qualifications using technologies cannot be generalized within the group of young learners as studies have shown big variances, showing new types of user profiles that cannot be generalized to the whole group (Conole & Alevizou, 2010). A very interesting finding is that despite (some of) the young people’s extensive use of Web 2.0 technologies, these technologies are used for certain purposes of mainly social and entertaining character. Following this insight a number of studies have shown that students lack both motivation and qualifications

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for using Web 2.0 technologies for learning and educational purposes, which needs to be taught (Ryberg et al., 2010). Clark et al (2009) defines a related gap between qualifications for informal and formal use of Web 2.0 as “digital dissonance” and argue that there is a lack in understanding how these technologies may support critical and creative uses and support learning. However it may be argued that teachers likewise need to develop skills in understanding and using the technologies in learning. Looking into some of the challenges using Web 2.0 for learning is among other how to handle the shifting roles of students - not only as receivers of knowledge but also co-creators, commentators etc. (Clark et al, 2009; Conole & Alevizou, 2010) and likewise for the teacher to leave the role of being the expert in control which is not easy as it is seen to question the authority (Collins and Halverson, 2009). Ryberg et al (2010) argue for differences in the distribution of control along a continuum between the teacher and the learner regarding control of the learning process with respect to tools, content, goals etc. Such changes do infer profoundly with our identities and repertoire of behaviors. Which hints towards explanations why social learning using Web 2.0 may be difficult and challenging.

Unfolding the experiment

In the beginning of the spring semester 2011 a 5 erts course in e-learning took place. 37 students in the fourth semester of their bachelor (humanistic informatics) participated. A fairly equal amount of male and female students in their twenties. The course aimed at providing insight into the theoretical and practical discussions in the field of e-learning however practical learning by dosing was also sought for. The 5 erts course requires 135 hours of student work. 12 hours of teaching divided into four three-hour lecture sessions spread out over a month was provided, meaning little time was available to get around the main themes of e-learning during the lecture sessions. The four sessions were designed as a mix of lecturing by the teacher (the author), student demonstrations and group work thus a high degree of participation was expected and designed for.

In order to design for further theoretical insight and practical experience the students (in groups of 6) were asked to look into Web 2.0 tools and platforms of their own choice, which they then had to present and demonstrate in class to their fellow students. These presentations should include trying out and discussing the potential of the Web 2.0 tool

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according to a framework developed within one of the textbook used (Dohn & Johnson, 2009). Following the assignment of presenting a Web 2.0 platform and discuss the e-learning potentials the second assignment was to engage in a number of “e-discussions”.

The intention of the Web 2.0 discussions was to enable the students to learn together. All students were asked to make at least three contributions. Two posts had to include theoretical material whereas one post could provide a case/examples found in magazines/newspapers. One of the contributions could be initiating a theme; the others should be responding. The students were encouraged to go together in groups deciding on a theme to start. At the same time they were asked to contribute to other discussions. All initiated discussions had to be written into Twitter using a specific tag. On the way Twitter was however changed to a Facebook group. Facebook was chosen because all students use this media on a regular basis in contrast to Twitter and we needed a better and more reliable overlook of the discussions.

Course session	Web 2.0 elements
1) Lecture: learning paradigms	Introducing Twitter as a tool to be used during class, grouping the students making them choose a Web 2.0 tool to present
2) Lecture: e-learning	1 round of group demonstrations of Web 2.0 tools
3) Lecture: use of Web 2.0	2 round of group demonstrations – starting up Web 2.0 discussions
4) Discussing the experiment	a) Discussing the e-discussions on class and b) Feedback on the individual assignments

Table 1. Course design

The experiment was thus seen as an alternative way to create a sort of critical literature reviews (build up by many students’ contributions), building understandings of concepts and themes by enforcing theoretically based discussions including practical examples as thinking tools. This way of working was intended to provide for multiple perspectives forcing critical thinking, making the students more active and confident in finding relevant material on their own and present it critically to their peers. The possibility to demand for a certain amount and quality of input was seen as the frames, which would grant for enough activity to create the critical mass to make some of the discussions flow/succeed.

In the third and last assignment in the course the students were asked to reflect on the relevance of Web 2.0 technologies in support of e-learning. These reflections were individual and had to be handed in to the teacher

by mail the day before the last course session. In the last course session the students received a feedback on the content of the their reflections.

Methodology

The insight generated in this study emerges from the data set in terms of the students' reflection and it can be argued that the study follows the principles in multi grounded theory using empirical data to build theoretical constructs combined with a theoretical grounding focusing the empirical input and informing the later analysis (Goldkuhl and Cronholm, 2010). Looking through the data set a number of interesting themes arose as well as a number of contradictory experiences and understandings. The analysis presented here is still preliminary and needs iteration. So far themes have been extracted and contradictions in the empirical data identified and analyzed against a limited proportion of the existing literature following the steps of Kvale (1990).

The face validity of the data collected may be questioned due to the situation as a mean to pass the course which may have made some students try to please their teacher. However the reflections are found to be personal and honest as critical considerations of the experiment is provided; discussing the outcome, the joy and frustrations. Another potential bias is the limitations of issues addressed due to the demands to discuss against one of two given theoretical frameworks (either the learning triangle by Illeris (2007) or E-learning by Dohn & Johnson (2009). However this is exactly what helps to make the internal validity high, meaning that all students address the learning related issues of the experiment.

In the following the reflections are presented followed by a number referring to the specific student. The statements are presented under a number of headlines representing the themes identified.

Findings

The feedback from the student reflections reveals that the experiment resulted in quite different experiences among the students. Quite a number of students express positive surprise regarding the learning outcome as they either found the assignment to easy or unchallenging for thereafter to find them self greatly challenged. Others were expecting little to come out of the experiment, as their main attitude towards the

use of Web 2.0 technologies for learning was that it mainly provides for superficial learning. However, quite a number of the students were surprised by the amount and quality of the discussions.

The learning process

Regarding the learning process supported through the Web 2.0 discussion a couple of students argue that they may invite for deep learning as they experienced strengthened argumentation and reflection (I20, I33), if the individual student is willing to engage (I20). Moreover it is argued that as a supplement the Web 2.0 discussions create for a more dynamic teaching form due to immerse amounts of multiple interactions. This is further nuanced by a student writing that “it has giving me much more to initiate discussion, read others texts with critical eyes, evaluate the material, comment and provide meaningful responses” (I18). A student (I13) argues that the discussions also demands for being self-critical and provide constructive comments. Another student express it very clearly as “I have to a much larger extent considered what my co-students have written, than what I would have if I had been presented to the same material in a traditional teaching session” (I7). A number of students point to the collaborative effort like reflecting together and building upon each others contributions (I34) Others explained that they just find the method really rewarding - “I think this method should be used more often, as it enforces the students to discuss a given theme with each other, to look up articles and find new knowledge from other sources” (I14). The set-up with the demands and possibility to reflect and write and to read and consider are seen as possibilities that provides for better input compared to what is possible in a discussion in class where the overview is easily lost and inputs are less prepared for and less elaborated (I18). A student describe the process as “you need to illustrate your understanding” “when you reflect with your student peers it enlarges your horizon and your understanding” (I2). Despite the seen potential of reflection and argumentation a student argues that this form of learning process may be seen as artificial and with input matching the teacher’s attitudes more than one’s own (I33). Another put up an argument reflecting about whether a deeper level of analysis might be lost and substituted by “superficial presentations making up a patchwork” or if it is just a good thing to learn to use each other’s input (I36).

PBL and the experiment

Two students reflect on the relationship between the experiment and the PBL model. Both praise the PBL model especially the semester project work, which is seen as where the students really learn working with real problems and theory. One of the students argues that Web 2.0 is interesting in competition with PBL it is turned down. The other student argues that the principles behind the experiment design are the same as the ones known from the project work (I19). This student as well as others praises the experiment for providing a possibility for the students to work and activate the theory (I1), by combining academic themes with experiences and knowledge from other areas (I2) which provides for the broadest understanding (I31) or expressed differently “like the project work it has helped me to transform theories and thoughts into practice” (I35).

Socializing by transparency of contributions

Regarding the experience of the outcome more of the students describe how, the experiment creates insight into the resources of peers “which you normally haven’t access to in this form” (I27). More specifically addressed by a student as the others presenting their resources through “worked through and academically interesting posts” (I28). This student expressed that she feels sure that this insight challenge the prevailing understanding developed from the socializing in classrooms, gossip etc. The new knowledge is assumed to influence her openness towards working with more student peers than usual in the forthcoming semester group work. However, also the other way around, that some peers shows disappointing efforts making them less attractive as project work members. Apart from the transparency of resources interest of the peers also became more visible meaning “some participants discovered that other people in the group had similar academically interests ...” (I24).

Changed student roles

A student writes about the changed roles in the experiment arguing that the students become a sort of “expert”, very much like the lecturer, when they contribute with new angles and nuances on the different themes. Moreover all students contribute which provide a certain context (compared to many activities in class) (I1). The motivation to engage is further argued to the new roles “.. via these Web 2.0 media we are co-creating the teaching and the learning, as it is us, who creates the content of the discussion input” (I25). A student argues “instead of just believing

what I was presented I had a critical approach, probably because I don't see my peers with the same authority as my lecturers² (I7).

Quality assurance

In relation to the changed student roles a precaution mentioned by many is how best to secure the focus of the discussions and the quality of the contributions generated (I10, I24, I36). Quite a number of students argue for the teacher acting as a moderator securing focus and quality of content (I1, I33).

Web 2.0 learning qualifications

Despite this group of students being known as highly tech-savvy it turned out that some of them had rather limited experience in using Web 2.0 technologies such as blogs and twitter. Some of the students discuss how their current qualifications using Web 2.0 is challenged as the collaboration using Web 2.0 demands different ways of behaving in learning compared to the well known personal use of Web 2.0 technologies (I36). This challenge is related to the existing knowledge on how to use eg. a blog as a personal communication tool, whereas the blogs in the course represented shared ownership. A student felt that this was a whole new genre to him creating quite some frustrations. The actual use was seen as a mix of a personal and academic writing style, which some of the students found awkward and unauthentic. Others saw the experiment as an opportunity to develop Web 2.0 socializing and collaborating skills, which indicates a felt need.

For some it felt quite overwhelming to write and post their writings to the rest of the participants. A student argues that the collaboration demand felt quite challenging probably because the students had to use unfamiliar working methods. Another argues that he probably didn't get the full learning outcome as the Web 2.0 felt to strange to him. Along the same vein the student argues for the use of Web 2.0 across the different courses to support the interdisciplinary use that Web 2.0 invites for (I20). Others argue that this form of communication feel less binding regarding the writings which became less academic (I3). The reason stated is that you write in the present and it becomes more impulsive and less reflected (I3).

Identity

One of the students argues that the "Web 2.0 is like a "showroom" where you get the opportunity to show the rest of the world what you can"

(I16). This is very much in line with the argument about insight into peers resources however from the sender perspective. The use of Web 2.0 provides for “adjustments of your contributions meaning you can reach 100 % satisfaction with your utterances” (I16). This stands against the utterance of impulsive and less reflected input stated earlier on.

Two of the students argue that some students might be reluctant to participate because they “feel they cannot live up to stronger students” (I17). Or as another student argues that if you are not fit for fight and know you wont be able to produce a splendid performance then it is difficult to motivate one self to write in public (I27) or if you feel insecure about the demands, the type or amount of theory to be used or the length of posts (I27). On the contrary another student write that the interaction level in the experiment was higher than in the traditional lecture “where the students fear a rejection or being corrected” (I2).

Combining the personal and academic sphere

The blurring of the personal and the educational was by many seen as both challenged but also what provided additional engagement. A student argues “it is an interesting way to learn ... it becomes academically in a way where it is still possible to include your own experiences and positions ... making the theme more interesting” (I21). According to another student “when real people provide input it creates for validity and authenticity” (I15) however a third student argues that the contrary is at stake in the experiment; that the authenticity is lost, because the learning process and the utterances are artificial (I18).

Using Web 2.0 technologies as a motivational factor

Quite a number of students found it motivating to learn due to the use of Web 2.0 technologies “Web 2.0 media are part of our everyday life and therefore something that we can identify with and find relevant” (I25, I34). Another student argues that the relevance comes from the opportunity to “draw on competencies developed due to interest” (I24). It was also mentioned that the use of Web 2.0 made the process of learning work out smoothly and it did not feel like hard studying more like playing. A student states “when looking back on this process the lightness and the naturalness of the process strikes me with regard to the learning” (I13).

Other motivational factors affecting the experiment

A couple of students provides a related argument to the above mentioned arguing that the social needs and a profound wish to interact with others is an essential driver in the experiment (I16, I33). One of the students argues that this motivate to immersion, which results in good learning (I33). Whereas the other explains that the motivation raises due to socializing issues meaning when friends or student peers write then “we” also want to follow (I16). Another student argues that the motivation to read comments and follow up depends on who “like”ed it in Facebook as well as who already commented upon a contribution (I5).

Some students argue that an additional drive was created from making the students decide their own theme (I2), which they then had to “sell” to the rest of the group. This creates ownership, which again is argued to support the learning outcome (I23). The formal demands to pass the course are mentioned as a determining factor for the actually number of inputs. However, a student mentions that this was mainly important in the initiating phase of the discussion hereafter the inner motivation raised (I13, I16) meaning some students made more comments than formally required (I10). Yet another student writes that despite the good experience he fears “that there isn’t momentum to continue using blogs this way, without involving the lectures, to pose demands ...” (I17). Another student pose the question whether the felt obligation to participate in the physical classroom is present online (I32).

Flexible learning - time and space

The use of Facebook to post updates and invite the co-learners to read and comment had different effects. It helped keep the group updated on developments in the different discussions/new discussions, which due to the number of students was quite some. One of the students explained how this ongoing flow of posts created engagement and kept involvement high; others argued that they felt stressed due to a felt obligation to keep updated.

A student argues that the here and now debate is appealing and probably generate more involvement than in class discussion as the virtual setting provides for students to pose questions and input when they arise (I1, I22). These questions may generate immediate responses and raise a debate, which she feels is more giving, rather than trying to remember the questions and reflections for the next class (I22).

Others find that the use of personal and social software like Facebook used daily with friends and family blurs the border between study time and leisure time. Some of the students felt the presence of the discussions everywhere and all the time creating stress. The number of input rose exponentially with few in the beginning and a lot the last few days. Some students felt it was hard to follow the pace and keep updated on all developments and many of the students lost overview (I5, I33). As a consequence some of the students decided by themselves to focus on a few themes to have time to think and reflect on the developments here.

Web 2.0 technologies as learning platforms

The free choice of Web 2.0 platform resulted in use of blog, tumblr, wiki and Mahara. Some students experienced that some platforms were not really suited and that “you cannot argue in general that all Web 2.0 technologies are suitable for (social) learning” (I12). A student states that it is the learning design, which is the most important success factor (I30). As already mentioned the lack of knowledge of Web 2.0 technologies for learning had its effects on the experiment. A student argues that the preference for blog among the students may be related to blogs as one of platforms that the students are more familiar with (I19). The same student argues that a broader use of these media is necessary and he suggests that students are taught how to use them. A number of the students argue that it would be nice if these technologies were used across courses. But a student also sees potential in having a common blog or wiki integrated in single courses (I31). Using these technologies requires nice presentation of content and explicitly stated relevance according to one of the students (I32).

Discussion and conclusion

Using Web 2.0 discussions as a supplement in coursework may indeed activate the students and support their learning processes. The findings suggest that the learning generated works on multiple levels and in multiple ways. It may be argued that active contributing to Web 2.0 discussion supports *deep learning* both on an individual and a social level. Regarding the e-discussion that the individual student did not contribute to these have for some contributed to more superficial learning *introducing new themes* and inputs that may be returned to later on. A third learning process identified is *how to use the Web 2.0 technologies* in academic learning processes. This have been an issue as it both

challenges the established ways of using Web 2.0, as well as the traditional ways of learning during courses. Yet a fourth learning effect of the experiment is a *different form of socializing* within the group. The e-discussions create a transparent forum regarding the contribution of other students, which are used as an insight into each other's resources supplementing the knowledge from the in class discussions and the gossiping.

The students may participate in a number of different ways some directly traceable some not. The written contributions provide insight into some of the reflections, the search for new material and the interest of students. The students may however also read and reflect on other discussion without contributing to the discussion. Or they may even have made contributions without posting them.

Looking into the challenges seen from the perspective of the students we may identify the ones directly mentioned by the students however a number of challenges emerge due to the differences in how the students perceive the process hinting to a complexity of multiple processes and individual differences. Among the many issues reported the challenge mentioned by most students is the lacking qualifications to behave academically using Web 2.0 technologies, this supports the existing knowledge of the "digital dissonance" argued for by both Selway (2009) and Ryberg et al (2010). Another challenge mentioned by many students is the need to secure the quality of the content generated by the students. Many of the students fear that others write something, which is wrong and a number of students point to the teacher as a safeguard. We thus see a push from the students to keep the teacher in the role as the expert and authority rather than the teachers own as described by Collins and Halverson (2009). This is related to another challenge demanding the students to take on different roles being more co-teachers than just students, which demands for critical approaches to the material presented to others and judgment of others input. A couple of students argue that it is possible to be critical in constructive ways but probably this process is helped by the fact that the students know each other. Some felt that writing in this forum was less stressful due to a lighter academic form and the possibility of preparing input. One student even expresses less fear of loosing face; this input is probably related to the group of students or the learning design and the very positive but still critical style of comments. But it may also point to a felt difference between perceiving feedback in person or virtually. Other students felt rather uneasy about writing "in public" being afraid of flashing their lack of competencies

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regarding the knowledge of the theme or how to use the media. Some of the data reveals that the writings do seem to influence the others perceptions of how clever and hard working a student you are based on your contributions.

The flexibility of the E-discussions was seen as an important issue meaning students could work and learn as the inspiration came. However as seen in many other areas this flexibility may create stress and some students developed strategies to cope. Likewise the huge number of e-discussions and input made the workload explode on the way. This problem is directly related to the design of the experiment. But again the students found shortcuts to deal with this, finding ways to select which discussions to follow and creating a number of different ways to participate as mentioned above; active participation, just keeping informed or skipping discussions.

Conclusion

Using Web 2.0 as platforms for supplementary e-discussion in coursework in higher education may indeed create for active participation and learning. Learning from participation in e-discussions operates in a number of different ways supporting

- reflections individually and socially by generating contributions on specific themes
- overview of interesting issues in other themes
- E-socializing – gaining insight into resources of peers
- learning how to participate in educational Web 2.0 discussions

The required processes within the different types of participation in the academic e-discussion as framed within the experiment are

- active participation in discussions writing posts, reading others input, searching and selecting additional material, writing and reflecting on the contributions.
- following others discussion by reading and thinking about the content.
- skipping discussions meaning not following some of them

A number of challenges have been identified some are directly related to the specific learning design of the experiment others are related to the immature and upcoming knowledge on how to use these new technologies for educational purposes and yet others are more profound. The challenges identified are

- lack of knowledge and experiences on how to use Web 2.0 for learning purpose
- dealing with the stress of ubiquitous learning
- ensuring authenticity in discussions
- ensuring relevance and quality
- voluntary versus enforced use
- creating a constructive learning culture
- be specific about requirements

Limitations and further research

Further research is needed in a number of different areas. Looking into individual differences in learning using Web 2.0 discussions seems promising. Another area of interest is how to generate the necessary motivation to make the students use Web 2.0 learning tools for social learning voluntarily.

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References

- Clark, W., Logan, K., Luckin, R., Mee A. & Oliver, M. (2009). Beyond Web 2.0: mapping the technology landscapes of young learners. *Journal of Computer Assisted Learning*, 25 pp.56-69.
- Cochrane, T. (2008). Mobile Web 2.0: The new frontier. Proceedings ascilite Melbourne
- Collins, A. & Halverson, R. (2010). The second educational revolution: rethinking education in the age of technology. *Journal of Computer Assisted Learning* 26, pp. 18-27
- Conole, G. C. and Alevizou, P. (2010). A literature review of the use of Web 2.0 tools in higher education. The Open University, Walton Hall, Milton Keynes, UK. A report commissioned by the Higher Education Academy
www.heacademy.ac.uk/assets/EvidenceNet/Conole_Alevizou_2010.pdf accessed april 2011

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- Dohn, N. B. (2009). Web 2.0: Inherent tensions and evident challenges for education. *Computer-Supported Collaborative Learning* 4, pp. 343-363.
- Dohn, N. B. & Johnsen, L. (2009). *E-læring på web 2.0*. Samfundslitteratur, Frederiksberg
- Goldkuhl, G & Cronholm, S. (2010). Adding Theoretical Grounding to Grounded Theory: Toward Multi-Grounded Theory. *International Journal of Qualitative Methods* vol.9 no. 2, pp.187-205
- Illeris, Knud (2007). *Læring*. Roskilde Universitetsforlag, Frederiksberg
- Kvale, S. (1990). Det kvalitative interview in Andersen, I. (ed.) *Valg af organisations sociologiske metoder – et kombinationsperspektiv*, Copenhagen: Samfundslitteratur, pp. 215-240.
- Ravenscroft, A. (2009). Social doftware, web 2.0 and learning: status and implications of an evolving paradigm. *Journal of Computer Assisted Learning* issue 25. Pp.1-5.
- Ryberg, T., Dirckinck-Holmfeld, L. and Jones, C. (2010). Catering the needs of the “digital natives” or educating the “Net Generation”. In Lee and McLoughlin (Eds.). *Web 2.0-based E-learning: Applying Social Informatics for Tertiary Teaching*. IGI Global.
- Selwyn, N. (2009). Challenging educational expectations of the social web: a Web 2.0 so far? *Nordic Journal of Digital Literacy* nr.2. www.idunn.no/ts/dk/2009/02/art04?mode=print&skipDecorating=true&textSize=default accessed april 2011
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance learning* vol. 2, no.1.
- Wenger, E. (1998). *Communities of Practice. Learning, Meaning, and Identity*. Cambridge University Press.

Developing metrics for analyzing IT supported student-teacher interaction in higher education

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Abstract: Widespread use of technology is changing the way we work, learn, and communicate. In higher education, technology has had, and no question will continue to have, a significant impact on the conditions for learning and consequently on how teaching is conducted. In general, we like to think that the adoption of IT in higher education is increasing, but we also acknowledge that there are significant differences between countries, schools, and teachers. But how can we operationalize and measure the use of IT? In this paper we want to initialize a discussion of how to develop relevant metrics for teachers' use of IT for interaction with students. The discussion is based on an ongoing survey of the use of IT in Higher Education at two Swedish Universities.

Introduction

Earlier studies suggest that when the majority of the teaching staff has adopted ICT, it is mostly used to support and improve existing practices, rather than to radically change them. It is becoming apparent that, in campus-based contexts, teaching staff appropriate those technologies which they can incorporate into their teaching activity most easily, that offer affordances for what they already do, rather than those which radically change teaching and learning practices (Svensson, 2002; Kirkup & Kirkwood, 2005). However, we have reason to believe that this is something which is in rapid transition. Entrenched organizational cultures may be one hurdle, as faculty members accustomed to traditional modes of instruction may be disinclined to change. The "digitalization" of the educational setting is of great interest in academic research and special attention is paid to how teachers' pedagogical beliefs may serve as a barrier to successful technological adaptation (Mumtaz, 2000, Ertmer, 2005).

The adaptation process for new technology is not yet well understood. Many studies have traditionally been focusing on one specific technology and how it is adapted and diffused within an organizational setting. These case studies have reported of collaborative technologies (Majchrzak et al, 2000), radiology systems (Barley, S. R. 1986), technologies supporting productive operations (Tyre M., J. et al 1994) and many more. While the above studies examined adaptation of one specific technology the current study focuses on the adaptation of concurrent and intertwined subsets of educational technologies within the higher education. We argue that in order to fully understand the diffusion and adaptation of technology you need to consider these interrelations between existing technologies. The technology acceptance model (TAM) has been a dominant perspective by virtue of its explanatory power, simplicity, and parsimony. TAM extends the beliefs-attitude-intention framework widely in terms of two core cognitive beliefs: users' perceptions of the usefulness and ease of use of the target IT. TAM suggests that IT usage behavior is primarily influenced by the perceived usefulness and ease of use of the target IT. (Bhattacharjee, A. & Harris, M., 2009).

Substantial efforts have been made during the past decades to push IT into educational settings (Selwyn, 2000). At the moment we see the increasing use of information technologies for bridging distance in educational settings. In the inaugural issue of the Distance Education Journal Keegan (1980) attempts to form a definition of distance education. The main elements of distance education are: teacher and learner separation, as opposed to face-to-face lectures, educational organization i.e. making in an education, use of technical media allowing two-way communication, possibility of occasional meetings (ibid.). Today this would include most courses in Swedish HE, not only those labeled as distance education. In previous studies of the use of IT in education you will find several

studies addressing the role of distance technology in distance education, but almost none which specifically looks at the use of distance technology in campus based education.

Much attention have been devoted towards a discrepancy between promises of IT's positive effects in educational settings and actual changes within the practices. Such a debate does not take our understanding of what is actually happening with IT in HE very much further (as suggested by Kirkup & Kirkwood, 2005). HE teachers seem to have a high level of freedom to choose whether or not to implement IT in their everyday practices. The introduction of digital technologies in many other work practices have meant replacing previous ways for conducting work, leaving little or no choice to the workers whether or not to use the new technologies. A teller at the bank could not chose not to use the computerized banking system, a police officer would not be able to file information on paper, or a x-ray technician would have to adapt to a new digital system for dealing with pictures taken. This leaves much room for different levels of appropriation among teachers, something which suggest only minor changes of everyday practice. "It is becoming apparent that, in campus-based contexts, teaching staff appropriate those technologies which they can incorporate into their teaching activity most easily that offer affordances for what they already do, rather than those which radically change teaching and learning practices." (ibid. p. 4). Such an explanation is much more plausible than the common, stereotypic ones, of teachers being less capable than students, inept or technophobic (as discussed in Mumtaz, 2000).

The study presented in this paper is ongoing and we have, so far, collected 1316 answers from two Swedish universities. The main purpose of the study is to investigate the actual use of IT in teacher-student interaction, but we also include questions concerning the use of IT among HE teachers more generally. In the study we want to explore some hypotheses concerning the use of IT among HE teachers:

The first statement to test is based on Ertmer's (2005) reasoning concerning teachers pedagogical beliefs: *Teachers that use information technology more frequently are those that might see the pedagogical use of these technologies. And, Teachers that see pedagogical use are not only more inclined towards using technologies to a larger extent, but also to use more technologies.* I.e. the positive attitude towards IT in education relate to a larger repertoire when it comes to using IT.

The second statement that we will explore is drawn from one of the premises of this paper: *teachers in distance education employ more IT support in their teaching than campus teachers do.* As distance education teachers have no other ways for communicating with their students other than technology mediated ones, it would be likely that they would use technology more frequently for interacting with students. It would also be likely that they would see the value of this use, as it provides an opportunity otherwise not available.

To be able to explore these we need some useful metrics for understanding the use of IT in the context of higher education. Let us give one example to further explicate the problem: teacher A reports sending 10 e-mails during the 5 week course. 10 students are taking the course and the teacher works 20 hours with the course during the 5 week period. Teacher B reports sending 100 e-mails during a 2 week course. 400 students are taking the course and the teacher works 80 hours with that specific course. Which one of these could be understood as having the highest use of e-mail in their everyday teaching? This paper will explore possible ways for understanding technology use, which will make it possible to explore the above presented statements in future work.

Data Collection

The data have been collected through a survey posted at two Swedish universities:

University West (Alpha)

The university was founded in 1990, and at present 10 000 students are enrolled, of which approximately 20% study via distance education. The University has a faculty of about 400 employees. Since 1998, an in-house developed learning management system (LMS) has been used at the Alpha. Today the platform is used in all courses.

Gothenburg University (Beta)

The university was founded in the late nineteenth century. Beta currently enrolls 37 000 students and employs about 2500 faculty members. Since 2009 Beta have been using a university wide LMS in most of the courses.

The questionnaire

Table 1 shows a schematic view of the structure and content of an online questionnaire that was distributed to the respondents at the two universities. The respondents were instructed to assess their use of email, learning management system and other ICTs during the most recent course they participated in. Frequency and purposes of use were rated in a five step ordinal scale. The list of 35 ICTs and software in part D of the questionnaire was derived from an open-ended pilot survey where eight informants contributed.

	Content Categories	Variables
A	Demographic and contextual information	Gender, Age, Educational Area, Job description, Teaching Experience, etc.
B	E-mail use	Frequency and Purposes of Use
C	Use of LMS	Frequency and Purposes of Use
D	Knowledge and Use of other ICTs	Video-conferencing, digital photo, streaming media, social media, blogs, wikis etc.
E	Attitudes towards using ICT in Higher Education	Allows for flexibility in working hours. Positive for students' learning. Helps developing pedagogical skills.

Table 1: Structure and Content of the Online Questionnaire

The Respondents

During a period of six weeks, an invitation to participate in the survey and three reminders, were sent out to 4128 persons. The definition of the population was set to include all teaching staff at the two universities. It is difficult to calculate the exact size of the actual population. People might be involved in teaching without having a permanent position at the university, such as guest teachers, practitioners involved in teaching, etc. We also discovered that the lists used for distributing the survey contained many people no longer working with teaching, retired people, as well as many e-mail addresses that simply were incorrect.

A total of 1806 responses were collected. Among these 1806, 490 stated that the questionnaire was not relevant to them, for example, they might not be involved in teaching at all. This leaving us with 1316 fully completed questionnaires. The gender distribution was fairly equal with 47% female and 53% male, and 90% are between 29-64 years old. About 60% of the respondents were working with a small group of students with 40 students or less. Only 8% of the respondent stated they were working with large groups with 100 or more students.

Most courses (88%) on the universities give 1-15 credits and 70% of all the courses have a study pace of 100%. Combined they form a result that 61, 4% of all courses runs at 100% and has a length of 1-10 weeks. 9% of the respondents have reported that their most recent course was held online as a distance course.

We are at the moment in the process of conducting a structured analysis of a randomly selected subset of the non-respondents, which will be completed during April 2011

Exploring the Teachers' use of IT

In this paper we focus on illustrating how teachers' use of IT varies with respect to email, LMS and other technologies.

Use of email

Figures 1 and 2 show that there is a fairly large variation in number of sent and received email during a course-week, even though close to 50% of the respondents report to both receive and send 1-5 email per week. The striking resemblance between the distributions in figure 1 and 2 is further underlined by the fact that sent and received emails correlate with a coefficient of +0.852, and the linear regression model shows that there exist conformity between the use of email and the use of LMS. ($R=0,86S+1,0$, R=number of received emails and S=numbers of sent emails). In other words teachers seem to be sending equally many emails as they receive; regardless of whether they receive no, few or many email. It is also worth noticing from figure 1 that close to 10% received no email.

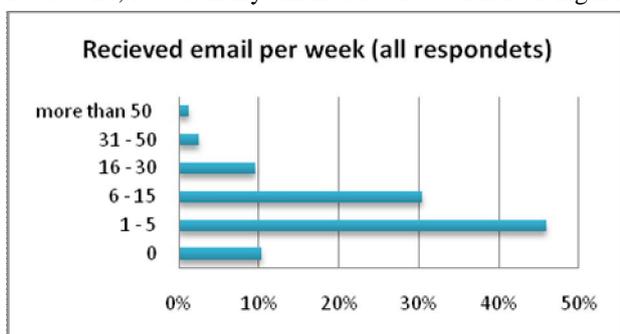


Figure 1. Received email per week (all respondents)

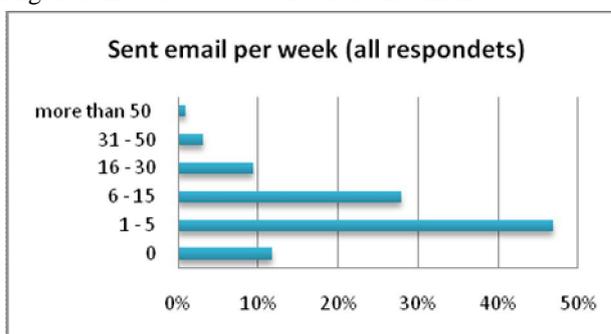


Figure 2. Sent email per week (all respondents)

Adding a filter

When looking at the profiles of the respondents it became clear that many of them reported having spent very few working hours on the course, whereas other had worked only in the role of supervisors for smaller group of students. In order to proceed with the analysis having a more homogeneous group of respondents, we decided to filter out the respondents with less than 10 working hours as well as the ones that did not state that they acted in the role as lecturers. Having applied that filter, the total number of respondents went from 1316 to 1076, and in figure 3 and 4 the distribution of incoming and outgoing email in the filtered response population is shown.

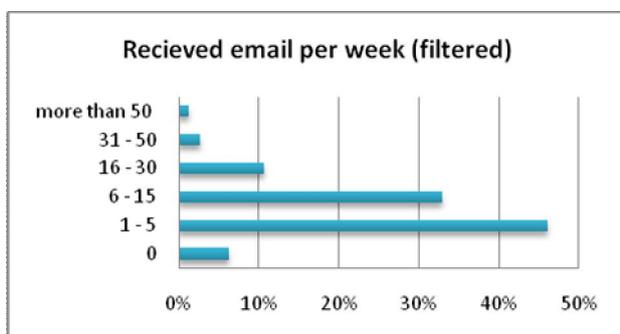


Figure 3. Received email per week (lecturers – more than 10 hours working time)

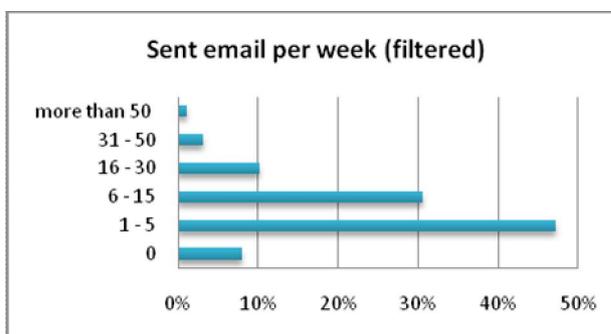


Figure 4. Sent email per week (lecturers – more than 10 hours working time)

As could be suspected, most of the respondents that were filtered out had reported having received and sent no email, and consequently this group was reduced substantially. Still, the general pattern of the distribution is similar, both for received and sent email. We will continue to use our filtered group of respondents in the following presentations of data in this paper.

As for the question regarding the purpose of the email use, figure 5 shows that the email is used for several different purposes, over 80% of the respondents have stated that they use email often or a few times for contacting individual students (81%), answering questions about management of the course (85%) and questions about the course content (83%).

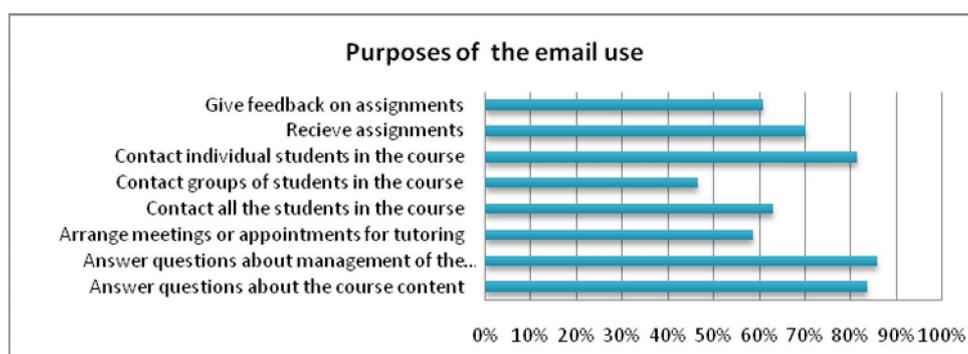


Figure 5. Purposes of the email use

Use of LMS

Turning the attention to how our filtered group of respondents have reported using the LMS, we were interested both in how frequently they used the system (logged in), and also the scope of use (i.e. how many of the possible functions that were used). Figure 6 shows the distribution with respect to frequency of use. It is worth noticing that close to 20% of the respondents report that they do not use login to the LMS at all, and well over 50% login several times a week or on a daily basis. The scope of LMS is more difficult to illustrate. Partly because the two systems used at Alpha and Beta are partly different in terms of the functionality available to the teachers, and partly because the teachers at Beta do not have total control over what functionalities can be activated on their courses since this to some extent is regulated by system administrators at each department. However, figure 7 shows an overall graph of how many functions the respondents have started to use once or several times, regardless of what system has been used. Figure 7 shows that there is a variety in how many functions the respondents use in the LMS, more than 55% have reported that they use between 2-6 functions. The most central functions that are common to both systems are: (i) The possibility to publish static course information such as literature lists, schedule, and course curriculum, (ii) The possibility to publish course material such as lecture slides or links to various web resources, and (iii) The possibility to publish a discussion forum (text-based threaded asynchronous communication). In tables 2-4 the use of these LMS-functions are illustrated.

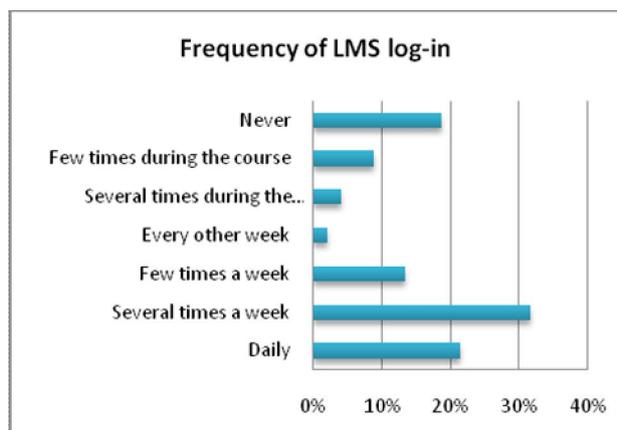


Figure 6. Frequency of log-in to the LMS

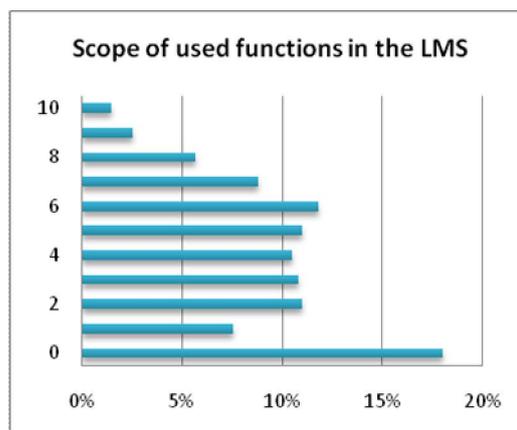


Figure 7. Scope of used functions in the LMS

Did you publish static course information?

Yes	71.2%
No	28.8%

Table 2. Use of LMS for course information

Did you publish course material?

Yes, often	50.9%
Yes, a few times	22.5%
No, have chosen not to	17.9%
No, Did not know I could	8.7%

Table 3. Use of LMS for course material

Did You use the Discussion forum?

Yes, often	15.3%
Yes, a few times	16.9%
No, have chosen not to	53.5%
No, Did not know I could	14.3%

Table 4. Use of LMS for discussion forum

Use of other technologies

When looking at the respondent's use of other technologies it is clear that teachers use more than just email and LMS in their education and communication with students. Most frequently used other technologies are presentations programs (e.g. PowerPoint) (74,3%), scientific databases (51,1%), online encyclopedias (33,3%), online forums (message boards) (29,8%), self captured digital photos (29,8%), other self made digital material (27,4%), chats and instant messaging services (27,1%), mass media online (e.g. newspapers online) (20,7%) and video hosting services (e.g. YouTube) (20,1%). Less frequent used, but still worth mentioning are the social media and Web 2.0 services like blogs (7,8%), co-authoring services (e.g. Google docs) (6,7%), Facebook (4,8%) and Twitter (1,2%).

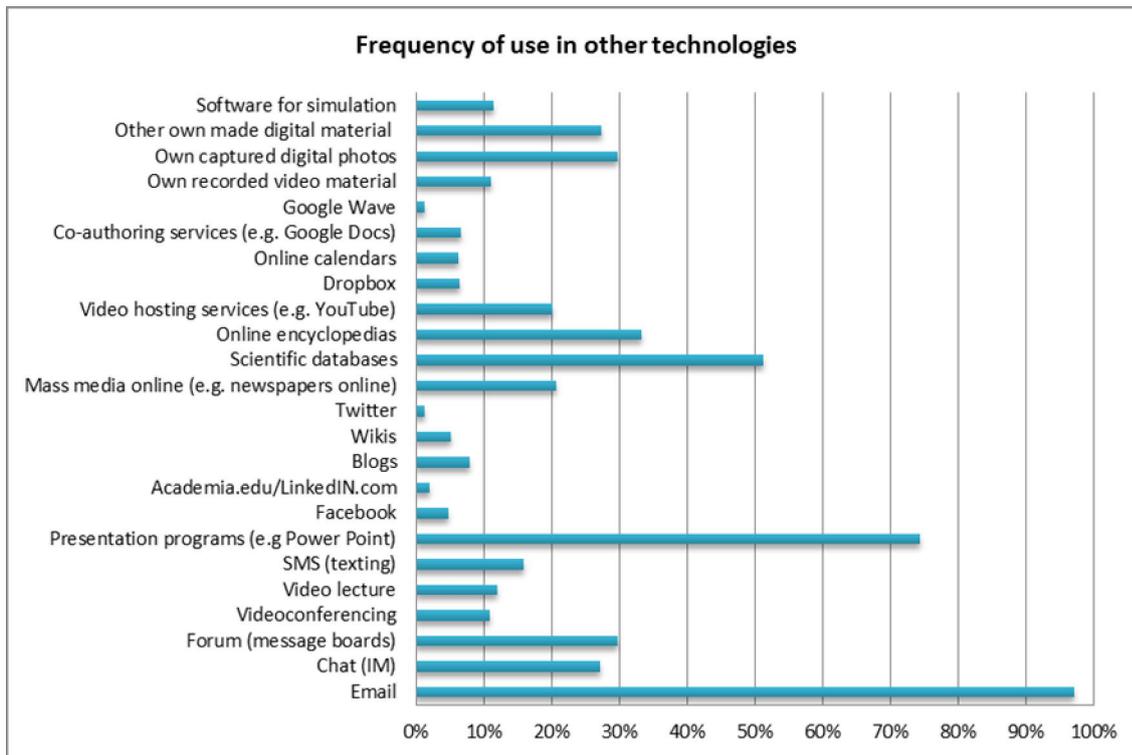


Figure 8. Percentage of use of other technologies

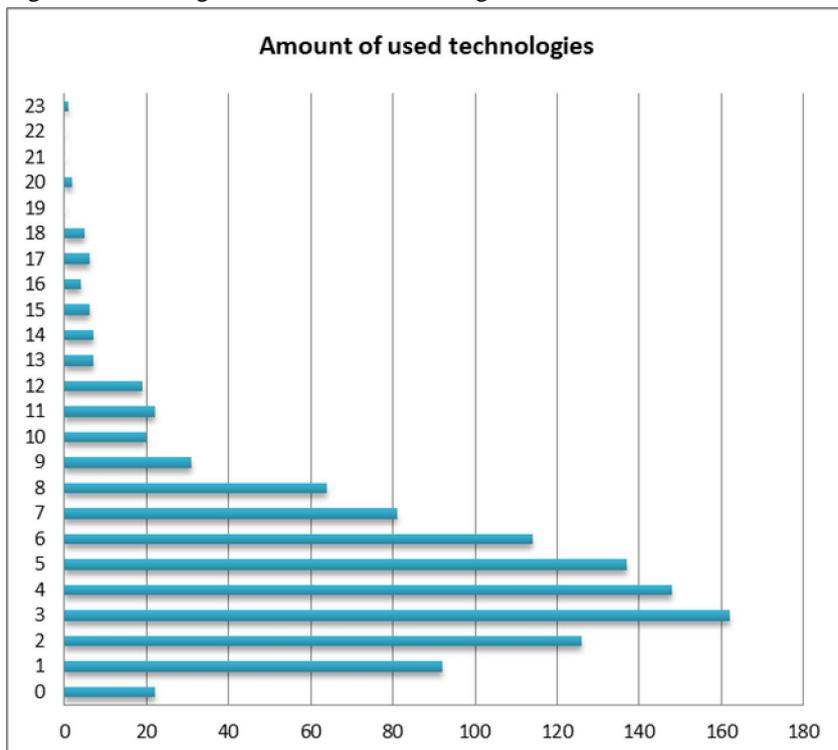


Figure 9. Amount of technology use per person

Operationalizing IT-use

It is a complex problem of understanding and defining amount, frequency, and scope of IT use. Faculty's use of IT within their educational settings is embedded in their daily practice and it is not normally something that they reflect upon. Since the courses, on which the teachers base their responses, vary with respect to how many students that participated and how many hours each respondent spent working with the course there are several variables that potentially influence the use of IT (A-D). For each of the variables we illustrate the complexity of operationalizing IT-use by presenting representative quotes from the open-ended comments made by the respondents.

- A. The amount of sent & received email/working hour
- B. The amount of sent & received email/student
- C. The use of LMS/hour
- D. The use of LMS/student

A. The amount of sent & received email/hour

The email use varies during different parts of a course, sometimes the teacher use a lot of email before the course starts or in the end of a course for example. These different use patterns that relates to the time variable affect the analysis of the data. The following quotes illustrate this problem:

"(Email use) varies within different parts of the course, in average there are not many but occasionally there are a lot of emails"

"Once the course has started I use only the LMS and the PIM system, so I use email only before the course has started."

B. The amount of sent & received email/student

Our data shows that the amount of the student groups has great impact on the amount of email being sent and received by the respondents. When there are many students in a course it is very difficult to keep up with frequent email communication.

"In a course with 120 students it is not possible to deliver messages via email."

"(Email use) can be very hard-working if it is individual communication with many students."

When there are few students in a course email seem to be a fruitful way to communicate:

"In courses with few students email is an effective way to communicate... The students don't need to log in to the course website, they know that they get the latest information straight into their inbox."

C. The use of LMS/hour

Teachers with many working hours in a course is often also responsible for course administration and general information to the students, which adds an administrative overhead to the LMS use.

"The LMS works perfect in the beginning of a term, to publish the schedule and the course plan."

D. The use of LMS/student

The size of the student groups that the respondents work with matters when it comes to LMS use. The data indicates that large student groups increase their use of LMS systems but when the students are few their use of LMS can be ineffective:

"The students in my course are few, and I choose to communicate with them via email instead."

"I have used the LMS system in a course that has 110 students and in that course it is absolutely necessary to use the LMS, which we have not in the advanced course with only 30 students. "

Correlating the variables

As the above section shows there are many different interdependencies between the variables. In order to understand the amount and the patterns of IT use amongst the teachers the next step when analyzing the data is to correlate the key variables with each other. In the next section we will define the key variables, discuss how to combine them and show the complexity related to this part of the analysis.

The volume of the IT use

A first and somewhat obvious hypothesis would be to suspect that the number of emails sent by a teacher depended on the number of students in the course group. However our data strongly falsify such a claim since the determination coefficient is 0,020 i. e. only 2% of the variation in email use can be explained by variation in number of students. A second interesting relationship relates to comparing use of email with LMS use. Here one might expect a positive correlation i.e. people sending many emails also being frequent LMS users. However, the above quotes together with the lack of influence on email use by group size could also support the idea of a negative correlation or a reciprocal relationship i. e. an increased use of one technology is at the expense of the other. In order to further explore this we grouped the responders into non-users, users and power users regarding how many email they sent and how often they used the LMS. It is of course to some extent arbitrary where to draw the line between a user and a power user. But for the purpose of this study a power user of email was defined as someone sending more than 15 student interaction email/week. Similarly, a power LMS user logs on to the course area at least on a daily basis. In table 5 we can see that 59% of the responders are classified in the same category regarding both their use of email and LMS (68 power users, 511 users and 33 non users). 19% of the responders use email less than they use the LMS (153+46+3) and 22% use email more than they use the LMS (67+14+147). A chi-2-test for independence clearly proves that email use and LMS use are dependent variables ($p=1,5*10^{-18}$) but table 5 gives a somewhat mixed message to the nature of this dependency. On one hand there is support for positive correlation and on the other hand there is also some support for a reciprocal relation.

		Email		
		<i>Power user(149)</i> send more than 15/week	<i>Users(811)</i> Send 1-15/week	<i>Non users(82)</i> send 0/week
LMS (1042)				
<i>Power user(224)</i> daily	68	153	3	
<i>Users(624)</i> few or several times during a course	67	511	46	
<i>Non users(194)</i> 0 times during a course	14	147	33	

Table 5. The volume of the IT use (all respondents)

The open-ended comments indicate that at least some of the teachers that have large groups of students use less email for interaction and instead use their LMS in their interaction with the students. In order to investigate how student group size affects the relationship between email and LMS use we have separated the teachers that have reported having large groups ($n=220$) in their course (75-800 students). We have also filtered out the teachers that have small groups ($n=215$) in their course (1-19 students). In table 6 and 7 the use of email and LMS is presented for large and small groups of students.

Email

	<i>Power user(46)</i> <i>send more than</i> <i>15/week</i>	<i>Users(155)</i> <i>Send 1-15/week</i>	<i>Non users(19)</i> <i>send 0/week</i>
LMS (220) <i>Power user(72)</i> <i>daily</i>	28	44	0
<i>Users(107)</i> few or several times during a course	14	85	8
<i>Non users(41)</i> 0 times during a course	4	26	11

Table 6. The volume of the IT use (large student groups)

	Email		
	<i>Power user(16)</i> <i>send more than</i> <i>15/week</i>	<i>Users(181)</i> <i>Send 1-15/week</i>	<i>Non users(18)</i> <i>send 0/week</i>
LMS (215)			
<i>Power user(32)</i> <i>daily</i>	8	23	1
<i>Users(124)</i> few or several times during a course	6	107	11
<i>Non users(59)</i> 0 times during a course	2	51	6

Table 7. The volume of the IT use (small student groups)

The data strengthens what the open-ended comments indicates, that teachers within large student groups more often than in smaller groups tend to be high users of LMS systems when interacting with the students. In large groups of students 33% of the respondents are power users of LMS compared with 15% in the small groups. The use pattern of email use are quite similar between the two filtered groups, 21% of the respondents in the large student groups are power users of email and 8% are non users compared to 7% high user and 8% non user within the small student groups.

When looking at the non users of LMS our assumptions strengthens a bit more. In the large student group the non users of LMS are 19% compared to 27% in the small student group. It may also be worth mentioning that 3% of the non users of LMS in the small student group are high users of email compared to 1,8% in the large student group which confirms that teachers with smaller groups of students that do not use the LMS use email more to communicate with their students.

The width of the IT use

Another interesting correlation concerns the width of the IT use, which can be related to our first hypothesis, Ertmers (2005) reasoning "Teachers that see pedagogical use are not only more inclined towards using technologies to a larger extent, but also to use more technologies". A wide usage of one technology, for example using email a lot and in various purposes or using several functions in the LMS is strongly related to the users interest in using other technologies, as table 8 demonstrates. We have categorized the respondents in three types of usage in LMS, email and other technologies, wide use, medium use and narrow use. Since the numbers of functions available in the LMS and presented in the survey differs between university Alpha (8 functions) and university Beta (10 functions) the measure of usage had to be change to percentage of use instead of amount of used functions. A wide use of the LMS is therefore categorized as using 75-100% of the functions and those who use 0-12,5% of the functions are categorized as narrow use. As table 8 shows, the width of LMS use and the width of use in other technologies is somewhat related, 57% of the respondents are classified in the same category (66 wide use, 477 medium use, 63 narrow use). 30% use a wider range of other technologies than their width of LMS use (105+23+189) and only 13% are using the LMS more than they use other technologies (97+3+43). Worth noticing is that only 3 respondents of the wide users of the LMS are classified as narrow users of other technologies.

Use of different functions in LMS (total respondents 1066)			
	Wide use (166) <i>Use 75-100% of the functions</i>	Medium use (625) <i>Use 20-70% of the functions</i>	Narrow use (275) <i>Use 0-12,5% of the functions</i>
Other technologies (1066)			
Wide use (194) <i>Use 8-23 other technologies</i>	66	105	23
Medium use (763) <i>Use 2-7 other technologies</i>	97	477	189
Narrow use (109) <i>Use 0-1 other technologies</i>	3	43	63

Table 8. The width of the IT use, LMS and other technologies (all respondents)

Another aspect of the IT-width is to examine how the use of different functions in the LMS correlates to email use, e.g. for how many different purposes the respondents use their email communications with students. Table 9 shows that the relation between the width of email use and LMS use to 56% correlates (52 wide use, 463 medium use and 69 narrow use). 19% (94+34+164) uses their email in a wider range than they use the LMS and 16% (108+5+60) has a wider usage of the LMS than their email use.

Use of different functions in LMS (total respondents 1049)			
	Wide use (165) <i>Use 75-100% of the functions</i>	Medium use (617) <i>Use 20-70% of the functions</i>	Narrow use (267) <i>Use 0-12,5% of the functions</i>
Use of email for different purposes (1049)			
Wide use (180) <i>Use email to 8 purposes</i>	52	94	34
Medium use (735) <i>Use email to 3-7 purposes</i>	108	463	164
Narrow use (134) <i>Use email to 0-2 purposes</i>	5	60	69

Table 9. The width of the IT use, email and LMS (all respondents)

Conclusions and further work

As illustrated through the descriptive statistics and the respondents' open-ended comments, teachers' use of IT for student interaction is complex to grasp and frame. Different communication channels appears to be supplementary and sometimes also in conflict. In further analysis we will attempt to derive a model for IT use that can help us further investigate the statements presented above, and also to enable longitudinal studies of how teachers' use of IT change over time.

One important aspect of technology adoption may be that the adoption of technology has passed the self-sustaining point on Rogers' diffusion of innovation adoption curve (1995). The early adopters at the universities have blazed the trail. The early majority has proven that information technology is effective. And now, as our data shows that 81% of the respondents report that the time that they use IT to communicate with the students are well spent, the technology is simply being integrated by the late majority as just a part of their pedagogy.

References

- Barley, S. R. (1986) "Technology as an occasion for structuring: Evidence from observation of ct scanners and the social order of radiology departments," *Administrative Science Quarterly* (31), 1986, pp. 78-108.
- Bhattacharjee, A. & Harris, M. (2009) Individual Adaptation of Information Technology. *The Journal of Computer Information Systems*
- Ertmer, P., A. (2005). *Teacher Pedagogical Beliefs and Classroom Technology Use: A Critical Link*. Purdue University
- Keegan, D. (1980). On defining distance education. *Distance Education*, 1(1), 13-36.
- Kirkup, G. & Kirkwood, A., (2005). Information and communications technologies (ICT) in Higher Education teaching – a tale of gradualism rather than revolution. *Learning, Media and Technology*, 30(2), pp. 185–199.
- Majchrzak, A., Rice, RE., Malhotra, A., King, N. (2000). Technology adaptation: The case of a computer-supported inter-organizational virtual team. *MIS quarterly* 2000
- Mumtaz, S. (2000). Factors Affecting Teachers' Use of Information and Communications Technology: a review of the literature. *Journal of Information Technology for Teacher Education*, Vol. 9, No. 3, 2000
- 010R - Universitet och Högskolors Årsrapport 2010, Högskoleverket (In Swedish).
- Rogers, M., (1995). *Diffusion of Innovations*. The Free Press A Division of Simon & Schuster Inc.
- Selwyn, N. (2000). Researching computers and education - glimpses of the wider picture. *Computers & Education*(34), 93-101.
- Svensson, L. (2002) *Communities of Distance Education*, Doctoral Thesis, Gothenburg University Series in informatics (no 25)
- Tyre, M., J. & Orlikowski W., J. (1994). Windows of opportunity: Temporal patterns of technological adaptation in organizations. *Organization Science*, 1994.

CRITICAL SUCCESS FACTORS IN BUSINESS PROCESS MANAGEMENT – A literature review

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Abstract. Assessing the critical success factors (CSF) during a business process management (BPM) effort will help an organization to understand the reasons why a particular BPM effort may succeed or fail. The traditional BPM perspectives have a problem of focusing on internal actions in organizations that seem to contribute to delivering outcomes to customers. Organizations spend time focusing on those actions without realizing that they do not necessarily contribute to successful customer outcomes – emphasis is on fixing the causes of work rather than their effects. The tendency in the field seems to be putting more emphasis on customer-focused results that go beyond basic customer satisfaction measurements, as customer relationships and engagement are better indicators and measures of future success of the organization. This paper goes through the business process management literature from the previous decades and synthesizes the change of focus and the critical success factors in the literature. We find that there has been a watershed period in the 21st century when the focus shifted from Inside-out perspective of organizations to Outside-In. BPM has several challenges over many categories like organizational, managerial, information systems and social problems. This has led into difficulties of clearly categorizing and making critical BPM factors general. The contribution of this paper is to provide perspective on the business process management capabilities (BPMP) that affect successful BPM endeavors.

Keywords: success factors of BPM, business process innovation, business process management, success factors, process development, business process management capabilities.

1 Introduction

(Business) Process management is almost a hundred years old concept (Shewhart, 1931). The basic idea of business processes and their management has been to create value for the customer through activities in an organization (Hammer & Stanton, 1999) and to fulfill other strategies like generating returns to stakeholders (Guha & Kettinger, 1993; Strnadl, 2006). The development of process methodologies started in the 1970s. Business Process Reengineering/Management (BPR/BPM) and other methods were introduced from the 1990s onwards. Business process management has stayed on the surface of business management concepts throughout the years. According to the latest research, business process management is going to be the top development priority in organizations at least until 2013, and after that change management will take the lead, but BPM will still stay second (Oracle, 2008). Change management and BPM can be seen interrelated since BPM is designed to change the functionalities of the organization with the support of change management.

Palmberg (2009) finds that even the practitioners have different perspectives on what business process management really is. 'Business' refers to the nature of an action, which is to accumulate wealth through one's work. 'Process' is described in different ways depending on the author. At least these components can be identified in different definitions of 'process': input and output, interrelated activities, horizontal: intra-functional or cross-functional; purpose or value for customer, the use of resources, and repeatability (Palmberg, 2009). An important point in process thinking is not to make people to do more, but to do things differently, so that an increased value comes through the process (Laamanen & Tinnilä, 2009).

The focus in BPM is mostly into 'management' of the processes and ensuring that processes are able to provide the benefits that are important to the customers. Organizations recognize the value of BPM as a way of attaining strategic alignment and as a means of creating and implementing business strategy (Ariyachandra & Frolick, 2008). Even though process improvement may cause revolutionary changes in an organization, it should never be uncontrolled. From the BPM capabilities perspective, categorization of success factors is more important than actual categorization of processes. However, categorization of processes is also an important matter in organizations, which have several core or strategic processes.

In this paper we are assessing the success factors of BPM through a literature review. From the literature review arises a question regarding the factors that contribute to the success of BPM. Next we will look into the theories behind BPM and then describe the Outside-In perspective on process improvement. Finally, we draw together the capabilities for successful BPM based on these success factors.

2 The History and Future of BPM

Towers (2010) suggests that there has been several waves in process management development, starting with Total Quality Management, and continuing with Business Process Improvement, Business Process Reengineering, Six Sigma, Lean, BPM itself and Outside-In approaches. Each of these waves has brought something new into the landscape of process management. Importantly, the tendency has been a development from task centricity towards customer centricity. This development which started in the 1970s is still continuing. This paper focuses mainly into BPM and Outside-In approaches.

The discussion around BPM necessarily also touches the concept of business process reengineering (BPR). BPR has existed as a term since the 1990s (Hammer M., 1990; Davenport & Short, 1990), but there have been several definitions of it over time and therefore

its meaning is still somewhat vague (Zairi & Sinclair, 1995). BPM is seen more as a holistic approach to processes (processes themselves, resources, roles, people, infrastructure and other aspects of overall process management), whereas BPR is more focused on optimizing processes (Hammer & Stanton, 1999). Choi & Chan (1997) conclude that there is consensus that, in performing reengineering work, BPR should aim at achieving a dramatic improvement – proactive and radical redesigning of the business actions. Business process reengineering is seen more as a rapid and dramatic performance improvement effort than as an incremental improvement (Ardhaldjian & Fahner, 1994). It is intended for improving product and service quality, reduce costs and increase speed. Davenport & Stoddard (1994) have concluded that successful business process reengineering is not an IT initiative, but it is business initiative with purpose of improving business practices to satisfy the needs of customers.

There are several approaches to business process management. This research does not look into differences between them, but tries to extract the capabilities that are common to those all. Also tools for process management vary and there are several methods for the actual implementation of business process management. Nowadays most of the business done in organizations is either directly or indirectly related to information technology (IT) and its usage. Therefore, the strategic alignment of BPM and IT means that the goals and activities of the business are in harmony with the information systems that support them (Woolfe, 1993). Information technology is one important tool behind the curtains, bringing possibilities to business process management. As Woolfe (1993) states, information technology's impact on business performance of an organization depends on the extent to which it enables business processes to be changed.

The continuous improvement of business processes must also consider the “Outside-In” perspective of customer needs and market requirements as a crucial part (Towers, 2010; Laamanen & Tinnilä, 2009; Zinser, Baumgartner & Walliser, 1998). Organization's business processes have to be able to respond to the changes in the external environment (Siha & Saad, 2008). The basic idea of the business processes and their management has been to create value for the customer through activities in an organization (Hammer & Stanton, 1999) and to fulfil other strategies like producing returns to stakeholders (Guha & Kettinger, 1993; Strnadl, 2006). Business value is not created anymore in traditional, hierarchical organizations with a separation between the organization and its clients. Networking has become a necessity and since it is not possible to gain benefits only from optimizing internally, both external and internal resources are compulsory assets for today's organizations (Palmberg, 2009; Zinser, Baumgartner & Walliser, 1998). Organizations need their customers to participate in their processes and to help them to improve their business, so that they grow to be strategic partners for their customers (Laamanen & Tinnilä, 2009). The internationalization of businesses has put more emphasis on co-operation and customer centricity (Zinser, Baumgartner & Walliser, 1998). As Zinser, Baumgartner & Walliser (1998) state, there is a need for organizational structures that bring together market and technology with the aim of assuring a long-range survival and competitiveness of the company.

There has been a clear evolution from process-centric business process improvement methods through 6sigma, TQM and others to business process management with a more holistic perspective. Still these methods have lacked the customer-centric focus on process development.

The next generation of BPM, also called as Customer Expectation Management (CEM), is based on Outside-In philosophy (Towers, 2010). The problem with the traditional BPM

perspectives is their focus on internal actions that seemingly contribute to delivering outcomes to customers. We spend our time focusing on those actions without realizing that they do not necessarily contribute to Successful Customer Outcomes (SCO). That will lead to doing the wrong activities very efficiently; Towers emphasizes on fixing the causes of work rather than their effects. There should be more emphasis on customer-focused results that go beyond the basic customer satisfaction measurements, because customer relationships and engagement are better indicators and measures of future success of the organization (Baldrige National Quality Program, 2009, p. 53).

The Outside-In philosophy's central thesis is that all organizations ought to be build and designed with keen focus on achieving Successful Customer Outcomes (Towers, 2010). It is not a new idea to focus on customers, but still the BPM literature is neglecting the customer focus almost completely; why is that? Does it really help organizations to do the things more efficiently through task optimization like 6sigma, when there is no clear picture on what the organization should be doing? Successful Customer Outcomes help organizations to align their endeavors to the real needs of their customers (Towers, 2010). SCOs are the road towards satisfied customers and through that to thriving organizations. Towers mentions that the whole philosophy is very easy: It is about organizing ourselves around the person who pays our salary and keeps the shareholders happy – the customer.

This can be seen as the next generation of business process management taking the holistic perspective on all the tasks done in an organization with clear purpose. This also leads to some critical success factors which consider the customer centricity of an organization. The Outside-In philosophy may also be one of the domain theories behind contemporary business process management taking it to the next level from a mere task optimization perspective. Contingency theory, dynamic capabilities and task-technology fit are all important theories behind the execution part of the BPM (Trkman, 2010), but Outside-In is the more overall reason for BPM to exist; to satisfy the real needs of customers that pay for our business processes to exist (Towers, 2010).

3 Critical Success Factors in BPM

Business process management is a young field in the academic world and has been considered quite atheoretical (Karim, Somers & Bhattacharjee, 2007; Melão & Pidd, 2000). This conclusion may also be made from most of the critical success factor (CSF) literature. Most of the literature introduces case studies lacking a theoretical framework for the phenomenon of business process management. Trkman (2010) suggests that business process management is based on the theories of contingency, dynamic capabilities (DC) and task-technology fit (TTF), which may be used as a basis for evaluation of the critical success factors in BPM. Trkman sees that these three base theories can be used to categorize the critical success (and failure) factors. These three frameworks are related to business process management as follows: Firstly, the fit between the business environment and the business processes is needed. Secondly, proper organization and continuous improvement efforts are needed to assure sustained benefits from BPM. Thirdly, a proper fit between the tasks in the business processes and the information technology/systems must exist. We suggest adding Outside-In perspective as the fourth framework to business process management, giving it purpose to exist.

Business process management efforts need to be firmly linked to the organization's purpose and strategy so that they will support them. If BPM is not responding to those needs, it may be slowing the organization down. That is why Trkman (2010) suggests looking into critical

factors of BPM from a more interconnected perspective, than just taking separate variables independently under consideration. All this sets the base for our research - identifying the most common success factors and extrapolating business process management capabilities of them.

Our literature review is based on a vast search for articles, from the dawn of BPR/BPM. Many of the articles were case studies, often with limited organizational perspectives on BPM. From these we identified the most important success factors and gathered them into a table. Many studies prioritized certain aspects and these aspects were identified as critical success factors (CSFs) in our research. These CSFs were extrapolated into business process management capabilities that contribute into the success of an organization. See Appendices A and B for the list of critical success factors we found in our study.

4 Conclusions

Our synthesis on critical success factors in business process management is based on the literature review presented in Appendices A and B. It seems that improving business processes takes more than just adding more resources into action, even though resources are also important (Feldes & Karuppan, 1995). Business process management is a very complex field, since it involves challenges from several domains, like organizational, managerial, information systems and even social problems (Trkman, 2010). Our synthesis contains aspects related to current resources as well as changes that radical business process management efforts entail. Understanding this whole picture is the key to success in all BPM efforts.

The following categorization for success factors is based on the categories found in our literature review (see Appendices A and B). We find that the critical success factors can be categorized under these four categories:

- Management and leadership (ML)
- IT and architecture (ITA)
- Change management (CM)
- Collaboration and communication (CC)

The ML category focuses on the issues of management and leadership (containing organizational, managerial and social issues). The IT and architecture category focuses more on the technology perspective while the change management category focuses on achieving positive changes in organizations. The collaboration and communication category is related to social issues that arise when people do work together. The main purpose of the categorization is to help the discussion on critical success capabilities that organizations need to have to succeed in their business process management endeavours.

In the following we will further open the four categories into more detailed lists of factors that can be used to assess the capabilities organizations need to possess to become successful in improving their business process perspective.

Management and leadership (ML)

- S1 Managers share the vision and information with their subordinates
- S2 Managers place confidence between supervisors and their subordinates
- S3 Managers constructively use their subordinates' ideas
- S4 Top management generally has realistic expectation of the projects
- S5 Top management usually has sufficient knowledge about the projects
- S6 Top management frequently communicates with project team and users
- S7 Top management generally supports changes in processes

- S8 The organization has empowered process owners, who are responsible
- S9 The performance measurements adequately correspond to the processes and changes into them
- S10 The employees are empowered to make decisions

IT and architecture (ITA)

- S11 Information technology is integrated in the business plan of the organization
- S12 The organization extensively uses its information systems
- S13 There are efficient communication channels in transferring information
- S14 Legacy information systems are reengineered if necessary
- S15 IT is aligned with the business process management strategy
- S16 Does everyone know the cost of customer acquisition, the annual value of a customer and the cost of a customer complaint?

Change management (CM)

- S17 The reward system is adjusted to serve the employees after the changes
- S18 There is training and/or educational programs to update employees' skills
- S19 BPM concepts and methodologies are known and understood
- S20 The project plan for reengineering processes is adequate
- S21 People are eager to improve the existing state of processes

Collaboration and communication (CC)

- S22 There is open communication between supervisors and their subordinates
- S23 Co-workers have confidence and trust in each others
- S24 Teamwork between co-workers is a typical way of solving problems
- S25 There is performance recognition among co-workers
- S26 Customer expectations are considered in discussions on the organization's business

As the literature review suggests, there are several different aspects that need to be considered when thriving for success through business process management. In future this research will advance into analysis of critical failure factors related to BPM and making synthesis for total business process management capabilities (BPMC) based on both critical success and failure factors.

References

- Ahmad, H., Francis, A. & Zairi, M. (2007). Business process reengineering: critical success factors in higher education. *Business Process Management Journal*, 13 (3), 451-469.
- Alavi, M. & Yoo, Y. (1995). Productivity gains of BPR: achieving success where others have failed. *Information Systems Management*, 4, 43-47.
- Ardhaldjian, R. & Fahner, M. (1994). Using simulation in the business process re-engineering effort. *Industrial Engineering*, 26 (27), 60-61.
- Ariyachandra, T. R. & Frolick, M. N. (2008). Critical Success Factors in Business Performance Management—Striving for Success. *Information Systems Management*, 25 (2), 113-120.
- Baldrige National Quality Program. (2009). *Criteria for Performance Excellence*. National Institute of Standards and Technology, Gaithersburg, MD.
- Biehl, M. (2007). Success Factors for Implementing Global Information Systems. *Communications of the ACM*, 50 (1).
- Burlton, R. (2001). *Business Process Management: Profiting from Process*. Indiana: Sams Publishing.
- Chan, Y., Sabherwal, R. & Thatcher, J. (2006). Antecedents and Outcomes of Strategic IS Alignment: An Empirical Investigation. *IEEE Transactions on Engineering Management*, 53.

- Choi, C. F. & Chan, S. L. (1997). Business process re-engineering: evocation, elucidation and exploration. *Business Process Management Journal*, 3 (1), 39-63.
- Davenport, T. & Short, J. (1990). The new industrial engineering: information technology and business process redesign. *Sloan Management Review*, 30 (4), 11-27.
- Davenport, T. & Stoddard, D. (1994 - June). Reengineering business change of mythic proportions? *MIS Quarterly*, 121-127.
- Davidson, M. & Holt, R. (December 2008). Failure Points: Where BPM Projects Tend To Falter. *Business Performance Management*, 18-23.
- Davidson, W. (1993). Beyond re-engineering: the three phases of business transformation. *IBM Systems Journal*, 32 (1), 65-79.
- DeToro, I. & McCabe, T. (1997). How to stay flexible and elude fads. *Quality Progress*, 30 (3), 55-60.
- Eardley, A.; Shah, H. & Radman, A. (2008). A model for improving the role of IT in BPR. *Business Process Management Journal*, 14 (5), 629-653.
- Eckerson, W. (2006). *Performance dashboards: Measuring, monitoring, and managing your business*. New Jersey: John Wiley and Sons, Inc.
- Elzinga, D., Horak, T., Lee, C. & Bruner, C. (1995). Business process management: survey and methodology. *IEEE Transactions on Engineering Management*, 42, 119-128.
- Feltes, P. & Karuppan, C. (1995). Re-engineering: getting down to the business of doing business. *Industrial Management*, 37 (4), 3-6.
- Forsberg, T., Nilsson, L. & Antoni, M. (1999). Process orientation: the Swedish experience. *Total Quality Management*, 10 (4-5), 540-547.
- Frolick, M. & Ariyachandra, T. R. (2006). Business performance management: One truth. *Information Systems Management*, 23 (1), 41-48.
- Fui-Hoon, F., Nah, K. & Zuckweiler, M. (2002). ERP Implementation: Chief Information Officers' Perceptions of Critical Success Factors. *International Journal of Human Computer Interactions*, 16 (1), 5-22.
- Goll, E. & Cordovano, M. (1993). Construction time again. *CIO*, 7 (2), 32-36.
- Grant, D. (2002). A wider view of business process reengineering. *Communications of the ACM*, 45 (2), 84-92.
- Griffin, J. (2004 - January). Information Strategy: Overcoming Political Challenges in Corporate Performance Management. *DM Review* .
- Grover, V., Jeong, S., Kettinger, W. & Teng, J. (1995). The implementation of business process re-engineering. *Journal of Management Information Systems*, 12 (1), 109-144.
- Gruman, G. (2004, 8-October). CPM software: an elegant way to measure business indicators. *InfoWorld*.
- Guha, S. & Kettinger, W. (1993). Business process reengineering. *Information Systems Management*, 10 (3), 13-22.
- Guimaraes, T. & Bond, W. (1996). Empirically assessing the impact of BPR on manufacturing firms. *International Journal of Operations and Production Management*, 16 (8), 5-28.
- Halachmi, A. (1996). Business process re-engineering in the public sector: trying to get another frog to fly? *National Productivity Review*, 15 (3), 9-18.
- Hall, G., Rosenthal, J. & Wade, J. (1993-November). How to make re-engineering really work. *Harvard Business Review*, 119-131.

- Hammer, M. (1990, July-August). Reengineering work: don't automate, obliterate. *Harvard Business Review*, 104-112.
- Hammer, M. & Stanton, S. (1999, November-December). How process enterprises really work. *Harvard Business Review*, 108-118.
- Hartlen, B. (2004 - June). Playing Politics: Debunking the Myths That Block a Successful BPM Implementation. *Business Performance Management*.
- Havenstein, H. (2006). Data governance, Exec buy-in are keys to BI adoption. *Computerworld*, 40 (40).
- Herzig, S. E. & Jimmieson, N. (2006). Middle managers' uncertainty management during organizational change. *Leadership & Organization Development Journal*, 27 (8), 628-645.
- Hirschheim, R. & Sabherwal, R. (2001). Detours in the path to strategic information systems alignment. *California Management Review*, 44 (1), 87-108.
- Holland, D. & Kumar, S. (1995 May-June). Getting past the obstacles to successful re-engineering. *Business Horizons*, 79-86.
- Hyde, A. (1995). A primer on process re-engineering. *The Public Manager*, 24 (1), 55-68.
- Ives, B. & Olson, M. H. (1984). User involvement and MIS success: A review of research. *Management Science*, 30 (5), 586-603.
- Jensen, A. & Sage, A. (2000). A Systems Management Approach for Improvement of Organizational Performance Measurement Systems. *Information Knowledge Systems Management*, 2 (1).
- Johnson, S. (1993). Re-engineering: what works, what doesn't? *Retail Business Review*, 61 (5), 28-30.
- Karim, J., Somers, T. & Bhattacharjee, A. (2007). The impact of ERP implementation on business process outcomes: A factor-based study. *Journal of Management Information Systems*, 24 (1), 101-134.
- Keen, P. (1997). *The process edge*. Boston: Harvard Business School Press.
- Kemsley, S. (2006). BPM Implementation Pitfalls. *AIIM E-Doc Magazine*, 20 (2), 35.
- Korogodsky, A. (2004). Moving toward alignment. *Best's Review*, 104 (9), 67.
- Kotter, J. (1995). Leading change: why information efforts fail? *Harvard Business Review*, 73 (2), 59-67.
- Kuwaiti, M. (2004). Performance measurement process: definition and ownership. *International Journal of Operations & Production Management*, 24 (1), 55-78.
- Laamanen, K. & Tinnilä, M. (2009). *Terms and concepts in business process management - Prosessijohtamisen käsitteet* (4th revised edition ed.). Espoo: Teknologiainfo Teknova Oy.
- Lee, G. & Pai, J. (2003). Effects of organizational context and inter-group behavior on the success of strategic information systems planning: an empirical study. *Behavioral and Information Technology*, 22 (4).
- Lee, R. & Dale, B. (1998). Business process management: a review and evaluation. *Business Process Re-engineering & Management Journal*, 4 (13), 214-225.
- Leith, S. (1994). Critical success factors for re-engineering business processes. *National Productivity Review*, 13 (4), 559-568.
- Lu, X.-H., Huang, L.-H. & Heng, M. S. (2006). Critical success factors of inter-organizational information systems—A case study of Cisco and Xiao Tong in China. *Information & Management*, 43 (3), 395-408.
- Mabin, V., Forgeson, S. & Green, L. (2001). Harnessing resistance: using the theory of constraints to assist change management. *Journal of European Industrial Training*, 25 (2-4), 168-191.

- Maul, R., Weaver, A., Childe, S., Smart, P. & Bennett, J. (1995). Current issues in business process re-engineering. *International Journal of Operations and Production Management*, 15 (11), 37-52.
- Maull, R., Tranfield, D. & Maull, W. (2003). Factors characterising the maturity of BPR programmes. *International Journal of Operations & Production Management*, 23 (6), 596-624.
- McAdam, R. (1996). An integrated business improvement methodology to refocus business improvement efforts. *Business Process Re-engineering and Management Journal*, 2 (1), 63-71.
- McAdam, R. & Donaghy, J. (1999). Business process re-engineering in the the public sector - A study of staff perceptions and critical success factors. *Business Process Management Journal*, 5 (1), 33-49.
- Melão, N. & Pidd, M. (2000). A conceptual framework for understanding business processes and business process modelling. *Information Systems Journal*, 10 (2), 105-129.
- Morris, D. & Brandon, J. (1993). *Re-engineering your business*. New York, NY, U.S.: McGraw-Hill.
- Nah, F., Lau, J. & Kuang, J. (2001). Critical factors for successful implementation of enterprise systems. *Business Process Management Journal*, 7, 285-296.
- Ongaro, E. (2004). Process management in the public sector - The experience of one-stop shops in Italy. *The International Journal of Public Sector Management*, 17 (1), 81-107.
- Oracle. (2008). *State of the Business Process Management Market 2008*. An Oracle White Paper Updated August 2008. U.S.A.: Oracle.
- Packwood, T., Pollitt, C. & Roberts, S. (1998). Good medicine? A case study of business reengineering in a hospital. *Policy and Politics*, 26 (4), 401-415.
- Palmberg, K. (2009). *Beyond process management - Exploring organizational applications and complex adaptive systems*. Luleå University of Technology, Department of Business Administration and Social Sciences. Luleå: Luleå University of Technology.
- Paper, D. J., Rodger, J. A. & Pendharkar, P. C. (2001). A BPR case study at Honeywell. *Business Process Management Journal*, 7 (2), 85-99.
- Politano, T. (2007, 27-2). Master data management: A key enabler for CPM. Retrieved 2010, 28-8 from <http://www.tdwi.org/info.aspx?id=33659>
- Poon, P. & Wagner, C. (2001). Critical success factors revisited: success and failure cases of information systems for senior executives. *Decision Support Systems*, 30 (1), 393-418.
- Pritchard, J.-P. & Armistead, C. (1999). Business process management—lessons from European business. *Business Process Management Journal*, 5 (1), 10-32.
- Ranganathan, C. & Dhaliwal, J. (2001). A survey of business process reengineering practices in Singapore. *Information & Management*, 39, 125-134.
- Reich, B. & Benbasat, I. (2000). An Empirical Investigation of Factors Influencing the Success of Customer-Oriented Strategic Systems. *Information Systems Research*, 1 (3).
- Rentzhog, O. (1996). *Core process management*. Division of Quality and Technology, Department of Mechanical Engineering. Linköping: Linköping University.
- Rothwell. (1995). Human resource management: restructuring and re-engineering organisations. *Manager Update*, 6 (4), 23-31.
- Savolainen, T. I. (1999). Cycles of continuous improvement: Realizing competitive advantages through quality. *International Journal of Operations & Production Management*, 19 (1), 1203–1222.
- Shewhart, W. (1931). *Economic Control of Quality of Manufactured Products*. New York: D. van Nostrand Company.

- Shin, B. (2003). An exploratory investigation of system success factors in data warehousing. *Journal of the Association for Information Systems*, 4, 141-168.
- Siha, S. M. & Saad, G. H. (2008). Business process improvement: empirical assessment and extensions. *Business Process Management Journal*, 14 (6), 778-802.
- Smith, B. (1994). Business process re-engineering: more than a buzzword. *Human Resources Focus*, 7 (1), 17-18.
- Smith, M. (2003). Business process design: correlates of success and failure. *The Quality Management Journal*, 10 (2), 38-49.
- Stiffler, M. A. (2006). Move from managing to driving performance. *Performance Improvement*, 45 (9), 17-20.
- Strnadl, C. (2006). Aligning business and it: The process-driven architecture model. *Information Systems Management*, 23 (4), 67-77.
- Terziowski, M., Fitzpatrick, P. & O'Neill, P. (2003). Successful predictors of business process reengineering (BPR) in financial services. *International Journal of Production Economics*, 84, 35-50.
- Tonnessen, T. (2000). Process improvement and the human factor. *Total Quality Management*, 11 (4/5), 773-778.
- Towers, S. (2010). *Outside-In. The secret of the 21st century leading companies.* (3rd Edition ed.). BP Group Press.
- Trkman, P. (2010). The critical success factors of business process management. *International Journal of Information Management*, 30, 125-134.
- Vessel, D. (2005). Bridging the IT and business needs gap. *InfoWorld*, 27 (22), 27-30.
- Watson, H. J. (2006). Three targets for data warehousing. *Business Intelligence Journal*, 11 (4), 4-7.
- Wellins, R. & Murphy, J. (1995). Re-engineering: plug into the human factor. *Training and Development*, 49 (1), 33-37.
- Willmott, H. (1994). Business process re-engineering and human resource management. *Personnel Review*, 23 (3), 34-46.
- Wixom, B. & Watson, H. (2001). An Empirical Investigation of the Factors Affecting Data Warehousing Success. *MIS Quarterly*, 25 (1), 17-41.
- Woolfe, R. (1993). The path of strategic alignment. *Information Strategy: The Executives Journal*, 10 (2), 13-23.
- Zairi, M. & Sinclair, D. (1995). Business process re-engineering and process management: a survey of current practise and future trends in integrated management. *Management Decision*, 33 (3), 3-16.
- Zeid, A. (2006). Your BI competency center: A blueprint for successful deployment. *Business Intelligence Journal*, 11 (3), 14-20.
- Zinser, S., Baumgartner, A. & Walliser, F. (1998). Best practise in reengineering: a successful example of the Porsche research and development center. *Business Process Management Journal*, 4 (2), 154-167.

APPENDIX A: Critical Success Factors Literature Prior Year 2000

Critical Success Factor	Research
Top and middle management commitment and support	Hall, Rosenthal & Wade (1993); Feltes & Karuppan (1995); Maul, Weaver, Childe, Smart & Bennett (1995); Holland & Kumar (1995); Kotter (1995); Grover, Jeong, Kettinger & Teng (1995); Alavi & Yoo (1995); Zinser, Baumgartner & Walliser (1998); Zairi & Sinclair (1995); Woolfe (1993); Hammer & Stanton (1999); Ives & Olson (1984); Savolainen (1999)
An effective, trained reengineering team	Leith (1994); Feltes & Karuppan (1995); Alavi & Yoo (1995); Grover, Jeong, Kettinger & Teng (1995); Zinser, Baumgartner & Walliser (1998); Zairi & Sinclair (1995)
Targeting of correct processes to be re-engineered, strategically significant processes	Leith (1994); Holland & Kumar (1995); Hyde (1995); Zairi & Sinclair (1995); Keen (1997)
Set specific outcomes and measurements in relation to performance, benchmarking, customer needs etc.	Johnson (1993); Hall, Rosenthal & Wade (1993); Leith (1994); Feltes & Karuppan (1995); Grover, Jeong, Kettinger & Teng (1995); Holland & Kumar (1995); Guimaraes & Bond (1996); Zairi & Sinclair (1995); Forsberg, Nilsson & Antoni (1999)
Synergistic use of IT and process redesign methods	Johnson (1993); Leith (1994); Smith (1994); Alavi & Yoo (1995); Maul, Weaver, Childe, Smart & Bennett (1995); Guimaraes & Bond (1996); Zinser, Baumgartner & Walliser (1998); Woolfe (1993)
Ensure project breadth and depth, goal for big enough improvements	Hall, Rosenthal, & Wade (1993); Maul, Weaver, Childe, Smart & Bennett (1995); Holland & Kumar (1995); Zinser, Baumgartner, & Walliser (1998)
Do not ignore the human factor - empowerment of 'process owners'	Goll & Cordovano (1993); Hall, Rosenthal & Wade (1993); Smith (1994); Willmott (1994); Maul, Weaver, Childe, Smart & Bennett (1995); Wellins & Murphy (1995); Kotter (1995); Rothwell (1995); Guimaraes & Bond (1996); Hammer & Stanton (1999)
The reengineering effort must be straightforward and practical	Johnson (1993); Leith (1994); McAdam (1996)
Organizations must possess the capacity and willingness to change	Johnson (1993); Grover, Jeong, Kettinger & Teng (1995); Halachmi (1996); Zairi & Sinclair (1995); Willmott (1994)
Existing organizational culture must be adaptable to change	Davidson (1993); Morris & Brandon (1993); Grover, Jeong, Kettinger & Teng (1995)
Setting team meetings up front	Feltes & Karuppan (1995)
Plan and implement the reengineering project concurrently	Woolfe (1993); Feltes & Karuppan (1995); Grover, Jeong, Kettinger & Teng (1995)
Use enablers	Johnson (1993); Feltes & Karuppan (1995); Grover, Jeong, Kettinger & Teng (1995)
Pilot new process designs	Hall, Rosenthal, & Wade (1993)
Assign the implementation team	Hall, Rosenthal, & Wade (1993)

Ensure implementation competency, in particular IS and IT proficiency	Grover, Jeong, Kettinger, & Teng (1995); Zinser, Baumgartner, & Walliser (1998); Zairi & Sinclair (1995); Woolfe (1993)
Enlist customers	McAdam & Donaghy (1999); Zairi & Sinclair (1995)
Empowered process owners	Hammer & Stanton (1999); Lee & Dale (1998); Pritchard & Armistead (1999)
Knowledge of process tools and methods	Elzinga, Horak, Lee & Bruner (1995); Forsberg, Nilsson & Antoni (1999)
Continuous improvement	Forsberg, Nilsson & Antoni (1999)
Sufficient resources, time and energy to the effort	Forsberg, Nilsson & Antoni (1999)
Reward the team	Goll & Cordovano (1993); Feltes & Karuppan (1995)

APPENDIX B: Critical Success Factors Literature in the 21st Century

Critical Success Factor	Research
Top and middle management commitment and support	Siha & Saad (2008); Paper, Rodger & Pendharkar (2001); Ahmad, Francis & Zairi (2007); Laamanen & Tinnilä (2009); Trkman (2010); Ranganathan & Dhaliwal (2001); Grant (2002); Ariyachandra & Frolick (2008); Hartlen (2004); Griffin (2004); Biehl (2007); Eckerson (2006); Fui-Hoon, Nah & Zuckweiler (2002); Havenstein (2006); Korogodsky (2004); Politano (2007); Nah, Lau & Kuang (2001); Ongaro (2004)
An effective, trained reengineering team	Paper, Rodger & Pendharkar (2001); Lu, Huang & Heng (2006); Ariyachandra & Frolick (2008); Wixom & Watson (2001); Fui-Hoon, Nah & Zuckweiler (2002)
Targeting of correct processes to be re-engineered, strategic alignment to organization's strategy	Siha & Saad (2008); Paper, Rodger & Pendharkar (2001); Palmberg (2009); Trkman (2010); Ariyachandra & Frolick (2008); Biehl (2007); Frolick & Ariyachandra (2006); Fui-Hoon, Nah, & Zuckweiler (2002); Poon & Wagner (2001); Stiffler (2006); Watson (2006); Zeid (2006); Maull, Tranfield & Maull (2003)
Set specific outcomes in relation to performance measurement, benchmarking and customer needs	Siha & Saad (2008); Palmberg (2009); Trkman (2010); Terziovski, Fitzpatrick & O'Neill (2003); Towers (2010); Maull, Tranfield & Maull (2003)
Synergistic use of IT and process redesign methods. IT to support BPM efforts.	Paper, Rodger & Pendharkar (2001); Ahmad, Francis & Zairi (2007); Trkman (2010); Grant (2002); Ariyachandra & Frolick (2008); Ongaro (2004)
All the needed resources (money, time, tools, etc.) and training of the people are available	Paper, Rodger & Pendharkar (2001); Mabin, Forgeson & Green (2001); Ahmad, Francis & Zairi (2007); Lu, Huang & Heng (2006); Ariyachandra & Frolick (2008); Biehl (2007); Eckerson (2006); Wixom & Watson (2001)
Do not ignore the human factor and empowerment of 'process owners' and teams	Siha & Saad (2008); Paper, Rodger & Pendharkar (2001); Ahmad, Francis & Zairi (2007); Mabin, Forgeson & Green (2001); Laamanen & Tinnilä (2009); Tonnessen (2000); Trkman (2010); Grant (2002); Maull, Tranfield & Maull (2003)
Organizations must possess the capacity and willingness to change (link to organizational culture)	Siha & Saad (2008); Paper, Rodger & Pendharkar (2001); Ahmad, Francis & Zairi (2007); DeToro & McCabe (1997)
Existing organizational culture must be adaptable to change	Siha & Saad (2008); Ahmad, Francis & Zairi (2007); Rentzhog (1996); Laamanen & Tinnilä (2009); Ongaro (2004)
Change is carefully planned, change management, managing uncertainty of people, management of resistance	Paper, Rodger & Pendharkar (2001); Ahmad, Francis & Zairi (2007); Laamanen & Tinnilä (2009); Herzig & Jimmieson (2006); Ariyachandra & Frolick (2008); Frolick & Ariyachandra (2006); Gruman (2004); Hartlen (2004); Poon & Wagner (2001)
Quality management system	Ahmad, Francis & Zairi (2007); Palmberg (2009)

Continuous and iterative improvement	Siha & Saad (2008); Paper, Rodger & Pendharkar (2001); Trkman (2010); Towers (2010); Ariyachandra & Frolick (2008); Poon & Wagner (2001); Vessel (2005)
Create team ownership and culture of dissatisfaction	Paper, Rodger & Pendharkar (2001)
Effective communication, at all levels	Smith M. (2003); Laamanen & Tinnilä (2009); Trkman (2010); Grant (2002); Lee & Pai (2003); Biehl (2007); Chan, Sabherwal & Thatcher (2006); Eckerson (2006); Fui-Hoon, Nah & Zuckweiler (2002); Hirschheim & Sabherwal (2001); Jensen & Sage (2000); Nah, Lau & Kuang (2001); Politano (2007)
Teamwork / working in teams	Ahmad, Francis & Zairi (2007); Ongaro (2004)
BPM project management	Ahmad, Francis & Zairi (2007); Burlton (2001); Laamanen & Tinnilä (2009); Trkman (2010); Grant (2002); Ongaro (2004)
Knowledge of BPM tools and approaches	Palmberg (2009); Laamanen & Tinnilä (2009); Grant (2002)
Process owners, who are empowered	Trkman (2010); Kuwaiti (2004); Ongaro (2004)
Both initial quick-wins and long-term solution should be sought	Trkman (2010)
Reward the team, use of appropriate incentive systems and training	Siha & Saad (2008); Ahmad, Francis & Zairi (2007); Mabin, Forgeson & Green (2001); Trkman (2010); Towers (2010)
Customer-centric focus on BPM	Towers (2010)
BPM champion who promotes it in an organization	Ariyachandra & Frolick (2008); Eckerson (2006); Fui-Hoon, Nah & Zuckweiler (2002); Jensen & Sage (2000); Nah, Lau & Kuang (2001); Reich & Benbasat (2000); Wixom & Watson (2001)
Users are involved in the development of a BPM solution and engage in specific responsibilities and tasks related to the BPM effort	Ariyachandra & Frolick (2008); Biehl (2007); Eckerson (2006); Shin B. (2003); Wixom & Watson (2001)
Support of data management structure	Ariyachandra & Frolick (2008); Biehl (2007); Eckerson (2006); Politano (2007); Poon & Wagner (2001); Reich & Benbasat (2000); Wixom & Watson (2001)
Prepare for potential emergencies and ensure continuity of operations	Baldrige National Quality Program (2009, p. 50)

Organizational Processes in the Secondary Software Sector: A Case study on Open Source Software Adoption

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Abstract. In this paper we report from a case study on OSS adoption conducted in a large multinational organization in the secondary software sector. Our study contributes to theory and practice of project management for OSS adoption, with important implications for different stakeholder groups and internal method usage. In particular, our results concern the following three issues in relation to a wish to increase the usage of OSS within the organization. Firstly, from a management level perspective, we elaborate on knowledge transfer and suggest a number of recommendations. Secondly, from an operational level perspective, we elaborate on potential benefits from changed work practices. Thirdly, from our analysis of the relationship between the project management model and the maintenance management model, we suggest adaptations to existing work practices by highlighting the importance of considering maintenance costs early in a project.

Keywords: Open source software, adoption, secondary software sector.

1 Introduction

Over the last decade, the software industry has been transformed as Open Source Software (OSS) has become mainstream. Today there are viable OSS choices in many categories of business critical software, from word processing software to operating systems (and other infrastructure software) that can compete with the proprietary alternatives on their own merits. In the past, the users of OSS have tended to be experts and often more or less involved in the development of OSS [1]. However, work practices have evolved into a situation in which many companies try to benefit from OSS usage. In recent years it has become common for companies in the secondary software sector to adopt OSS [2-5]. This case study covers the area of OSS adoption in the secondary software sector, an area where little reported work has been done.

In large companies it is common to use formal adoption processes to govern the uptake of systems in their organizations. Seen from a system lifecycle perspective, the adoption processes traditionally govern the phases of requirement specification, design, implementation, testing and deployment. These adoption processes are often company specific, designed to suit organizational needs. Furthermore, these adoption

processes might have been developed long before OSS became a viable option in the market, at a time when proprietary software was the only alternative. There is a risk that these internal adoption processes inhibit the adoption of OSS even if there is a will to adopt it.

The work reported here investigates whether the adoption processes within a specific company can inhibit the adoption of OSS. Having answered this in the affirmative, it set out to find the nature of these potential inhibitors and conversely of potential enablers.

2 Background

In the secondary software sector, companies are software intensive, but their primary business is not to develop and deliver IT solutions. This is a sector where companies in, for example, the automotive, consumer electronics and telecommunication sector operate [6,7]. Ghosh [8] finds the following views among companies in this sector: (1) software is seen as a cost centre rather than profit centre, (2) some software might give revenue, but not from selling the software as a product itself, and (3) a significant proportion of the software used provides an infrastructure rather than a competitive advantage. This contrasts with the primary software sector, where software companies whose primary business is to develop software and related services reside. For example Microsoft, Oracle and SAP are typical primary software sector companies. The secondary software sector is very important for Europe [6-9]. For example, according to the FLOSS impact report "Economic impact of open source software on innovation and the competitiveness of the ICT sector in the EU", 68% of all companies in the European secondary software sector have incorporated OSS software into their own products or services [8].

Adoption deals with the switch when an organization wishes to go from an old system to a new. The term adoption can be used broadly and addresses both a small switch, e.g. to change the default browser to a larger switch where e.g. the desktop operating system or an enterprise system is changed. There are many reasons why an organization might want to adopt new software including getting access to new functionality, a faster system and increased competitiveness. Three factors influence adoption in either a positive or a negative way. These factors fall into three broad categories: technology, organization and environment [10]. The organizational factors handle, among others, the structure and processes of the organization. In more recent work, a fourth factor, the individual, has been added [11]. Several attempts to classify and organize adoption of OSS have been taken with the Tornatzky and Fleischer's framework as a basis [10]. Examples are described in [5,11,12]. It is, however, not fully understood exactly how OSS affects adoption processes.

There are several reasons for this, not least because different companies and organizations use different adoption strategies, and cultural differences exist between countries. There is much active research in the OSS field at the moment, but [13] state that "[d]espite the fact that much research has been devoted to open source software, most studies have focused on the software engineering or social aspects of open source software development. Relatively little effort has been devoted to studying the

adoption decision of organizations concerning the use of open source software". According to [14], much of the OSS research has focused inwardly on the phenomenon itself and far less has been done looking at the process of adoption and implementation in organizations. Although a number of OSS adoption studies have been performed, the focus in most of these studies is on specific products, either in the public sector or companies in the primary software sector outside Europe [5]. Hauge et al. [15] have recently performed an extensive systematic literature review, which revealed no publication of an in depth study in the fields of adoption or deployment of OSS. The majority of publications in the field of adoption of OSS have been performed as questionnaires among several companies, including [5,6,12,16-20]. Therefore, it is important to further investigate the area of adoption in the secondary software sector.

3 Research Approach

This paper reports from an in-depth case study in a commercial organization in order to learn more about inhibitors when adopting OSS. More specifically, the following research question has been posed: *do documented company processes implicitly inhibit adoption of OSS, and if so how should they be improved?*

The company selected for this case study is a large multinational company in the secondary software sector based in the Nordic countries, referred to as "the Company" in this paper. The company is a very typical secondary software sector company and fits all three of the attitudes attributed by Ghosh [8] to the sector. They are very software intensive and use a large variety of software and platforms. The Company sees itself as a potential user of more OSS. One of the main motivators for starting to use OSS is the potential cost reduction, a vision shared by other companies, see for example [6,21,22]. Recently the top management have decided that the amount of OSS should increase, but it is important to point out that possible OSS adoptions are based on pragmatism rather than ideological beliefs and that OSS compete on its own merits as proprietary alternatives do. This top management support is a crucial enabler, or success factor, for the adoption of OSS according to [5,23,24]. The Company has for many years focused on its core business, going from developing own in-house solutions to procuring solutions. Therefore, they lack developers, both for developing OSS but also for developing internal solutions, which clearly places them in the secondary software sector. The business in which they operate within handles many critical systems, both critical for business, where badwill could cause severe financial losses, but also critical for society.

In a company context, frameworks for securing a formalised way of working are a common and often necessary tool. According to [25], there are both rational and political reasons for using a formalised method of working, that include for example facilitation of project management, division of labour, standardisation of development process and comfort/confidence factor. Method in concept refers to a description of a method, as its users understand it [26]. Fitzgerald et al. [25] have created a framework for information systems development that has been adopted and adapted in this work to study the potential tensions between how the method in concept is described, and

how it is used or implemented in reality, which method in action is referred to as. In principle, method in concept and method in action could be the same; however, there is likely to be a tension or gap between concept and practice. It is important for a company that the tension or gap is not too big since that might influence the quality of the intended result.

To be able to tell if there are any tensions between concept and action, and what they could be, an adoption must be studied. It must be a complete adoption, from the first phase of pre-study until the product is taken into production and maintained for a specific case. If there are no tensions between the method in concept and the method in action it does not mean that the method is optimal. This is the case if the method in concept is not well suited for the organisation's needs. Therefore, it is important that also the existing body of knowledge is investigated to see that the method in concept is as optimal as it can be in the organisation so that it does not inhibit the use of OSS. During the case study an on-going literature review on OSS adoption was performed. Such review informed the method in concept, and helped to place the study in the existing body of knowledge.

Furthermore, the study of the method in action helps in understanding the current method in concept so that a potential change can be made to get an evolved method in concept. By improving the method in concept, it is possible to lessen potential inhibitors to OSS adoption within the Company. It is important to point out that if the method in concept is improved, the adoption of both OSS and proprietary software benefit. In other words, it can open up the company adoption processes for other kinds of software irrespective of licences.

One specific OSS adoption experience was selected for the case study by a senior representative from the Company management, and was upon completion installed on over 1500 servers company wide. The selected adoption was the first large-scale OSS adoption performed by the Company, since previous OSS adoptions were limited either in deployment size or limited to smaller OSS components. The adoption experience studied was a broadly deployed infrastructure software, used on all levels within the company. The project involved stakeholders from several geographically distributed sites and spanned over a six months' time period. Prior to the adoption of the selected software there was limited experience of OSS adoption within the Company. The case study context also included documentation governing all project management and maintenance management within the Company.

The conduction of the case study included interviewees from all relevant roles of the adoption project, but also stakeholders representing the central group governing the models for project management and maintenance management. More specifically, five in depth interviews were performed with three managers and two system administrators. Furthermore, five round table discussions were performed with representatives from all four levels of responsibility as described in Table 1. To be able to analyse the project management and maintenance management models within the Company, additional contacts were taken with stakeholders, both in-person, via email and over telephone to clarify the way the models work and how they work with them internally.

4 The Case Study Context

The Company has very well described models and frameworks to aid staff in starting, executing and documenting routines and procedures. They use a life cycle model to govern the life cycle of all IT systems used in the company. There are strategies and policies governing development, maintenance and retirement described in the life cycle model. The development phase is governed by the Project Management Model for IT projects (PMM-IT) that is based on a waterfall style model. The maintenance is governed by an internal model called the Maintenance Management Model (MMM) that draws from [27,28]. These models are all iterated within the company, and each of the models are the responsibility of a designated team governing the further development of the models. Revisions of the models can reflect both adaptations to internal changes and external changes, for example, to comply with the Sarbanes-Oxley act. PPM-IT for a generic IT project governs a project from pre-study that includes requirements, functional and architectural analysis, via a project execution phase where design, implementation, testing and deployment are initiated. Projects finish with a closing phase where deployment is finalized and an evaluation is performed. There are recurring decision points (DP) at different stages of every project. The DPs concern all kinds of issues that could need attention in a project. To aid the people working in the project and to make sure the management gets notifications about the progression there are mandatory templates that need to be filled at every DP.

It is important for the Company that all their solutions are driven by business, so that all systems stem from a business need. The maintenance is therefore seen as a sub-operation of business and IT, and is therefore governed from two perspectives with associated roles on both the business and IT sides, as depicted in Table 1.

Table 1. The roles of responsibility in MMM.

Level	Business Solution	IT Solution
Strategy	Business Strategist	IT Strategist
Budget	Business Solution Owner	IT Solution Owner
Decision	Business Solution Manager	IT Solution Manager
Operating	Business Solution Specialist	IT Solution Specialist

The business solution aims at fulfilling the needs arising from the business side, while the IT solution is the technical solution that realizes the business solution. The strategy level is normally not a part of the actual maintenance; rather they are responsible for making sure that the maintenance objects are developed in accordance with the business and IT strategies in the company. The budget level normally steers the maintenance, by making decisions on the expansion or withdrawal of resources for the maintenance work. The decision level has management responsibility for ensuring that maintenance goes according to the defined maintenance plan. The personnel working at the operating level carry out the maintenance plan. On the operating level, the business solution role applies to, for example, key users, business solution specialists, help desk, and trainers, while the IT solution role applies to, for

example, IT operation managers, database managers, application managers, and IT developers.

All decisions regarding the maintenance and management of maintenance take place in two groups, the steering committee and the maintenance team. The steering committee is manned by persons on the budget level, the Business Solution Owner and the IT Solution Owner, and possibly with other persons depending on the situation. On this level, decisions regarding families of related systems take place. Normally, prioritisation and trade-offs regarding budget vs. needs are decided. The maintenance team is manned by persons from the decision level. The maintenance team constitutes of the Business Solution Manager, the IT Solution Manager, and if needed, persons from the operating level. In the maintenance team the activities within the system are managed and prioritised. Above the steering committee at the strategic level, the Business Strategist and the IT Strategist manage and prioritise from an overall perspective.

MMM consists of 5 phases and starts with a plan to establish the process, which is focused on creating and deciding the working groups, setting a time plan and deciding who writes documentation. In phase 2, the maintenance objects are described by checking which user groups exist, their relation to other systems, laws, regulations and policies that could affect the system but also which platforms and applications are running in the object. In phase 3, it is decided how important the object is, and a 5 year plan is created for maintenance. The kind of support that is expected from the system is also specified in detail, for example, how questions will be answered, how change management will be carried out, and finally, the operation, for example, how to make back-ups. In the fourth phase, a clarification of all roles of responsibility is specified, so that all involved staff know what to do, and in the 5:th phase the maintenance plan is approved.

To fully understand how the Company operates it is important to understand the relation between PMM-IT and MMM, and how they fit into the life cycle model. PMM-IT matches the development, and MMM matches maintenance. The last part of the life cycle, retirement, is omitted from this study since the company only makes, at most, a 5 year plan in the MMM, and retirement is a non-issue when selecting a new system, and will, therefore, not inhibit the adoption of OSS. Moreover, according to the interviews performed, the retirement phase is rarely used, because systems are rarely retired. Normally when a system that is in the maintenance phase and needs more than just the usual change management, an upgrade project is initiated. All major upgrades or changes of systems are handled as a new development, which means that PMM-IT is used. Once a project runs in PMM-IT and is at the end of the project execution phase, MMM is invoked. All phases of MMM are gone through before the end of the project execution phase, as depicted in Figure 2. Only once the maintenance plan is agreed upon, is it possible to proceed to the closing phase of a project.

There is also a relation to ITIL (Information Technology Infrastructure Library), which affects MMM, which, in turn, affects PMM-IT. However, this connection and ITIL itself will not be covered in this study since ITIL is a general set of principles for handling IT infrastructure. ITIL must not be applied, and is seen as project specific.

Figure 1 shows the action case study objects, mapped in relation to method in concept and method in action as described in Section 3.

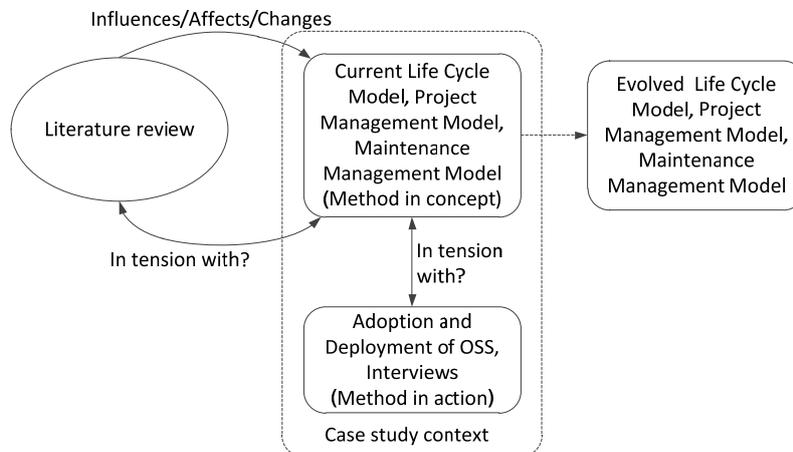


Fig. 1. The case study objects in relation to method in action/method in concept.

5 Results

The interviews reveal that the administrators describe themselves as very competent and they require little external support when problems arise, and several of them have very good OSS competence. This was also confirmed by members of the strategy and operating levels of their organization. In other words, the Company has several OSS champions in-house, a significant factor influencing OSS adoption according to [11]. An OSS champion has good knowledge about OSS alternatives, and, in many cases, they are very interested in what they are doing at work and do experiment with similar things at home. This resource is very important, and it is important to pick up the knowledge these administrators possess to a higher level within the company. The problem today is that the organization is quite hierarchical, as shown in Table 1, and to scale an OSS solution from an idea at a local site to a system that is implemented companywide is a major undertaking. The information flow in the documents regulating MMM and PMM-IT are written in a way that use levels of hierarchy where orders are given downwards in the hierarchy and completed checklists and documents are sent upwards for control. Unfortunately, many of the lessons learned when projects are run can be missed due to the quite massive documentation burden put on each project. In addition, there are gaps in the documentation for gathering lessons learned, so even if the documentation requirements are quite heavy, there are still gaps if the management wants to collect lessons learned. Today, there is no direct communication between the strategic level where the overall decisions are made and the maintenance level. In the internal IT strategy, it is stated: “best practices including processes, standards, frameworks, patterns and solutions shall be used”. This lack of direct access between the levels is a severe weakness in the models since it is much harder for the strategy level to know what the best practices are for administrators. It is naive to assume that the strategy level manages to pick up all best practices, and the

studied adoption is one example where a bottom-up initiative has proven to be good for the company as a whole. Evidence that further strengthens this fact came from the round table discussions where the managers acknowledged the fact that the probable reason for that the studied adoption took place at all was because an administrator got promoted to a higher position in the hierarchy. The promotion of the administrator enabled transfer of knowledge bottom-up in the organization. It is important to point out that this weakness might not only affect OSS, but also, other proprietary alternatives, even if it is most likely that OSS suffers the most since it is easier to download and try OSS. Further, with no or little explicit marketing, an inhibitor described by e.g. [29,30] bottom-up is very often the only way in which OSS is introduced into a company.

The models and frameworks used within the Company are well documented, their place in the company context is well defined and when problems are identified the models are changed and a new version of the models and frameworks is released. If a new project is started, the models support the process from idea, via execution and maintenance until the system is retired. The current models support this, but from the viewpoint of enabling the company to use more OSS, there are several things to remark on in the models and the relationship between the models.

PMM-IT has been developed to be a versatile model suitable for projects of all sizes. PMM-IT ranges from projects with few participants and a couple of weeks duration to hundreds of people over several years. The model suits the needs and certifies that all possible angles of the project are handled. These procedures might be more relevant for longer, more complex projects than for short straightforward projects. Some of the documentation for the studied adoption feels written mainly because it had to be written, rather than necessity for the success of the project. Not all parts of the documentation are required to be able to get the same kind of results at project end. Therefore, it could be beneficial for the project manager to talk with responsible management one step up in the hierarchy to see if the documentation burden can be decreased based on the individual project. There are of course many pit falls with this since documentation is central in any organization, and the documentation also serves as a check at each decision point (DP) that all tasks have been considered. Despite this, a more pragmatic approach to the reports at each DP could benefit especially smaller projects and put more focus on the execution of the project itself rather than its documentation.

The relationship between MMM and PMM-IT is not optimal because of the late introduction of the maintenance in PMM-IT. Today, the maintenance planning starts between DP4 and DP5 and finalizes at DP5, as depicted by the green dashed arrows in Figure 2.

In the optimal case the maintenance plan is created as early as possible in the project, preferably even in the pre-study phase so that maintenance costs are one of the factors considered when evaluating several candidates in relation to what they perform and the TCO (Total Cost of Ownership). The TCO of the system should include the original cost of the computer and software, hardware and software upgrades, maintenance, technical support, training and coaching, and downtime [31]. Additionally, it is beneficial if exit costs (or switching costs) are included to cover the whole systems life cycle. However, exit costs are very hard to calculate and predict since no one can predict the future and what software will exist in for example, 15

years' time. It is, however, sure that one always should try to opt for the usage of open standards as much as possible as a strategy for lowering exit costs. Maintenance costs are also hard to calculate, but an effort must be made, at least for the first years of usage. The goal is to provide a decision basis as complete as possible for the management when evaluating several different options. According to [5,13], it is very hard or even impossible to make a formal TCO calculation. In the case of OSS, it could be especially important, considering that the initial cost might be similar to a proprietary alternative, but OSS can become cheaper in the long run due to the lack of software upgrade costs [8].

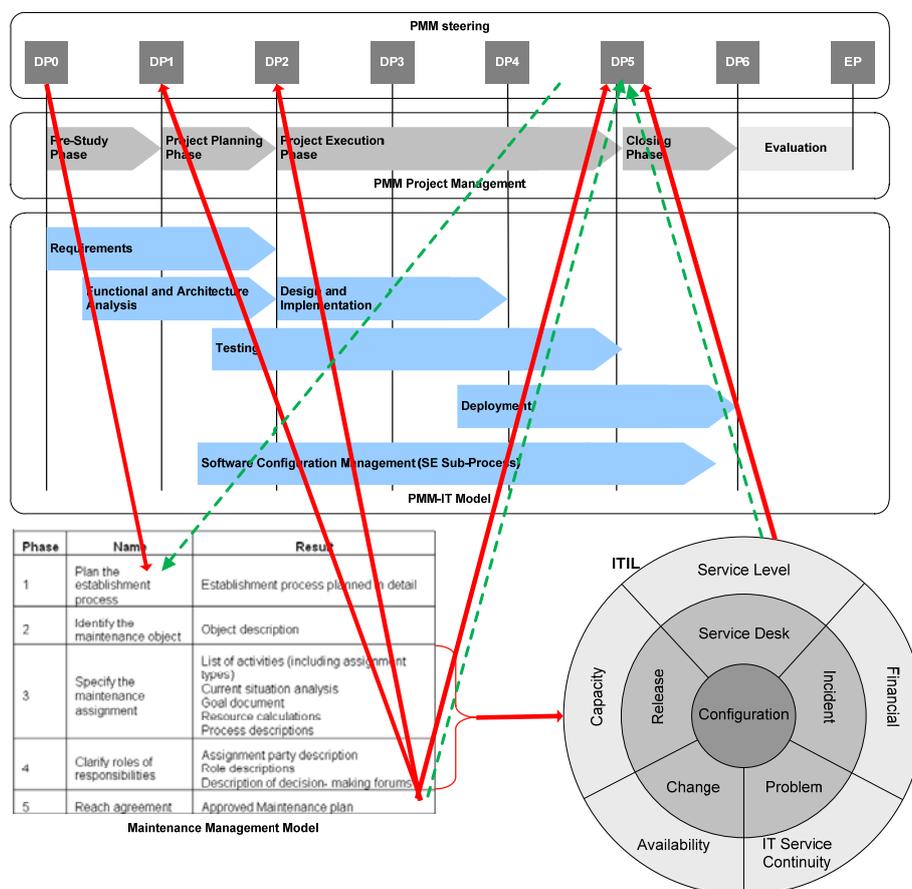


Fig. 2. Recommended and current relationship between PMM-IT, MMM and ITIL.

The exact position for including the start-up of the MMM differ depending on the type of project. If it is, for example, a large upgrade project where it is already decided what system will be used, the TCO is of less importance than a project where one out of several candidates will be chosen. If there are several candidate systems it is important that the initialisation of the creation of the maintenance plan is started at DP0, with a preliminary draft of the plan already available at DP1, since systems

under evaluation can be discarded already at this point of the project. At DP2, it is necessary to have a more specific maintenance plan since the final decision on which system will be implemented and deployed is taken at this point. When the project reaches DP5 the final maintenance plan is produced, and it is impossible to produce the final plan at an earlier DP since the final changes of the project have been implemented at this point. The new recommended relationship between PMM-IT and MMM is depicted by the red solid arrows in Figure 2.

It is important to point out that the process of creating the maintenance plan is initiated at DP0, but not finished completely until DP5. The preliminary plans are just to give guidance and to produce a foundation for better decision-making, and the process could be seen as iterative rather than procedural. This creates extra work for the project participants to some extent, especially since several alternative maintenance plans must be created, but it might save money in the end.

To be able to look after the OSS interests within the company and to make sure they benefit from OSS as much as possible, it could be argued that new roles within the organization should be assigned. The organizational structure is divided into several levels and it has been shown both in the literature and in the case study that many OSS adoptions come via a bottom-up-approach. It is important to gather the knowledge and experience at the operational level, and condense and scale this information into something useful for the company at the strategic level. These skilled OSS champions on the operational level are a great factor influencing adoption [11]. The recommendation is to assign two new roles, an OSS-specialist at the operating level and an OSS-strategist at the strategic level. The organization is already filled with roles organized hierarchically, and to benefit from the system administrators' knowledge would rather require a less hierarchical organization. It is therefore important to point out that the new roles can be added as an extra role to the strategists and specialists under the assumption that the persons have OSS competence. One major benefit of doing this is that there is a more direct and visible route between the highest and lowest organizational levels as depicted in Figure 3.

The committee at the strategic level manages and prioritises from an overall company perspective. In the steering committee, decisions regarding families of related systems take place. In the maintenance teams the Business Solution Manager, the IT Solution Manager, and possibly persons from the operating level handle the activities within the system where tasks are managed and prioritised. This means that there might be systems where no operational staff is a part of the maintenance team, and, since the OSS champions most likely will be on the operating level, this is a severe weakness. The optimal way for harvesting the possible ideas and solutions from the floor would of course be if there always were OSS champions present in the maintenance teams. This would, in turn, lead to more person-hours of work and that could be seen as counterproductive, but it is a trade-off between betting on potential cost savings as opposed to putting in more persons in the maintenance teams.

The exact way the interaction between the levels is going to function and to which extent is open for discussion, but it is clear that there will be two distinctly different approaches depending on whether a project is run in PMM-IT or MMM. In PMM-IT, the goal of the added roles is to collect and harvest the operational knowledge that exists about possible OSS alternatives that could be beneficial. It could range from completely new system alternatives, through different component selection in the

proposed solutions to the use of open standards. In the MMM the focus is to pick up knowledge on how the day-to-day administration can reap the benefits of OSS and scale it into something that is run on several sites, but also to pick up experience about alternatives that can be fed into the PMM-IT when new projects start. The addition of OSS strategists and OSS specialists, either in all maintenance teams or the ones that already have OSS champion presence, does not necessarily mean so much in terms of extra workload, but more that somebody watches over and takes ownership of the OSS question.

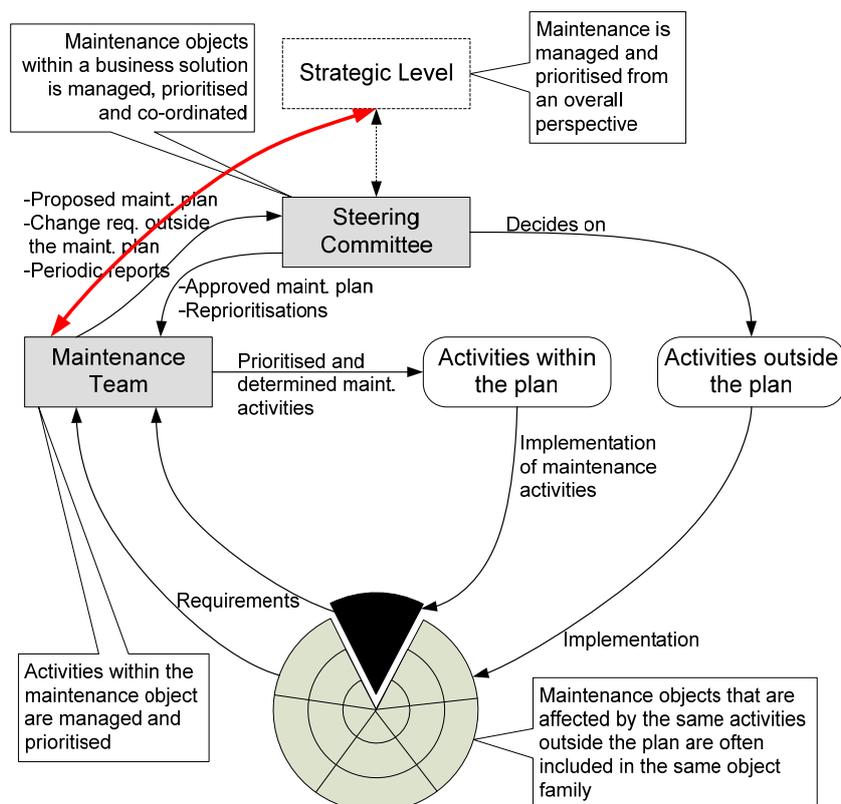


Fig. 3. Recommended and current relationship between PMM-IT, MMM and ITIL.

This is so important that, regardless of whether the OSS strategist and OSS specialist roles become implemented or not, there must be a sense of ownership of the question. Since the management has decided that the amount of OSS should increase in the Company some formal way of gathering experience is needed. It is recommended that additions to the pre-study, the checklists at respective DP and the final report are created, so that the management can learn from projects and avoid pitfalls in the future. Recommended additions include questions for the pre-study and checklists making sure that OSS and open standards have been considered or used. In the final report, one section handles experiences and observations, and this section

should be complemented with experiences from the adoption or non-adoption of OSS. These additions might give the company increased knowledge about how their projects are run with regard to OSS adoption, but also to pick up other inhibitors to the adoption of OSS. These additions might be even more important for the Company than other similar companies because they have outsourced many of the competences and rely on external companies not only in their day-to-day operations, but also in new adoption projects.

If one wants to be even more aggressive in the pre-study phase of a project, it could be beneficial from an OSS perspective to make it mandatory to consider an OSS solution. In many cases, there might not be any viable OSS alternatives and the check for an OSS alternative might not take long. In some cases however, there might be a good OSS alternative and if it is mandatory to evaluate this solution, it puts pressure on the pre-study team to consider it. If it is the best option, it can be implemented, and if it is not the best alternative it needs to be stated why it has not been chosen, as is currently the case with a proprietary alternative. This information is very valuable in the long-term, to be able to see when, where, and what inhibits the use of OSS.

6 Discussion and Conclusions

Even if we have studied a single company, we can extract some contributions that show important implications for different stakeholder groups and internal method usage. Firstly, from a management level perspective, we elaborate on knowledge transfer and suggest a number of recommendations. Secondly, from an operational level perspective we elaborate on potential benefits from changed work practices. Thirdly, from our analysis of the relationship between the project management model and the maintenance management model, we suggest adaptations to existing work practices by highlighting the importance of considering maintenance costs early in a project.

For an organization in the secondary software sector considering OSS adoption, our study has exposed a number of issues that need attention. The ability to adopt OSS is closely related to the ability to harness the knowledge in the lower level of the organization. This reconfirms and highlights the importance of the OSS-champion as described by [11]. If the organization does not have the organisational hierarchy to enable the transfer of knowledge from OSS champion to strategist, they will not utilise them to their full potential. From an organisational viewpoint, it is very easy for the management to control the levels below via the use of strict hierarchies and procedures such as checklists to verify the results of the work performed. It should be noted that this inhibits the flow of information upwards in the hierarchy. In a big organisation, roles and organisational hierarchy are necessary and it should also be noted that there is no attempt to change this in the recommendations. It is better for the management to try to harvest the knowledge and encourage the work performed by the OSS champions. This can easily be done by changing the way of reporting, so that experiences of adopting and using OSS are included, and thereby, enabling a transfer of knowledge from operational level to management. Furthermore, it is

recommended that someone take ownership of the OSS question. One or possibly several persons must look after OSS if the company is going to adopt as much OSS as possible. OSS differs from proprietary software in many aspects and no one should expect OSS to market itself within the organisation or create awareness by commercials as is the case with many proprietary alternatives. The addition of OSS strategists and OSS specialists clearly addresses this issue.

The addition of OSS strategists and OSS specialists on the strategy and operational levels would also make it possible for the management to discuss possible OSS solutions. Furthermore, it gives new insight on how the system administrators work in their everyday situation instead of just watching key performance indicators every month. This is a smaller step in a direction where management becomes more visible and perhaps even can answer questions on why things are like they are. If the strategists meet the OSS champions, solutions that are used locally can more easily be scaled to be used company wide.

It is also important to understand how the lifecycle models work and whether they potentially inhibit the adoption of OSS or other proprietary alternatives. To get as fair comparison as possible between different candidates for adoption, the TCO for the whole lifecycle must be calculated, something rarely done. Since it is very hard to calculate more than a couple of years ahead, especially for systems that have long lifecycles, the recommendation are to at least calculate the first few years of maintenance and possible upgrade costs.

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References

1. Morgan, L., Finnegan, P.: How Perceptions of Open Source Software Influence Adoption: An Exploratory Study. In: Fifteenth European Conference on Information Systems, 2007, St. Gallen, Switzerland, pp. 973--984 (2007)
2. ITEA: ITEA Report on Open Source Software, ITEA Office Association (2004)
3. Feller, J., Lundell, B., Marttiin, P., Scacchi, W. Schellingerhout, N.: Panel: Opportunities and Risks for Open Source Software in Industry. In: Russo, B., Damiani, E., Hissam, S., Lundell, B. Succi, G. (eds.) Open Source Development, Communities and Quality. Springer Boston, pp. 413--414 (2008)
4. Lundell, B., Bermejo, J., Labezin, C., Sempert, F., Valentin, M.-L., Laprevote, A., van der Linden, F. Pablos, J. J.: Open Source Software Workshop, ITEA 2 Symposium. ITEA 2 Magazine, Rotterdam (2008)
5. Morgan, L., Finnegan, P.: Open innovation in secondary software firms: an exploration of managers' perceptions of open source software. SIGMIS Database, 41(1), pp. 76--95 (2010)
6. Ågerfalk, P. J., Deverell, A., Fitzgerald, B., Morgan, L.: Assessing the Role of Open Source Software in the European Secondary Software Sector: A Voice from Industry. In: First International Conference on Open Source Systems, Genova, Italy, pp. 82--87 (2005)
7. Lundell, B., Lings, B., Syberfeldt, A.: Practitioner perceptions of Open Source software in the embedded systems area. Journal of Systems and Software. In press (2011)

8. Ghosh, R. A.: Economic impact of open source software on innovation and the competitiveness of the Information and Communication Technologies (ICT) sector in the EU, UNU-MERIT (2006)
9. van der Linden, F., Lundell, B., Pentti, M.: Commodification of Industrial Software: A Case for Open Source. *IEEE Software*, 26, pp. 77--83 (2009)
10. Tornatzky, L., Fleischer, M.: *The Processes of Technological Innovation*, Lexington Books, Lexington (1990)
11. Glynn, E., Fitzgerald, B., Exton, C.: Commercial adoption of open source software: an empirical study. In: *Proceedings of International Conference on Empirical Software Engineering*, Noosa Heads, IEEE, pp. 225--234 (2005)
12. Dedrick, J., West, J.: Why firms adopt open source platforms: a grounded theory of innovation and standards adoption. In: *Proceedings of the Workshop on Standard Making: A Critical Research Frontier for Information Systems*, Seattle, pp. 236--257 (2003)
13. Ven, K., Verelst, J.: The Organizational Adoption of Open Source Server Software by Belgian Organizations. In: *Open Source Systems*, Springer Boston, pp. 111--122 (2006)
14. Fitzgerald, B.: Open Source Software Adoption: Anatomy of Success and Failure. *International Journal of Open Source Software Processes*. 1(1), pp. 1--23 (2009)
15. Hauge, Ø., Ayala, C., Conradi, R.: Adoption of Open Source Software in Software-Intensive Organizations - A Systematic Literature Review. *Information and Software Technology*. 52(11), pp. 1133--1154 (2010)
16. West, J.: How open is open enough?: Melding proprietary and open source platform strategies. *Research Policy* 32(7), pp. 1259--1285 (2003)
17. Nikula, U., Jantunen, S.: Quantifying the Interest in Open Source Systems: Case South-East Finland. *Proceedings of The First International Conference on Open Source Systems*, Genova, pp. 192--195 (2005)
18. Hauge, Ø., Sørensen, C.-F., Conradi, R.: Adoption of Open Source in the Software Industry. *Open Source Development, Communities and Quality*. B. Russo, E. Damiani, S. Hissam, B. Lundell, G. Succi, Springer Boston, pp. 211--221 (2008)
19. Ven, K., Verelst, J.: "The Impact of Ideology on the Organizational Adoption of Open Source Software." *Journal of Database Management* 19(2), pp. 58--72 (2008)
20. Lundell, B., Lings, B., Lindqvist, E.: Open source in Swedish companies: where are we? *Information Systems Journal*, 20, pp. 519--535 (2010)
21. Brink, D., Roos, L., Weller, J., Van Belle, J.-P.: Critical Success Factors for Migrating to OSS-on-the-Desktop: Common Themes across Three South African Case Studies. In: *Proceedings of the 2nd International Conference on Open Source Systems*, pp. 287--293 (2006)
22. Ziesing, J.-H.: Industry Needs in OSS. *UPGRADE, The European Journal for the Informatics Professional*. X(3), June, pp. 41--43 (2009)
23. Fitzgerald, B., Kenny, T.: Open Source Software the Trenches: Lessons from a Large-Scale OSS Implementation. In: *Proceedings of the International Conference on Information Systems*, Seattle, Association for Information Systems, pp. 316--326 (2003)
24. Daffara, C.: Best Practices for FLOSS Adoption. *UPGRADE, The European Journal for the Informatics Professional*. X(3), April, pp. 11--16 (2009)
25. Fitzgerald, B., Russo, N., L., Stolterman, E.: *Information Systems Development: Methods-in-Action*, McGraw-Hill Higher Education, New York (2002)
26. Lundell, B., Lings, B.: Method in action and method in tool: a stakeholder perspective. *Journal of Information Technology*, 19(3), pp. 215--223 (2004)
27. Nordström, M., Welander, T.: *Affärsmässig förvaltningsstyrning - en referensmodell för (system-) förvaltning*, Studentlitteratur, Lund (2002) (in Swedish).
28. Nordström, M.: *Styrbar systemförvaltning - Att organisera systemförvaltningsverksamhet med hjälp av effektiva förvaltningsobjekt*. Ph. D. thesis, University of Linköping, Linköping (2005) (in Swedish)

29. Krishnamurthy, S.: A managerial overview of open source software. *Business Horizons*, 46(5), pp. 47--56 (2003)
30. Ellis, J., Belle, J.-P. V.: Open source software adoption by South African MSEs: barriers and enablers. In: *Proceedings of the 2009 Annual Conference of the Southern African Computer Lecturers' Association, Eastern Cape*, pp. 41--49 (2009)
31. Larsen, M. H., Holck, J., Pedersen, M. K.: The Challenges of Open Source Software in IT Adoption : Enterprise Architecture versus Total Cost of Ownership. In: *IRIS 27, Information Systems Research In Scandinavia, Falkenberg* (2004).

Towards a framework for understanding adoption, implementation and institutionalization of ITIL.

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Abstract: ITIL has been proposed and indeed adopted by many as a framework for solving the problem of IT Service Management. It has been available for organizations for more than 10 years and initial adoption has been high. However, consultancy surveys of ITIL adoption, implementation and institutionalization show that there are only few complete and institutionalized ITIL implementations. This paper presents work in progress on a comprehensive ITIL literature review, focussing on critical success factors and benefits documented in scientific literature about ITIL implementation. Based on this, the paper presents a draft framework aiming at assisting organizations during their decisions regarding ITIL adoption, implementation and institutionalization.

Key Words: IT Service Management, ITIL, Best Practice adoption, Best Practice implementation and Best Practice institutionalization.

Introduction

The purpose of the ITIL (Information Technology Infrastructure Library) literature study is to investigate the body of ITIL knowledge related to adoption, implementation and institutionalization of ITIL focussing on benefits and critical success factors. Findings will be used to form parts of a draft framework to understand the phenomenon better. The purpose of the work will be further specified later through the section “objectives and research questions”. The work is part of a Ph.D. thesis and the findings and conclusions are only preliminary results.

Organizations become increasingly dependent on Information Technology (IT) as an integrated part of the business. This development force top management to focus on aligning IT to the strategy of the organization. Disruptions in IT delivery must be avoided and new IT solutions must continually be launched to cope with market needs and higher demands for improved corporate performance.

To meet this challenge, organizations often look for guidance in popular “Best Practices” like e.g. ITIL; a management and control framework for IT service delivery and support. ITIL was developed by the UK “Office of Government Commerce”, and they state “modestly” on the top of their homepage that “ITIL is a cohesive best practice framework” [22].

ITIL version 1 and 2 has been available for more than a decade and during these years the framework has become increasingly popular in Denmark; the latest ITIL version 3 has been available since 2007.

ITIL version 3 is a life cycle based framework building on a cradle to grave view of managing IT services. It consists of several parts that together form a complete framework.

Adoption, implementation and institutionalization of a Best Practice like ITIL will obviously take time, but in spite of the popularity and relatively high adoption rates it is still unexpectedly difficult to find completed and institutionalized implementations of ITIL version 3 in Danish organizations.

In 2011, four years after the launch of ITIL version 3, and taking into account the high adoption rates of the earlier versions, it could be anticipated that a significant part of the organizations adopting ITIL version 3 have succeed in implementing and institutionalizing this “cohesive best practice framework”. However it seems that most organizations have settled for a partial implementation and very few have institutionalized the “cohesive framework” e.g. by becoming certified for compliance to ISO 20000.

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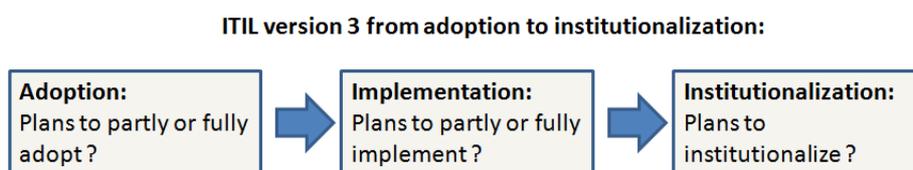


Fig 1. Illustrate the presumed causal relationship. If an organization plans to adopt ITIL it would also begin to implement ITIL with the objective of institutionalizing.

We propose to initially apply theories like e.g. Rogers “Diffusion of Innovations” [28] to help explaining this phenomenon. The aim of this ITIL literature study is primarily to investigate how scientific ITIL literature can contribute to understanding the adoption, implementation and institutionalization of an IT Best Practices like ITIL.

IT Service Management (ITSM)

Service oriented IT management has become increasingly popular together with the need for more customer focus in IT service delivery. This shift from technology orientation to customer orientation [19] is an indication that management strive to increase IT value to the organization. This can be supported by adopting the IT Service Management concept. When adopting IT Service Management, many organizations adopt the ITIL Best Practice framework.

Another motivation for adopting ITIL could be risk mitigation. The introduction of the Sarbannes-Oxley act on corporate governance requirements in US after the spectacular collapses of Enron and WorldCom could influence ITIL adoption. Globally organizations followed the lead of the US focussing on corporate governance [25].

ITIL

The idea of IT Service Management spread during the 1980s. The ITIL usage and the literature however were limited during the first years. ITIL version 2 was released just after year 2000. The combined pressure for more IT value, customer orientation, security and improved governance could be part explanations of increased ITIL adoption. In 2007 the new and considerably extended version of ITIL was released by the UK Office of Government Commerce (OGC) under the name of “ITIL V.3”.

Table 1. The ITIL v.2 and ITIL v.3 processes mapped to illustrate the broader scope of version 3. Processes *in italic* are almost identical processes in both versions.

ITIL v.2	ITIL v.3
Service Support:	Service Strategy:
<i>Service Desk (Function)</i>	Strategy generation
<i>Incident Management</i>	Service Portfolio Management
<i>Problem Management</i>	Demand Management
<i>Release Management</i>	<i>Financial Management</i>
<i>Change Management</i>	Service Design:
<i>Configuration Management</i>	Service Catalogue Management
Service Delivery:	<i>Service Level Management</i>
<i>Availability Management</i>	<i>Capacity Management</i>
<i>IT Service Continuity Management</i>	Availability Management
<i>Capacity Management</i>	<i>IT Service Continuity Management</i>
<i>Service Level Management</i>	Information Security Management
<i>Financial Management</i>	Supplier Management
	Service Transition:
	Transition planning and support
	<i>Change Management</i>
	<i>Service asset and configuration management</i>
	<i>Release and deployment management</i>
	Service validation and testing
	Evaluation
	Knowledge Management
	Service Operation:
	Event Management
	<i>Incident Management</i>
	Request fulfilment
	<i>Problem Management</i>
	Access Management
	<i>Service Desk (Function)</i>
	Technical Management (Function)
	IT Operations Management (Function)
	Application Management (Function)
	Continual Service Improvement(CSI):
	7-Step Improvement Process
	Service reporting
	Service measurement
	Return on Investment for CSI
	Business questions for CSI
	CSI service level management

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At the same time IT service management standards were developed. “BS 15000 was fast-tracked in 2005 to become ISO/IEC 20000, the first international standard in ITSM” [22]. The ISO 20000 standard provides a basis for assessing if the organization actually works according to the IT service management best practices and a certification of compliance is possible.

The coverage of ITIL version 3 is noticeably broader than the previous versions; based on a life-cycle based perspective ITIL version 3 presents a complete cradle to grave IT Service Management framework. Version 3 contains several new processes to keep focus on customer satisfaction and business value while handling the complete path from introducing new services to retiring outdated services.

ITIL V.3 consists of five books summing up to more than a 1000 pages with detailed descriptions of the framework. The five books are: Service Strategy, Service Design, Service Transition, Service Operation and Continual Service Improvement. ITIL version 3 provides detailed advice on how to execute the tasks of an IT department (supplier of IT Services). Process examples from each of the five books are left out due to paper size limitations but will be included in the Ph.D thesis, see Table 1 for a brief overview. More information can be found on the official ITIL web-site: <http://www.itil-officialsite.com/home/home.aspx>

For the moment there are efforts to withdraw the old and simpler ITIL V.2, because the “OGC is committed to the maintenance of alignment between future versions of ITIL and ISO/IEC 20000”. A refreshed version of ITIL was introduced in 2007 (known as version 3). It is planned to withdraw version 2 following a consultation on the best way to do this.” [22].

ITIL adoption

ITIL adoption started on a larger scale from the mid-1990s and adoption of the framework still continues. Regarding the actual adoption of ITIL, this has been studied in two consultancy surveys examining ITIL in a Danish context. From “IT i praksis” [27] we know that adoption rates are high: 46% of private organizations and 88% of municipalities and government organizations use ITIL today. The survey does not investigate if only small parts of the complete ITIL framework are applied nor does it report the maturity of the implementations investigated. Finally the survey doesn’t reveal if it’s the simpler ITIL version 2 or the current version 3. According to the authors’ knowledge – with many years of CIO experience and participating in e.g. CIO networks - only very few organizations in Denmark have completed, matured and institutionalized ITIL V.3.

From “MATERNA IT Service Management Executive Study” [20] we can get some indications regarding this topic. This survey reported a continuing increase in Nordic ITIL adoption. “Acceptance of ITIL” numbers rose from 59% in 2006 to 90% in 2009. Additionally in the 2008 survey 70% of respondents think positively about the new ITIL v.3.

Despite the high adoption rates, when we compare the results from the 2008 and 2009 Materna surveys something interesting can be observed (see table 2).

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Table 2. Percentages of completed implementation of single processes in 2008.

MATERNA Survey:	ITIL:		Completely implemented	Adequately implemented
	v.2	v.3		
Process/function:	2	3	2008	2009
Service Desk	2	3	63%	53%
Incident Management	2	3	58%	44%
Change Management	2	3	38%	32%
Problem Management	2	3	37%	19%
Request fulfilment		3	23%	29%
Service Level Management	2	3	20%	14%
CMDB/CMS	2	3	14%	-
Event Management		3	12%	15%
Service Asset & Config. Mgt.		3	8%	-
Release & Deploy. Mgt.		3	12%	-

The number of completed implementations of single processes seems to drop from 2008 to 2009. Even answers relating to core processes like Incident, Change and Problem Management show rather large drops. There could probably be several explanations for this, but one explanation could be that respondents find it difficult to complete implementation of the processes. The change in the question from “complete” to “adequately” could furthermore hide even bigger drops indicating that implementing a process partly would now be “adequate”?

Our conclusion based on the surveys is that although ITIL version 1, 2 and 3 got adopted on a broad scale, only few organizations seems to adopt, implement and institutionalize the complete version 3 framework.

Because ITIL v.3 is “a cohesive” framework, implementing only a few processes would not indicate institutionalizing ITIL v.3. Another and better measure on this would be certification according to ISO 20000.

The surveys contain information about ISO 20000 certification. This is interesting because certification can be considered a “blue stamp” that ITIL v.3 has been implemented “adequately”. From the Materna surveys we could see: In 2008 15% of respondents in Denmark plan to continue their ITIL implementation with an ISO 20000 certification within 24 months.

If the implementation and institutionalization were spread evenly over time, it could be expected, that 15% of the 500 respondents = 75 planned to have a certification before 2011.

In the 2009 survey “more than 50% strive for an ISO 20000 certification within the next twelve months which is a big increase compared to the 2008 survey.” These numbers predicts that we could expect an even higher number than 75 certificates in Denmark within 12 months from 2009.

However the authors know only of very few organizations in Denmark that had actually realized their plans, we plan to follow this. In early 2011 only a handful of Danish organizations have obtained the ISO 20000 certificate, why?

Relevance of the study

According to the surveys numerous Danish organizations reports that they want to ISO 20000 certify their ITIL implementations. The certification can be considered a sign of institutionalization for which reason the number of certificates is interesting. However despite the intention only very few had reached their goal. This corresponds with the knowledge of the authors that only very few organizations have institutionalized the complete ITIL v.3 framework. Considering the high adoption rates in Denmark and the amount of resources used on ITIL; understanding of the low institutionalization rate and providing a framework to assist management in their ITIL efforts is of high relevance.

Objectives and research questions

This paper contains a literature study and the initial thoughts regarding a framework. The methodology is designed to create more knowledge from our present body of knowledge about ITIL. Its aim is to provide a basis for a better understanding of the adoption, implementation and institutionalization of ITIL. The purpose can be condensed into two objectives:

Objective I: To provide an overview of the literature regarding adoption, implementation and institutionalization of ITIL

Objective II: To develop a framework for a better understanding of the high adoption but surprisingly low implementation and institutionalization rates of ITIL version 3. The intention is to further develop this framework in order to assist management in their adoption, implementation and institutionalization of ITIL.

Objective I and II are broken down into the operational research questions 1-3:

- 1) *What is the present body of knowledge about ITIL adoption, implementation and institutionalization in the scientific ITIL publications?*
- 2) *What benefits and contingency factors can management find in scientific ITIL publications assisting them to decide whether to adopt ITIL or not?*
- 3) *What critical success factors can management find in scientific ITIL publications assisting them to implement ITIL successfully?*

Because this “work-in-progress” paper is part of a thesis the above questions will not all be addressed completely in this paper, the main purpose of this paper is to receive feed-back on the methodology.

Methodology

A literature review will be used to create an overview of the ITIL body of knowledge addressing the research questions. The literature review will be structured according to Okoli & Sahabram [23] and their 8-step approach see table 3.

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Table 3: The 8-step approach: “A guide to conducting a systematic literature review of information systems research”

<p>Step 1: Purpose and intended goals of the literature review</p> <ul style="list-style-type: none"> ○ Has been determined in the previous sections of this paper.
<p>Step 2: Protocol</p> <ul style="list-style-type: none"> ○ Is the review protocol, used to document the method of the literature review making it reproducible for others and making it easier to cooperate between more researchers working on the same review. ○ Due to size limitations the protocol will not be presented here as a detailed procedures manual, but instead the steps will be described in details throughout the 8 steps to make it reproduce able for others (only extracts will be presented in this paper, the full process will be presented in the thesis).
<p>Step 3: Searching for the literature</p> <ul style="list-style-type: none"> ○ Will be documented in headlines in the next sections of this paper and in details in the thesis.
<p>Step 4: Practical screen – screening for inclusion</p> <ul style="list-style-type: none"> ○ Will be documented in details in the next sections of this paper.
<p>Step 5: Quality appraisal – screening for exclusion</p> <ul style="list-style-type: none"> ○ Will be documented in details in the next sections of this paper.
<p>Step 6: Data extraction</p> <ul style="list-style-type: none"> ○ Data will be presented under the “Findings” section.
<p>Step 7: Synthesis of studies</p> <ul style="list-style-type: none"> ○ Has not been started yet, however initial thoughts on methodologies to aggregate, compare and discuss extracted data will be present in the “Methodology” section together with preliminary results under the “Findings” and “Discussion” sections of this paper.
<p>Step 8: Writing the review</p> <ul style="list-style-type: none"> ○ Will not be a separate step, but the result is contributions assembled, combined and synthesised into the final Ph.D thesis.

Step 1 was completed in the first part of this paper and step 2 was left out due to size limitations.

Step 3 “Searching for the literature” According to the 8-step approach, a pool of publications should be accumulated. In addition it must be decided whether the review should be narrow or broad and in which locations to search for the literature.

Because of the limited amount of scientific literature within the topic, a broad approach was chosen for a start not to miss too many important sources of information and to get an outline of the body of ITIL knowledge. For this reason the search started with keyword “IT Service Management” narrowing down with keyword “ITIL”.

The focus of this review is what management can learn from scientific ITIL literature. This is defined as peer reviewed articles about ITIL published in scientific journals or conference proceedings. However since there is a very limited amount of scientific ITIL literature, the scope was set very wide to be able to identify everything what has been written about ITIL. For this reason all publications that could be found in the CBS library databases on ITIL was included. Step by step the pool of papers was narrowed down, as will be explained below.

As a consequence of this decision articles from popular IT trade magazines like Computer World and books will be included in the first steps presenting an overview of publications. Trade magazines and books will nevertheless be excluded in the later steps. The trade magazines and books will merely contribute to complete the picture of the full body of ITIL knowledge.

Before the search started the next decision was deciding which of the CBS library databases to search for materials, selection of the search keywords and whether the search for keywords should be done within title, subject etc.

List of resources searched in the CBS library databases:

- [Academic Search™ Elite](#)
- [ACM Digital Library \(ACM Portal\)](#)
- [Business Source® Complete](#)

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- [Cambridge Journals Online](#)
- [Communication & Mass Media Complete™](#)
- [Emerald ManagementXtra](#)
- [Oxford Journals Online](#)
- [SAGE Journals Online](#)
- [Science Direct](#)
- [SocINDEX™ with Full Text](#)

Year range: ITIL version 1 was developed during the 1980's by CCTA (British Central Computer and Telecommunications Agency). However a search for ITIL in the Title for year range 1980-1990 in the CBS Library article search databases above returned only 5 hits, none of the hits had any relevance towards IT Infrastructure Library (ITIL). For this reason it was decided to narrow search to the years: 1990-2010.

The article search started in the autumn of 2010 and went on for a period of three weeks. Papers located were imported into RefWorks to be able to:

- browse, search and manage the references
- share folders of included and excluded sources with readers that have further interest in the subject

At this step the search was performed going through several steps, which have been left out here due to space limitations. This resulted in a total of 588 records that was imported into RefWorks.

Step 4: “Practical screen – screening for inclusion” During this step 4, it was decided what studies to include and what studies to leave out without further examination, because they were not relevant.

All articles included in this step were placed in the RefWorks folder: "ITIL_Lit_inclusion". The file can be accessed through this link: http://www.refworks.com/refshare?site=016351135918800000/RWWEB10420756/ITIL_Lit_inclusion

After these searches, the recommendation of Webster & Watson [35] was followed going backwards by looking at citations in already identified articles and going forward by Web of Science Citation Index to look for further articles citing key articles.

Left out articles have been placed in the RefWorks folder: ITIL_Lit_leftout_inclusion, the folder can be seen on this link: http://www.refworks.com/refshare?site=016351135918800000/RWWEB10420756/ITIL_Lit_leftout_inclusion

In this stage a simple account of number of publications in the pool: ITIL_lit_inclusion will be presented, before several contributions will be excluded in the later steps.

Step 5: "Quality appraisal – screening for exclusion" The quality appraisal aimed to ascertain that possible learning possibilities will be drawn from scientific ITIL literature of a certain (high) quality. For this reason under the name of "scientific ITIL literature" only the following was included:

- Primary sources: scientific literature published in scientific journals or presented at conferences that reports original empirical or theoretical work.

And as a result these were excluded:

- Secondary sources like books and review articles.

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- Tertiary sources including work made for the broad public e.g. trade publications like Computer Weekly. However we will need to refer to the OGC ITIL manuals during this work.

Completing step 5 left behind a pool of papers from which the in dept data extraction in step 6 could begin.

Step 6: “Data extraction”: during step 6 applicable data was systematically extracted from each study supporting the work on answering the operational research questions, preliminary findings are presented under the findings section.

Continuing from the “simple counting” to the more in dept data extraction it was decided to use an open coding technique. During the analysis of the titles and abstracts an initial understanding of possible topics developed. Inspiration by a more rigid methodology Grounded Theory that presents a single, unified, systematic method of analysis, we applied elements of this to structure the next iterations of data extraction. Open coding is the first step of data analysis, where phenomena were identified, labelled and categorized. This was done prior to the next step axial coding, where a coding paradigm was used to identify causal relationships. Codes were related to each other through inductive/deductive thinking; building on the assumption in figure 1. The elements below were used as a coding paradigm during the data extraction. The headlines are derived from a basic frame of generic relationships used in grounded theory [8].

- **Phenomenon:** Subject of interest: ITIL Benefits(expected, short term and long term), ITIL implementation Critical Success Factors, documentation of completed, matured and institutionalized ITIL implementations
- **Causal conditions:** Reasons and motivations to adopt ITIL
- **Context:** Contingency factors like e.g. industry, organization size, importance of IT for the organization, which version of ITIL, amount of ITIL implemented and level of ITIL and IT maturity, Business Process Management maturity[9], Turn around organization or stable organization

- **Intervening conditions:** E.g. management strategies used before and during the implementation.
- **Action strategies:** Ways of adopting, implementing and managing ITIL
- **Consequences:** Intended and unintended consequences of the above and documented in the paper

Finally selective coding was applied to relate sub-categories to the categories through the paradigm model and relate categories at the dimensional level (this was done in step 7 synthesis of the studies to aggregate, organize and compare data) [8], [32], [35].

Step 7: “Synthesis of Studies” “When the articles for the review have been screened, selected, and scored, the next requirement was to combine them in order to make comprehensive sense making of a large number of studies” [23] According to the 8-step process, the synthesis can be either quantitative or qualitative. Quantitative synthesis in the form of meta-analysis often “makes no sense in the context of qualitative primary studies”. The ITIL studies are merely qualitative for which reason qualitative synthesis is applied. In step 7 under the “Findings” and “Discussion” sections the selected papers in the ITIL_lit_step6 folder will be classified according to topics [35], transforming information from an author perspective at the “simple counting” stage to a concept-centric perspective to fit data in the best way to answer the operational research questions.

Step 8: “Writing the review” The writing step will be completed during the work in step 1-7 and presented finally in the thesis.

After this outline of the methodology the preliminary findings will be presented below.

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Findings

Research question 1 will be partly answered presenting a “simple counting” of the selected literature in the ITIL_Lit_inclusion folder, the simple counting contains:

- Number of publications per year:
- Journals with most publications
- Authors with highest number of publications
- Topics

Number of publications

Total number of publications can be seen in figure 2. From the headcount of the publications can be seen, that no publications before 2002 passed the previous steps and even the number of publications before 2005 is very limited. Interest seems to peak in 2007. No conclusions will be drawn about 2010, because the data extract was made partly before the end of year 2010.

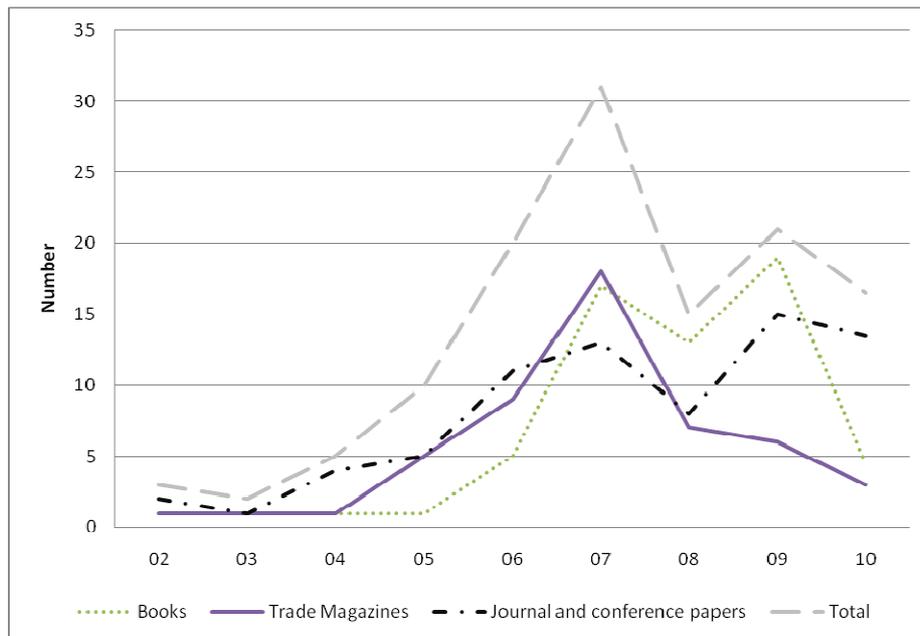


Fig. 2. The number of ITIL publications per year from 2002-2010 (all numbers for 2010 are estimated on the basis of the first 8 months of 2010).

There seems to be a peak in interest in 2007; to understand that peak more in depth, we choose to split the sources according to the following criteria:

1. Books
2. Journal articles from “trade magazines etc.” often with no specific “abstract field” information
3. Academic journal articles and conference proceedings (mostly with abstract field filled out)

The number of publications for each is as presented in figure 2.

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This provided a slightly changed picture. After 2007 especially the trade magazine articles drops fast in number. Since these contained the more practically oriented articles from e.g. Computer World, this could indicate that the peak and the drop show a fading interest in ITIL for practitioners. On the other hand, the number of published books and academic journal articles and conference proceedings increase again in 2009, which could indicate an increased interest among scholars.

Journals publishing ITIL articles

Analyzing the ITIL_Lit_inclusion folder gave us the following data: A total of 178 publications presented through 60 books, 46 journals and 34 conferences. There were 29 trade journals that published a total of 50 articles without abstract; which is an average of 1.7 article/journal. Journals within this category were mostly popular practitioner oriented journals e.g. Network World. The most publishing of these journals were: Network World, Computer World and ITNOW with 7, 6 and 5 publications. Title examples within this category:

- Lining up behind ITIL
- The IT Best Practice Revolution
- Taking on IT Service Management

Journals and conference proceedings with abstracts count for 68 publications from 34 conferences and 17 scientific journals. Journal rankings are from www.aisnet.org (August of 2010) The most publishing journals were:

- 4 papers - IBM Systems Journal (*MIS Journal Ranking: 55*)
- 4 papers – Information Systems Management (*MIS Journal Ranking : 65*)
- 3 papers – Wirtschaftsinformatik (*MIS Journal Ranking : 61*)
- 3 papers – Fujitsu Scientific & Technical Journal (*No MIS ranking*).

Most contributing author

The most contributing authors amongst the publications within the ITIL_Lit_inclusion folder are listed below; number of publications refers to papers/books, where the authors are primary author:

- 5 publications: Dr. *Axel Hochstein*
- 4 publications: Michael Brenner
- 4 publications: *Marko Jäntti*

If both primary, secondary, tertiary author roles count: *Aileen Cater-Steel* should be mentioned with 6 contributions in total.

Now the simple counting was completed and the process was proceeded to step 5 “Screening for exclusion”.

After having performed this “Screening for exclusion” there were 60 scientific ITIL references left in the “ITIL_lit_step5_exclusion” folder that at this stage contains only “Primary sources: scientific literature that is published in scientific publications or presented at conferences and reports original empirical or theoretical work”.

The folder can be seen here:

http://www.refworks.com/refshare?site=016351135918800000/RWWEB10420756/ITIL_lit_step5_exclusion

Topics

At this step titles and abstracts of the publications were analyzed to see which topics were dealt with and which papers could be directly related to answering the research questions. During this coding work each title and abstract was investigated to identify the topics studied.

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Summing up the topics studied figure 3 was developed. Each topic is defined in details in the thesis, but left out here due to size limitations.

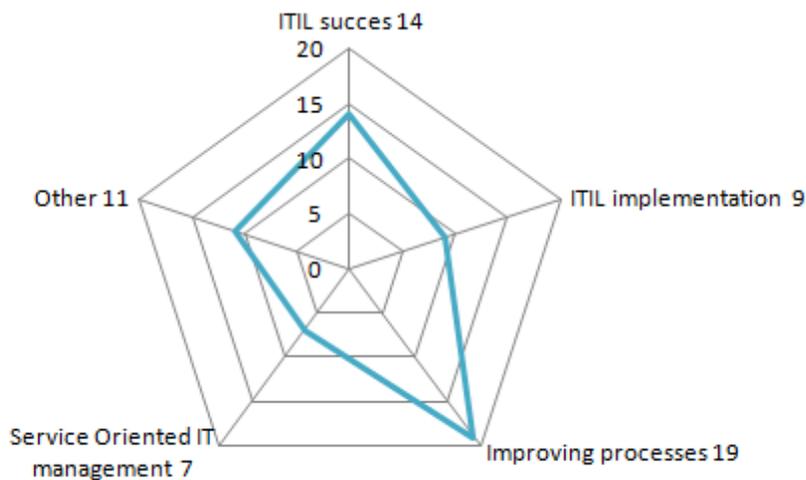


Fig.3. Topics studied. The scientific ITIL references left in the “ITIL_lit_step5_exclusion” split in topics.

After this initial work, the papers were split into two groups according to their relevance in answering our research questions

1. Topics that can help answer the research questions. This group will include “ITIL success” and “ITIL implementation” both topics contains papers dealing with:
 - Facts about coverage and maturity of ITIL implementations
 - Benefits from ITIL implementation
 - Contingency factors
 - Implementation Critical Success Factors (CSF)
 - Facts about long term usage of ITIL and institutionalization
2. Topics less relevant in answering the research questions: “Detailed process analysis and improvement”, “Service oriented IT management” and “Other” all topics dealing with other subjects like:

- In dept work on ITIL supporting IT systems etc.
- Detailed information about single ITIL processes with no or little information about completed ITIL implementations
- General IT Service Management discussions without direct ITIL relevance
- ITIL Education
- Other

We will proceed only with group 1 now containing 23 papers; they have been extracted into the following folder, where they can be accessed through this link: http://www.refworks.com/refshare?site=016351135918800000/RWWEB10420756/ITIL_lit_step6

Next step was an in dept data extraction working with open-, axial and selective coding on the 23 papers. This quality appraisal was done during the detailed data extraction. The findings from the in dept data extraction was organized to answer the research questions.

Research question 2 will be answered referring to the coding of the papers according to the coding paradigm. The answer will be split in two parts: The first part contains the benefits part, which will be answered via the causal conditions from the coding paradigm. The second part concerns the contingency factors, and will be answered via the context factors from the coding paradigm.

Benefits to be expected are a part of the coding paradigm causal conditions: "Reasons and Motivation to adopt ITIL". From the coding a list of benefits were drawn from the papers and categorized according to the Shang and Seddon [29] benefits framework. They are shown in appendix 1 with direct reference to each paper including which page in the paper they were presented. Management can use this appendix when they consider whether these benefits can justify the time and resources that must be invested in adopting, implementing and institutionalizing ITIL. Examples from the complete list of benefits can be seen in table 4.

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Table 4. Examples of main benefits summed up. The complete overview of identified benefits during coding can be found in appendix 1.

<p>Operational benefits: Improved service delivery Proactiveness of IT better Optimized work procedures Rigour in testing and system changes Clear definitions of tasks and processes Server faults reduced</p> <p>Managerial benefits: Verifiable and traceable success Standardization => efficiency Process documentation => efficiency Process assesment Process improvement Common language => better communication</p> <p>Infrastructure benefits: More predictable infrastructure</p> <p>Strategic benefits: Benchmarking of IT performance Significant cost reductions Improve IT strategy Strategic alignment</p> <p>Organizational benefits: Improve client & service orientation Create organizational learning = new routines Higher satisfaction with IT service provider Common sense of purpose, processes and terminology</p>
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About the contingency factor part of research question 2 only very little were directly documented in the papers. However some contingency factors with possible influence on success were mentioned. An example was organization size – see table 5.

Table 5. Example of contingency factor “organization size” drawn from the papers during coding work.

<p>Organization size: During the coding a causal relationship between organization size and ITIL adoption, implementation and institutionalization revealed, however no CSFs were related directly to organization size, even though e.g. "[4]: Cater-Steel and Tan 2005" found support for the hypothesis that larger organization were more likely to implement ITIL. Along a similar vein "[36]: Winniford et al. 2009" found that in companies larger than (+20000 employees) 60 % of companies used IT Service Management, while figures for smaller companies were 23-29%</p> <p>Implications for framework: From open-, axial- and selective coding, there seems to be a causal relationship between industry and ITIL adoption, implementation and institutionalization for which reason this variable will be included in the draft of the framework</p>

We have drawn the contingency factors in table 6 from the papers and chosen them to be included as part of the draft framework as contextual/contingency factors management should consider before deciding to adopt, implement and institutionalize ITIL:

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Table 6. Context factors drawn from the papers; to form part of the framework, industry are presented with details as an example.

<p>Coding paradigm "Context":</p> <ul style="list-style-type: none"> - Industry - Organization size - Importance of IT for the organization - Business Process Management maturity - Turn around or stable organization - Other contingency factors <p>Industry</p> <p>During the coding indications of a causal relationship between industry and ITIL usage seems to appear however no CSFs were related directly to industry. The papers on successful ITIL usage seems to be within the following industries:</p> <ul style="list-style-type: none"> - Banking and finance - Institutions of Education - Telephone and IT - Public administration <p>"[36]: Winniford et al. 2009" found that there were more IT Service Management users in the following industries: Telecommunications, technology, wholesale, and non-profit.</p> <p>Futher could be mentioned that "[4]: Cater-Steel and Tan 2005" found no support that public sector organizations would be more advanced in ITIL adoption than private sector organizations</p> <p>"[3]: Carol Pollard and Cater-Steel, 2009" found no difference in justification to implement ITIL or implementation strategy between private and public organizations, neither was it related to geograhpic location.</p> <p>"[10]: Hochstein, Tamm and Brenner, 2005" discuss that in ITIL no reference is made to size, or specific branches of business. In "[12]: Hochstein and Brenner 2006" an example of different needs in financial and steel industry is discussed</p> <p>Implications for framework:</p> <p>From open-, axial- and selective coding, there seems to be a causal relationship between industry and ITIL adoption, implementation and institutionalization for which reason this variable will be included in the draft of the framework</p>

Research question 3 will also be answered in two parts according to the coding paradigm. The CSFs derived from the papers were according to the coding paradigm split in intervening conditions and action strategies. Intervening conditions: the management strategies used before and during the implementation and CSFs related to this topic. Action strategies: ways of adopting and implementing ITIL and CSFs related to this topic.

Intervening conditions

Answer to the first part of question 3: During the open-, axial- and selective coding the intervening conditions (management strategies) were categorized in: operational-, managerial, infrastructure, strategic and organizational levels according to the Shang and Seddon [29] framework. The first part of the answer to research question 3 (the CSFs related to management) is summed up in table 7. The complete list of CSFs related to management can be seen in appendix 2 with direct reference to the specific papers. The list of CSFs indicates that management could find comprehensive assistance in the scientific ITIL literature on this aspect.

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Table 7. Management CSFs derived from the papers summed up and categorized. The complete list of CSFs with direct reference to the papers and exact page numbers can be seen in appendix 2.

<p>Management - Operational level: Keep processes simple and efficient "[2]: Barafort et al. 2002" Minimize paperwork "[2]: Barafort et al. 2002" Minimize time required in meetings "[2]: Barafort et al. 2002"</p> <p>Management - Managerial level: Sufficient budget for implementation "[10]: Hochstein and Brenner, 2006" Use of learning and knowledge management "[24]: Pedersen et al. 2010" Use of change management "[24]: Pedersen et al. 2010" Senior Management must understand the benefits of process orientation "14: Iden and Langeland"</p> <p>Management - Strategic level: Develop corporate mindset "[4]: Cater-Steel and McBride, 2007" Be aware that introducing ITIL means changing organizational culture "[14]: Iden and Langeland" Strategic alignment and customer focus "[24]: Pedersen et al. 2010" Process as a priority "[24]: Pedersen et al. 2010"</p> <p>Management - Organizational level: Use of a contingency based approach "[24]: Pedersene et al. 2010" Consultancy assistance can be need to speed up learning process "[2]: Barafort et al. 2002" Business and it people must work hand-in-hand "[15]: Kashanchi and Toland, 2006" Customer focused metrics "[15]: Kashanchi and Toland, 2006" Let key personnel participate ind process design and improvement "[14]: Iden and Langeland 2010"</p> <p>Management - Infrastructure level: Before buying IT tools deep feasibility/function analyses must be made "[30]: Spremic et al. 2008" Modular ITSM system must be provided for all processes "[14]: Iden and Langeland 2010" Not let tool decisions and implementation delay the progress "[6]: Cater-Steel, A 2006) Simple tool supported processes better accepted by employees "[12]: Hochstein and Brenner, 2006" Promote automated tracking and reporting "[2]: Barafort et al. 2002"</p>

Answer to the second part of question 3: The CSFs related to action strategies: ways of adopting, implementing and managing ITIL and CSFs related to this topic were drawn from the paper and categorized according to Kotter [17] 8-step approach to be easier reckonable for practitioners.

The complete list of CSFs can be seen in appendix 2 with direct reference to the specific papers and page numbers. The list of CSFs indicate that management could find ample assistance in the scientific ITIL literature on this aspect as well. Examples could be seen in Table 8.

Table 8. Implementation CSFs derived from the papers summed up and categorized.

The complete list of CSFs with direct reference to papers can be seen in appendix 5.

<p>1: Sense of urgency Establish objective, consistently and reliably absence of process maturity "[2]: Barafort et al. 2002"</p> <p>2: Guiding coalition Senior Management must formally decide the ITIL introduction "[14]: Iden and Langeland 2010" Change in corporate culture by appointing senior staff as process owners "[33]: Tan, Cater-Steel and Toleman, 2009" High quality project team important for success "[12]: Hochstein and Brenner, 2006"</p> <p>3: Create vision Both business and it people need to understand ITIL concept "[15]: Kashanchi and Toland, 2006" Create common language "[34]: Wagner 2006" Change in culture of IT staff towards focus on service excellence "[15]: Kashanchi and Toland, 2006"</p> <p>4: Communicate vision Marketing campaigns "[10]: Hochstein, Tamm and Brenner, 2006" Interdepartmental communication and colaboration "[3]: Carol, Pollard and Cater-Steel, 2009"</p> <p>5: Empower to act Implementation scope must fit nature of organization "[2]: Barafort et al. 2002" Implementation scope must fit the critical processes "[2]: Barafort et al. 2002" Winning "hearts and minds" through enrollment "[4]: Cater-Steel and McBride, 2007"</p> <p>6: Plan for short term wins Focus on benefits realisation plan "[6]: Tan, Cater-Steel and Toleman, 2009" Start with a few ITIL processes with great opportunity for success "[24]: Pedersen et al. 2010" Showing of "quick wins" "[10]: Hochstein, Tamm and Brenner, 2006"</p> <p>7: Consolidate Implement appropriate processes slowly and adjust over time "[2]: Barafort et al. 2002" Using consensus to reach agreement on processes and adjust over time "[2]: Barafort et al. 2002" Plan an reinforce project objectives "[24]: Pedersen et al. 2010"</p> <p>8: Institutionalize Prepare workforce for external assesment "[2]: Barafort et al. 2002" Set wide range of KPI to follow process improvements "[30]:Spremic et al 2008" Audit and assess the maturity development "[30]:Spremic et al 2008"</p>

Discussion

What knowledge can be drawn from the previous steps?

The literature review showed that ITIL publications in trade magazines have peaked back in 2007. There still seems to be some interest in the subject by researchers and book publishers even though publications in the area remain very scarce. No top ranking journals deals with the subject and most of the papers studied report findings on small elements of ITIL like parts of IT systems, improvement in parts of single processes etc. As little as 23 papers were of high relevance contributing to answer the research questions.

We know that Danish initial adoption rates are high but there are strong indications that institutionalization rates are low. Very few have certified their ITIL implementation by ISO 20000.

This could indicate that many Danish organizations adopt ITIL but the majority of the implementations will only be done partly with no institutionalization of the “cohesive best practice” and actually no significant documentation can be found in scientific ITIL literature explaining this phenomenon.

What can be learned from the scientific ITIL literature identified and studied in this work?

Even though the phenomenon can't be explained through the scientific ITIL literature we can draw knowledge regarding benefits and contingency factors from the scarce scientific ITIL literature. About benefits or as we translated it in the draft of the framework “reasons and motivations to adopt ITIL”: On the operational level benefits as “clear definitions of tasks and processes” and “optimized work procedures” could be important reasons to adopt ITIL. These kinds of improvements could result in improved “Rigour in testing and system changes” and “Improved service delivery”. On the managerial level further benefits can be enhanced supporting further

improvements: “Process documentation => efficiency” good documentation will provide a basis for “Process assessment” and further “Process improvement”. If these benefits are combined with a “More predictable infrastructure” an organizational benefit like e.g.: “Improve client and service orientation” could appear; these elements can provide possibility for some of the strategic benefits like “Significant cost reductions” and “Strategic alignment”.

Regarding contingency factors only little was documented and even less was examined for causal relationship with ITIL adoption, implementation and institutionalization. However we have drawn a few contingency factors from the literature e.g.: industry, size and business process management maturity as exogene factors that could indicate influence on ITIL adoption, implementation and institutionalization.

We found a rich amount of documented critical success factors and we split them in two categories: management and implementation. The critical success factors add up to an important body of knowledge about different management and implementation elements to remember during adoption, implementation and institutionalization of ITIL. However in the scientific literature there is only very limited or no documentation of institutionalized complete ITIL v3 implementations. If we combine this with the low number of ISO 20000 certificates and the high interest to obtain the certificate this could indicate several explanations. ITIL v.3 diffusion rate could be influenced by e.g. its complexity or compatibility. Organizations could have difficulties in implementing and institutionalizing ITIL. Or maybe organizations re-evaluate ITIL v.3 relative advantage during the implementation. The framework presented in the next section has focus on assisting organizations in their adoption, implementation and institutionalization of ITIL.

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Towards a framework to assist management in adopting, implementing and institutionalizing ITIL

If the knowledge from the ITIL body of knowledge presented above is combined with theory it may be possible to develop a framework to assist management during their adoption, implementation and institutionalizing of ITIL.

The theories of relevance are out of the scope of this IRIS paper and will not be finally identified in this work-in-progress paper.

To be useful to management the framework must present relevant variables that could influence on the complexity of implementation and institutionalization as well as the benefits and disbenefits resulting from the adoption, implementation and institutionalization of ITIL.

Because the theoretical work is just about to begin, the framework will not be finally developed in this paper, but a very early idea for a framework is presented anyway to obtain feed-back on the basic idea of the framework.

In the draft framework the benefits and CSFs from the literature was further categorized into causal conditions (why adopt ITIL), exogene variables that are difficult to change on short term, and endogene variables that can be changed in short term. Finally the output could be observed, expecting that after adoption and implementation it should be possible to observe the consequences: benefits, dis-benefits and signs of institutionalization. The first draft of the assisting framework is presented in figure 4 is must be read together with the two appendixes containing the benefits and CSFs.

What can management learn from scientific ITIL literature about ITIL adoption, implementation and institutionalization (CSFs and benefits):

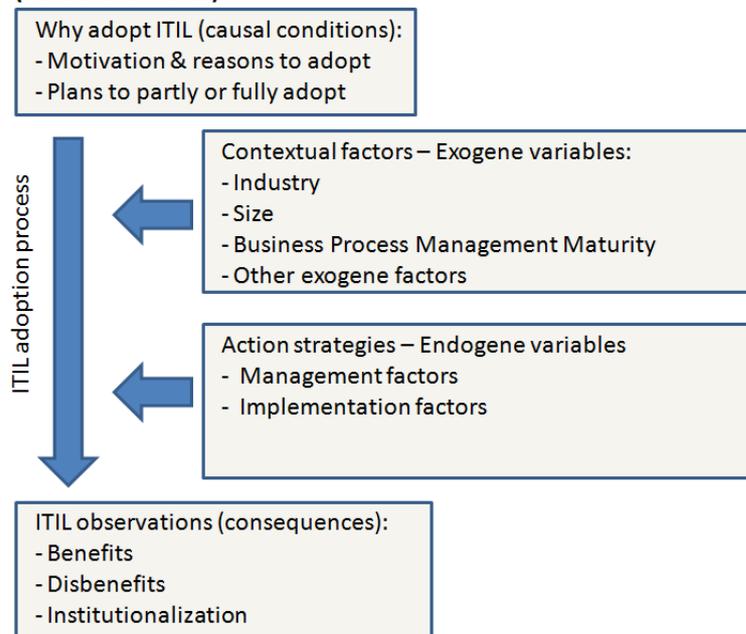


Fig. 4. The first draft of the framework.

In the Ph.D thesis the framework will be tested against data (e.g. through action research, survey/interviews etc.) and a simpler framework will be made to provide guidance to management.

Conclusion

Early 2011 only a handful of Danish organizations have obtained the ISO 20000 certificate, why?

At this stage of the work it seems that scientific ITIL literature is too scattered to provide any conclusive picture. We have not found one single scientific paper providing an estimate of the number of completed and institutionalized ITIL v.3 implementations.

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We were able to identify expected benefits from ITIL and we incorporated these into our draft framework so management can consider whether these benefits can justify the time and resources that must be invested in adopting, implementing and institutionalizing ITIL.

We were also able to identify several CSFs from literature. These were categorized and incorporated into the draft framework, and they also provided knowledge to management as “practical advice” during their work with adopting, implementing and institutionalizing ITIL.

The authors expect that this literature review and the framework eventually will be able to assist management in their initiatives during ITIL adoption, implementation and institutionalization. Through this paper we have provided the first elements in this “practitioner toolbox”.

References

1. Arcilla M, Calvo-Manzano J, Cuevas G, Gomez G, Ruiz E, and Feliu TS. A solution for establishing the information technology service management processes implementation sequence. *Software Process Improvement, Proceedings 2008*; 16: 106-116.
2. Barafort B, Di Renzo B, and Merlan O. Benefits resulting from the combined use of ISO/IEC 15504 with the information technology infrastructure library (ITIL). *Product Focused Software Process Improvement, Proceedings 2002*; 2559: 314-325.
3. Carol Pollard, Aileen Cater-Steel. Justifications, strategies, and critical success factors in successful ITIL implementations in U.S. and Australian companies: An exploratory study. 2009; 26: 164 – 175.
4. Cater -Steel A, McBride N. IT service management improvement - actor network perspective. 2007; .
5. Cater -Steel A, Tan WG. Implementation of IT infrastructure library (ITIL) in Australia: Progress and success factors. 2005; .

6. Cater-Steel A., Toleman M., and Tan. Transforming IT service management - the ITIL impact. 2006; .
7. Ghayekhloo S, Sedighi M, Nassiri R, Shabgahi GL, and Tirkolaei HK. Pathology of organizations currently implementing ITIL in developing countries. Second International Conference on Computer and Electrical Engineering, Vol 2, Proceedings 2009; 7-10.
8. Glaser BG, Strauss AL. The discovery of grounded theory, Aldine de Gruyter New York. 1967.
9. Hammer M. The Process Audit Harvard Business Review page 111 April 2007
10. Hochstein A., Tamm G., and Brenner W. Service-oriented IT management: Benefit, cost and success factors. 2005; .
11. Hochstein A., Zarnekow R., and Brenner W. Evaluation of service-oriented IT management in practice. 2005; .
12. Hochstein A, Brenner W. Implementation of service-oriented IT management: An empirical study on Swiss IT organizations. 2006; .
13. Hochstein A, Zarnekow R, and Brenner W. ITIL as common practice reference model IT service management - formal evaluation and implications for practice. *Wirtschaftsinformatik* 2004; 46: 382-389.
14. Iden J, Langeland L. Setting the stage for a successful ITIL adoption: A delphi study of IT experts in the Norwegian armed forces. *Inf Syst Manage* 2010; 27: 103-112.
15. Kashanchi R, Toland J. Can ITIL contribute to IT/business alignment? an initial investigation. *Wirtschaftsinformatik* 2006; 48: 340-348.
16. Koch H, Gierschner C. Advantages of an ITIL-based process framework in a complex SAP((R)) system landscape. *Idaacs 2007: Proceedings of the 4th IEEE Workshop on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications* 2007; 431-433.
17. Kotter J.P.: *Leading Change* Harvard Business January 2007
18. Lawkobkit M. Information technology service management: A Thailand perspective. *Software Engineering, Artificial Intelligence, Networking and Parallel/distributed Computing* 2008; 149: 103-111.

Towards a framework for understanding adoption, implementation and institutionalization of ITIL 35

19. Luftman J, McLean ER. Key issues for IT executives. *MIS Quarterly Executive* 2004; 3: 89-104.
- 20 Materna Information & Communications www.materna.dk. Materna IT service management executive study 2008 + 2009. 2008.
21. Năstase P, Năstase F, and Ionescu C. CHALLENGES GENERATED BY THE IMPLEMENTATION OF THE IT STANDARDS COBIT 4.1, ITIL V3 AND ISO/IEC 27002 IN ENTERPRISES. *Economic Computation & Economic Cybernetics Studies & Research* 2009; 43: 1(16).
22. OGC. Homepage: [Http://www.ogc.gov.uk/guidance_ityl.asp](http://www.ogc.gov.uk/guidance_ityl.asp).
23. Okoli C, Schabram K. A guide to conducting a systematic literature review of information systems research. *sprouts working paper on information systems* 10(26) <http://sprouts.aisnet.org/10-26>.
24. Pedersen Keld, Kræmmergaard Pernille, Lyng Bjarne Christoffer, and Schou Christoffer Dalby. ITIL implementation: Critical success factors a comparative case study using the BPC framework. *Journal of Information Technology Case and Application Research* 2010; 12: 11.
25. Peterson R ed. *Integration strategies and tactics for information technology governance*. 2003.
26. Potgieter BC, Botha JH, and Lew C(. "Evidence that use of the ITIL framework is effective".
27. Ramboell. *IT i praksis rambøll management consulting A/S*. 2010; .
28. Rogers EM. *Diffusion of innovations* (5th ed.). new york, NY: Free press. 2003; .
- 29 Shang, S. and Seddon, P. (2002) Assessing and managing the benefits of enterprise systems: the business manager's perspective. *Information Systems Journal* 12, 271-299

30. Spremic M. IT and business process performance management: Case study of ITIL implementation in finance service industry. Proceedings of the Iti 2008 30th International Conference on Information Technology Interfaces 2008; 243-249.
31. Strauss A, Corbin J. Grounded theory methodology handbook of qualitative research: Edited by norman K. denzin; yvona S. lincoln. 1994; .
32. Strauss A, Corbin J. Grounded theory methodology. handbook of qualitative research: Edited by norman K. denzin; yvona S. lincoln. 1994; .
33. Tan W, Cater-Steel A, and Toleman M. Implementing it service management: A case study focussing on critical success factors. Journal of Computer Information Systems 2009; 50: 1-12.
34. Wagner H. Managing the impact of IT on firm success: The link between the ressource-based view and the IT infrastructure library. 2006; .
35. Webster J, Watson RT. Analyzing the past to prepare for the future: Writing a literature review. MIS Quarterly 2002; 26: 13-23.
36. Winniford M, Conger S, and Erickson-Harris L. Confusion in the ranks: IT service management practice and terminology. Inf Syst Manage 2009; 26: 153(11).
37. Zhao C, Gan H, and Gao F. A study on the process model for IT service management. Cea'09: Proceedings of the 3rd Wseas International Conference on Computer Engineering and Applications 2009; 206-210.

The Six-C model for IS project teambuilding

Abstract. This conceptual paper presents a model for IS project teambuilding in six phases called the Six-C model. The model is derived from an analysis of existing teambuilding models, their strengths and weaknesses. The paper shortly presents the existing models and the analysis of each. Following the presentation of the Six-C model there is an overview of techniques that can be used in each phase. Finally, the Six-C model has been used in numerous projects. The experiences from empirical use are shortly elaborated.

Keywords: IS Projects, teambuilding, techniques and tools

1 Introduction

Nearly all IT development work is organized as projects today. And the scope of a typical IT project is so that no single person can handle the project alone; a team is needed.

A recent survey (2010) with participation of 400 IT managers from major organizations in Denmark, Sweden and Norway identified the key business challenges that these companies faced. They stated "increased efficiency" and "improvement of processes" as two of the main challenges.

Thus there is an obvious need for improving the processes of IT project teams.

This conceptual paper aims at deriving a new teambuilding model for IT projects. We start out from the widely known Forming-Storming-Norming-Performing model (Tuckman, 1965). Next we compare and analyze other known teambuilding models and we derive a new model called *the Six-C model* – where the "C"s comes from the initials of the six stages.

2 Team development models

2.1 Forming-Storming-Norming-Performing

A team development model is - as its name says - a model of how teams develop and how this development evolves over time. Most models consist of several phases, each with different characteristics and goals. One of the most widespread and well known team development models dates back to 1965 when Bruce W. Tuckman (1965) identified four stages that a typical team goes through, called Forming, Storming, Norming and Performing.

The model was based on Tuckman's studies of small groups in many different contexts. Tuckman had completed his doctorate and worked in the psychology laboratory at the U.S. Department of Princeton University in New Jersey. In 1963 he was employed at the Naval Medical Research Institute. After studying small groups as well as literature on observations of groups and teams he put together the

model with the four phases. Further, he argued that team members having conscious knowledge of the four phases had the potential to increase a group's function and performance.

In 1977, Bruce Tuckman suggested an addition to its original model in the form of a fifth stage, called "Adjourning" (Tuckman, 1977).

Each of the - now five - phases of development involves a characteristic interaction between group members:

The **Forming** phase starts when the team comes together, get to know each other and build new relationships. At this point one treats each other in a polite way and there is great uncertainty for all; How will the team work? What is expected of me? Members seek acceptance from each other and avoid any conflicts. If the project team has a formal project manager, then they demand guidance and direction from him or her. As a whole the productivity of the team is low in this phase (Tuckman, 1965, 1977).

The **Storming** phase is marked by tension or conflict. Team members begin to focus on expectations for the team and who is responsible for what. Individual differences become apparent. Things may become competitive, and the value of certain tasks or the feasibility can be challenged. Conflicts can arise in relation to the team's goals, tasks and the like.

Team members will react differently to conflict and stress. Some have a need to demonstrate individual status either as a counterweight to the team or by trying to dominate it. Others will respond by withdrawing into themselves. Again, productivity is low and there are only minimal work results coming out from the team.

Despite conflicts in the project team the Storming phase may be very valuable, if handled effectively. Hidden agendas may become unhidden and personal ambitions and differences in perception of agreements and working can be identified. All this can lead to mutual understanding.

When the members have gotten to know each other better and have started problem solving the team is entering the third phase, called **Norming**. Here confidence and trust in each other increase, and the feeling of unity in the team grows. The team now knows how to resolve conflicts. Members exchange ideas and give feedback. Productivity increases in this phase.

After successful completion of the previous three phases the team is capable of really **Performing**. The team has gradually built solid relationships, they are interdependent, and differences are respected and valued. Problems are being solved in cooperation and with shared leadership. Morale and loyalty is high, and the team exhibits a focused problem-solving. The Performing phase is the most productive phase.

When a project manager is aware of those phases, then he will be far better equipped to handle the team. The goal is to lead the team safely through the first phases and if possible maintain the high productivity in the Performing stage.

The project manager or team leader should always have a feel for how the team is doing and be able to intervene when relevant in each phase. Stelter & Bertelsen (2005) argue that many teams easily reach the Norming phase, while it may require a prolonged effort to reach the Performing phase.

Not all project teams will experience all phases and elements from each phase can take place in parallel. Time wise the move from one phase to another can happen very rapidly - within one day is not unprecedented.

Each time a new team member joins the team the entire project team in principle return to 'start', i.e. the initial Forming phase (Sheard & Kakabadse, 2001). But for the 'old' team it will obviously be easier to maintain the old ways of working together.

Adjourning, the fifth phase that Tuckman added 12 years later (Tuckman, 1977) is about the team's dissolution. Relationships within the team stop either because the members leave the team or the task is completed and the project terminated. The Adjourning phase must be planned and should include recognition of participation and achievements, as well as a chance to say goodbye. Often you will experience that the project team seeks to avoid this phase, thus avoiding the feeling of loss, which in turn can lead to destructive acts, conflicts, reluctance to complete the team assignments, etc.

Kinlaw (1998) criticizes the Tuckman's model for giving the impression that team development takes place in recognizable phases and not in jumps and leaps, as Kinlaw argues it actually happens. He also believes that the team development can be as conscious and deliberate, that the Storming phase never needs to take place.

2.2 Drexler-Sibbet

The two American psychologists Allan Drexler and David Sibbet have spent more than 10 years studying teams and refining a team development model with seven phases; four of the first is about creating the experience of being a team, and the last three to achieve as high performance team as possible.

Originally, Russ Forrester (Drexler, Sibbet, & Forrester, 1988) who was also consultant, participated in the work in the companies that were helped to work better in teams. The three psychologists were rather special consultants, as they carefully took notes and kept a diary while they acted as consultants helping their clients. Later they gathered the notes, analyzed them, and gradually emerged the model of team development in seven stages (Forrester & Drexler, 1999).

The seven phases of the team model are:

- 1. Orientation
- 2. Trust Building
- 3. Goal and role clarification
- 4. Commitment
- 5. Implementation
- 6. High performance
- 7. Renewal and goodbye

For each phase there are some things that should be achieved in the phase and some symptoms if the phase is not over. These symptoms can be used by the project manager to say "Aha, I can see that I'm missing something. I need to go back to that stage ... and do this and this."

The Drexler / Sibbet model is often characterized as ‘a ball bouncing’, where the ball jumps high symbolizes the team delivering high performance - a high performance team. The four initial phases is about getting 'the ball knocked well in the ground', and the remaining three are more result oriented.

Phase 1, **Orientation**: During this phase, team members understand that they are a team. There must be room to explain - orient - the others about why you are in the team. Similarly, the individual understand why the others are part of the team. Everyone must know that they are members, and by which team. Symptoms showing that a team has not been properly through this phase are that members are confused, uncertain, perhaps even scared.

Phase 2, **Building trust**: Trust is crucial in order to work as a team. When you trust each other you can give each other more open and honest feedback. Therefore, you need to build enough trust within the team. Typically it happens slowly. Symptoms that we have not built enough trust are for example a lot of caution, that people keep up their ‘facade’ as opposed to showing the real person, and of course distrust.

Phase 3; **Goal clarification**: Only when membership and trust is in place one can begin to focus on what it is you need to aim for as a team - the goal. Each team member must have a clear understanding of what is to be achieved and what lies beyond. Consensus on goals and roles - for example who has the role as project manager - is a prerequisite for doing something meaningful together. Symptoms of no common goal understanding are apathy, skepticism and irrelevant competition - "I can write more words per hour than you", for example.

Phase 4, **Commitment**: Now we know what the target is. The next is to ask: Would we do it? We therefore commit to the team and commit to that we will solve this task with the team we have now assembled. Once Phase 4 is well over, we have clear roles, we have resources to solve the task ahead of us, and we have taken the decisions needed to get started. A symptom that the team is not properly committed is dependence e.g. on the project manager. Another symptom may be downright opposition – “It was a stupid plan”.

Phase 5, **Implementation**: Phase 5 points to confusion about 'classical' project management. WHO does WHAT, WHERE and at WHAT time? If we do not make a good plan, keeping the deadlines will be difficult, we may experience periods with either too many tasks or too much waiting.

Phase 6, **High Performance**: This stage is a bit special. Successful passage of the five preceding is a necessary condition but not a guarantee. Some teams reach high performance, i.e. unexpected synergy where two and two does not give four but five or six! As project manager you experience that everything works and that team members themselves seek interaction and make deals. The symptom that high performance is not reached is of course that team performance is ordinary.

Phase 7, **Renewal and goodbye**: In a long term project you have to ask from time to time: Does it make sense to continue? We need to renew agreements, confirm confidence in one another, updating the goal and commit ourselves anew. All work ceases, so when you are at phase 7 you have to say goodbye. Here Drexler/Sibbet emphasize that it is important to appreciate team members, celebrate the success we have had together, and retain learning. Symptoms that the

team has not terminated the project properly is that participants get bored (but in the next project team) and burned out.

With the researcher's eyes one can criticize the Drexler / Sibbet model that they have never published any of their diary entries so you can 'look them in the cards'. As researcher one could also wish for a serious and well documented study of the five factors - symbolized by the balls - which precedes high performance; are they really sufficient as causal factors? Finally, it is also dubious that the Drexler / Sibbet model emphasizes that you have to go through the phases in sequence.

Some of the strengths of the Drexler / Sibbet model is that for every phase are symptoms that can be used to assess if a phase has not been gone through. This makes the model highly operational for a project manager, you can see that something is wrong, and you can do something about it.

There is also a largely positive undertone in the Drexler / Sibbet. There is, for example, no equivalent to "Storming" in Tuckman (1965). Finally, since the model was first published, Drexler and Sibbet have worked hard to identify a number of techniques they have associated with each phase (Sibbet, 2002).

2.3 Team Software Process (TSP) model

In Pittsburgh lies the Software Engineering Institute (SEI), associated with Carnegie Mellon University who is one of the world's leading universities. The charismatic director Watts Humphrey was hired in from IBM, where he had been responsible for huge technical development projects. Watts Humphrey and the SEI developed a so-called Capability Maturity Model, CMM, which was successfully used all over the world; recently in an improved version called the CMMI (Capability Maturity Model Integrated), who came in 2000, and recently in November 2010 has been released in version 1.3.

In the mid-'90s Watts Humphrey and the SEI began to take an interest in team processes. The first edition of a Team Software Process (TSP) model was developed in 1996, and the book on the TSP was published in 1999 (W. Humphrey, 1999).

Although the name TSP suggest that it is a model for software projects, the model is actually applicable to all types of technical development projects where the team work together to solve a major development task.

TSP operates with three real stages:

1. Team formation
2. Team start-up
3. Teamwork

A fourth activity that is given high priority, is the ongoing maintenance of the team. But let us look at each phase (Humphrey, 2006).

Team formation includes four primary activities. First, the management task of allocating resources. Second, identify the skills they need, partly related to the technical product to be developed and its scope, and partly to team skills such as estimating, planning, quality management and interpersonal qualities. Third, recruit members of the team. When recruiting use the required skills, but also assess how interested the person is in being part of the team, and how their attitude and

motivation are. Finally, as the fourth activity, the team is trained in the skills gaps. So by the end of team formation, we have a bunch of trained team members with the required skills.

TSP emphasizes the actual **start-up of a team**. For example an agenda is described for a 4-day start-up for a new team, with 10 activities (Humphrey, 2006, p. 52). This start-up is only about the actual management of the team. This is followed by meeting from 2 to 8 before it is started. It felt obvious that this process can be used for very large development projects.

In the **ongoing teamwork** used plans and estimates from the beginning. Actual work hours are recorded and compared with expected. Job status compiled. Prepare management reporting. It resembles the 'classical' project, so we will not dwell on it here.

An interesting innovation is called "Load Balancing". Here you focus on whether everyone in the team has enough or too much to do, and all skills are exploited. Prepare also a critical path analysis, i.e. an analysis of the activities that will delay the entire project if they are delayed. Critical path analysis is made not only in time. It also highlights a critical path for certain skills. If one, for example, has a solution architect task and three men who have the skill, then you look at the load across the project for just skills that require an architect and ask: Will it be critical at any time?

During the project, and thus as an underlying part of team work, there is an ongoing maintenance. Periodically you ask five key questions (Humphrey, 2006, p.194):

1. Does everyone in the team have a common understanding of belonging and membership?
2. Are all team members committed to a common goal?
3. Does the team take ownership of processes and plans?
4. Have all team members the necessary skills to carry out the plan and do they have the discipline to do it?
5. Is the team committed to do an excellent job?

Another thing to focus on is the relationship between task and maturity. This is called relational maturity, dealing with emotions and attitudes. If you have low relational maturity, then you are more worried about self evaluation, rather than how well tasks are performed.

It is very clear that the TSP is designed for very large projects. It is closely aligned and familiar to the thinking of maturity as represented by for example CMMI and the personal software process (PSP) which is about the individual's maturity. It is alleged (W. Humphrey, 2000) that the TSP is for teams from 2 to 20 people but many of the things mentioned and included in books about the TSP would be 'overkill' to use in a small team.

The empirical background is not impressive. A technical report of November 2000 (W. Humphrey, 2000) shows that the first version was developed based on literature studies and studies of what influence quality. Version zero was then tested in two projects and based on observations from these projects TSP was improved. Six or seven different versions were developed before a 'simplified' version was released as a technical report (W. Humphrey, 2000).

However it is also a great advantage that TSP is so closely tied to the maturity models. So many companies have chosen a maturity model as CMMI as a basis and foundation for organizational improvement. Here, the use of TSP ensures consistency between the general improvement initiatives, and the specific focusing on improving the team. And the empirical basis for CMMI is now right sound (cf. <http://www.sei.cmu.edu/cmmi/research/results/>).

2.4 The Plan-Do-Check-Act (PDCA) model

As a complement to the various team development models we will also review the widely used process improvement model PDCA, as we estimate that the iterative aspect of this model can contribute added value in relation to team optimization. Good teams are working systematically to improve, i.e. the process is constantly improving. Each team member would also like to develop and gain more skills so they can do things better and faster.

Process improvement is a concept strongly influenced by quality concepts and models, such as Total Quality Management (TQM). The perspective of process improvement is that quality can be controlled and that a good development process leads to a high quality product. Process improvement is a continuous process, often illustrated by Deming's (1986) classic improvement cycle - also called Quality Circle. The elements of the model can be briefly explained as follows:

Plan implies that objectives should be identified and prioritized. Then you must define a strategy for how the objectives can be achieved. Finally, we must determine the methods and metrics that can be used to check whether the objectives are reached.

Do is about introducing and working from the planned strategy. Also included are training and education, for example related to the methods and tools that you have chosen to use to achieve the objectives.

Check consists of two parts. First check whether your objectives are achieved. Then analyze the collected data to examine whether something went wrong in the process and why and how this could possibly be prevented.

Act means to respond to the problems you have found and to let the company take the new lessons to heart. Thus, continuous improvement is achieved by letting this experience be input for the next cycle and its planning phase.

Process improvement has gone from strength to strength in many years. Continuous improvement is the core of the LEAN concept, which has also been known as the Toyota method (Liker 2004). What is interesting in relation to team development - and the reason we include it here - is the iterative element. Iteration means repetition. The Quality Circle is, as stated above, characterized in that the process or parts of the process is repeated as many times as necessary and in principle infinite.

The benefits of going through small iterations are many. The investment in each iteration is not so big, and nor is the risk. You get the opportunity to integrate and apply new learning quite quickly. And you become very flexible, in each iteration you can change team manning, upwards or downwards, depending on needs.

A possible criticism in relation to process improvement is that the many iterative flows that are essential to process improvement (plan-do-check-act repeated) can easily become a little mechanical. They are doing the same thing again and again. Some will feel that creativity is lost en route. Therefore, process improvement is an approach for small steps, rather than for major innovations. Process improvement is good to use when improving existing processes, but not to (re-) exploration. Process improvement mindset is essential in achieving lasting improvements. Last but not least, process improvement help with an understanding that team development is not linear but a cyclical iterative process.

2.5 Other teambuilding models

Many books on project management (cf. Adair, 1986), or teams suggest that good team leadership is about creating balance between:

1. People – those who are in the team
2. Tasks – what is lying ahead of team
3. Processes, i.e. the way we do things in the team
4. The team itself

The individual needs to develop, to be noted and rewarded for good performance, and to get help with both professional and personal problems. Tasks must be defined, goals must be set, resources must be allocated, responsibility distributed, plans must be followed up and quality must be checked. The processes must be defined, described, taught and applied. And then the use of them is evaluated, so we can continuously improve the way we do things.

Team members require that we start up the team wisely, that we build a team spirit, that we develop working methods so the team can function as a whole, that we set standards and keep the discipline, that we create a system to communicate with the team, that we provide adequate training and education, and that we - as required - appoint managers within the team. Often these three or four elements are characterized as overlapping circles, in order to symbolize that there are important interactions between them.

Over the years, many others – besides the ones we chose to highlight – have been working with team models, although the ones we have reviewed above, in our view, are the most prominent.

Bion (1961) has a three-phase model with the following contents:

1. Dependency: Team members attach the leader with authority and power
2. Fight or flight: Team Members challenge the leader and other members (= fight) and leave the team (= flight)
3. Pairing: Team members come together in order to overcome fear (e.g. of the unknown)

The middle phase of these three is very similar to Tuckman's (1965) "Storming" phase.

Another three-phase model was developed by Schutz (1982). He calls his phases:

1. Inside or out: the individual decides whether he is part of the team

2. Top or bottom: Who should have power and authority?
3. Close or distant: How much do we commit ourselves?

Especially the discussion on top or bottom is interesting here. In many educational institutions in Denmark projects are used as a key educational tool. At Roskilde University, for example, it is a requirement that half of all teaching in all studies takes place as project work. But what distinguishes this type of project from most projects outside the educational world is that in these projects everyone has equal power (= bottom-controlled Phase 2) while projects in organizations normally have a project manager who has, in one degree or another, the power and authority (= top-controlled Phase 2),

Finally, there are Hill and Gruner (1973) who have the three phases "Orientation," "Exploration" and "Production" as well, most of all recalls the TSP model.

In literature, you will also find a series of four-phase models. Modlin and Faris (1956) comes before Tuckman (1965), and have the phases, "Structuralism," "Unrest," "Change" and "Integration", where "Unrest" is similar to Tuckman's "Storming".

Whittaker (1970) speaks of four stages:

1. Preaffiliation where there may be embarrassment, shyness and uncertainty about the individual's connection to the team.
2. Power and control, which includes the decision about roles and power.
3. Intimacy, which is the phase where the team commit and really work together.
4. Differentiation, where the different roles and responsibilities have become commonplace and routine, and do not need to be further discussed.

Especially the last phase, namely that things become routine in the team, brings something new to our review of the models above.

Finally, Scott Peck (1990) presents a model with four phases: "Pseudo-Community", "Chaos," "Emptiness" and "Community" where chaos, of course, corresponds to the "Storming" but where "Emptiness" - the feeling of emptiness - highlights that a team is not always successful, but may also be unsuccessful.

We have reviewed a number of popular team models with emphasis on some rather different models such as Tuckman (1965), Drexler / Sibbet (Drexler et al., 1988), TSP (Humphrey, 2006) and the iterative approach to process improvement (PDCA).

It is clear that none of the models include all the activities and pitfalls that can and will happen to a team. It also appears that all models have important points which must not be lost.

3 The Six-C model

There is therefore a need for a model that incorporates the best and indispensable from each of the models, and puts it into a framework that can be used to focus on a team, its members, as well as how the team's task is solved and the way it is solved (the process).

In Figure 1 we have tried to compile the teambuilding models into the first four columns to the left. Phases with (almost) equal activities are aligned. It can be seen - as mentioned above - that no team model covers everything. Each model focus on some – but not all - relevant issues. E.g. Tuckman has the Storming phase realizing that there may be conflicts in a team. Drexler/Sibbet's model emphasizes confidence and trust building as well as the importance of committing the team. TSP has a firmly entrenched teambuilding process with activities prior to the creation of a team, and PDCA embodying iterative process improvement focus on the fact that there often is a need to pause and reflect on how it goes, and possibly return and repeat - iterate - any of the team activities and phases that have not initially been done adequately.

Tuckman	Drexler/Sibbett	TSP	Process improvement	Six-C model
		Forming Team		Constitute
	Orientation			
Forming	Trust building			Clarify
Storming				
Norming	Goal clarification	Launch Team	Plan	Commit
	Commitment	Team Work		
Performing	Implementation	Team Work	Do	Carry Out
		Maintain Team	Check	Check
	'High Performance'			
	Renewal and		Act	
Adjourning	goodbye			Conclude

Fig. 1. The Six-C model brings together the best from a number of team models.

Based on our analysis of what is the strength of each of the existing models, and what is missing, we have constructed a new unifying model.

We have named the model the Six-C model from the initials of each of the phase we have found; Constitute – Clarify – Commit – Carry Out – Check – and Conclude.

3.1 Techniques in the Six-C model

To each phase is attached various techniques that can be used to optimize the team performance. In choosing these activities we have emphasized the following key aspects:

- Commitment
- Common vision and goal
- Common approach
- Mutual responsibility

At all phases we describe:

1. Input Situation, the state of the team when the phase begins.
2. Focus areas: aspects that is especially important to focus on in this phase.
3. The project manager's role in this particular phase.
4. Techniques: a collection of useful techniques to be used in this phase.
5. Inspiration: examination of a topic of particular relevance to the stage.
6. Output: the condition that must be achieved, or the techniques to be implemented for the phase to be considered finished for now.
7. Measuring and/or control points: to see or measure whether the team has achieved what was intended.

PHASE	FOCUS	TECHNIQUE
CONSTITUTE	Manning of the project	Competence matrix Knowledge Map
CLARIFY	Other team members	Participant Presentation Cooperation Team Game Team Work
	Communication	Work Contract Listening Technique
	Group Dynamics	Contract of Cooperation Team Rules Team Work Ice Breaker
	Tolerance of Diversity	Participant Presentation Ice breaker
COMMIT	Goal	Goal Clarification Context Map Explore Barriers Top Story
	Priorities	Role Clarification Prioritization
CARRY OUT	Performance	Identify Strengths Success celebration Celebrate Small Successes

	Management	Six-C Review
	Communication	HVEM (who)
	Creative Thinking	Idea Generation
CHECK	Evaluation	Evaluate status in relation to goals, roles and responsibilities Evaluate status in relation to cooperation Process Observation Fish-bone Diagram Meeting Evaluation
CONCLUDE	Settlement	Retrospective Evaluation Maintain Learning Recognition Celebration

3.2 An iterative model

The Six-C model is basically designed as an iterative model, we repeat the phases when it is required and each iteration can be either scheduled or event driven, but always meaningful. Opposite many highly linear models, this model allows you to move back if the team is adversely affected by external or internal factors, the team can choose to stop, assess and possibly move back.

It is impossible to predict how long each phase takes: How long it takes to build trust or to get acceptance of who has which role. So in contrast to other activities in a project, you cannot just estimate and plan the six phases of the Six-C model. However, it is possible to plan how often and how the team will stop and check how it goes. For example it can be once a month or it can be when there is something important happening in the project.

In assessing how it goes, the team can move back to an earlier stage. There is perhaps a need to build more trust in one another, i.e. the team moves back to the Clarify phase. An example of an event that causes the team to repeat a phase is when replacing a team member. In such a case, the team must revisit the Constitute phase. There may also be conflicts along the way that need clarification, which in turn may lead to the formation of new team norms, i.e. going through the Commit phase partially or completely when the established norms for group behavior changes. Each team will have its own course.

The understanding of the fact that the team moves through recurring phases can strengthen the team, because there is now room for the areas that require special focus in each phase.

3.3 Use in practice

We have used the Six-C model in approx. 30 projects in courses named "Advanced Project Management" at the IT University" and "Masters in Project Management and Process Improvement (MPF)" at Roskilde University, with very good results. The purpose of the courses was to train project management skills, cooperation and coordination.

The project teams consisted of 4-7 members working together to produce an essay report elaborating on project management issues based on case studies. Simultaneously the team used the Six-C model to develop their own team performance, improve their cooperation, and finally reflect on their own cooperation and coordination skills. The main conclusion of the teams' retrospectives was that the model had been very useful for optimizing their teamwork.

4 Conclusion

This conceptual paper have now presented a model for IS project teambuilding in six phases called Constitute – Clarify – Commit – Carry Out – Check – and Conclude. Together we coined these six phases *the Six-C model*. This model is derived from an analysis of existing teambuilding models, their strengths and weaknesses. We have in prior sections of this paper presented the existing models, our analysis, a comparison of models, and the details of the Six-C model.

The Six-C model was derived from existing models mainly from the IT and software process improvement areas. The model has been used in IT projects as well as in other projects where IT is only a (smaller) part of the solution. Whether the model will work in none-IT areas we do not know. That is a question for further research.

References

- Adair, J. (1986). *Action-Centred Leadership* London: McGrawHill.
- Bion, W. R. (1961). *Experiences in Groups and Other Papers*. London.
- Deming, W. E. (1986). *Out of the Crisis*. MA, USA: MIT Press.
- Drexler, A. B., Sibbet, D., & Forrester, R. H. (1988). The team performance model. In W. B. Reddy & K. Jamison (Eds.), *Team building*. Alexandria, Virginia, USA NTL Institute for Applied Behavioral Science.
- Daarbak, T. (2010, 18.05.2010). Det vil skandinaviske it-chefer ha'. *Computerworld*.
- Forrester, R., & Drexler, A. B. (1999). A model for team-based organization performance. *Academy of management executive*, 13(3), 36-49.
- Hill, W. F., & Gruner, L. (1973). A study of development in open and closed groups. *Small Group Behavior*, 4(355-382).

- Humphrey. (2006). TSP Leading a Development Team.
- Humphrey, W. (1999). *Introduction to Team Software Process*. Massachusetts: Addison Wesley Professional.
- Humphrey, W. (2000). *Team Software Process*. Pittsburgh: Software Engineering Institute.
- Kinlaw, D. C. (1998). Fremtidens samarbejdsform.
- Liker, J. (2004), *The Toyota Way* (McGraw-Hill).
- Modlin, H., & Faris, M. (1956). Group adaptation and interaction on psychiatric team practice. *Psychiatry*, 19, 97-103.
- Schutz, W. (1982). *Elements of Encounter*. New York.
- Scott Peck, M. (1990). The different drum, community-making and peace. London.
- Sheard, A. G., & Kakabadse, A. P. (2001). From loose groups to effective teams.
- Sibbet, D. (2002). *Best Practices for Facilitation*. California, USA: The Grove Consultants International.
- Stelter, R., & Bertelsen, M. (2005). *Team - Udvikling og læring*: Dansk Psykologisk Forlag.
- Tuckman, B. W. (1965). Developmental Sequence in Small Groups.
- Tuckman, B. W. (1977). Stages of small groups revisited.
- Whittaker, J. (1970). Models of group development, implications for social group work practice. *Social Science Review*, 44(3).

Towards a contextual insecurity framework: How contextual development leads to security problems in information systems

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Abstract. Most research in our field of Information Security highlights the need to consider application security during functional requirements. Yet, we see numerous examples where security of information systems is an afterthought. The paper suggests that the process of functional requirements gathering helps in inscribing “contextual insecurity” within an application. Through the case study of an open-source health management information system, which has large scale, country-wide implementations in developing countries, the paper suggests that if contexts of use are inherently insecure in nature, these insecurities become part of an application's development and use. The paper presents the process of security certification for this large-scale system, by the government's IT ministry and highlights how most improvements done to pass the certification process do not actually make it in the production environment

Keywords: contextual insecurity, health information systems, OWASP, security testing, web security, InfoSec

1. Introduction

When Castell (1996) [1] first described the networked society as a society where the key social structures and activities are organized around electronically processed information networks, he might not have considered the consequences of an organization like Wikileaks and its Hacktivism [2] would breach the circle of trust of the networks and have access to information that could change social structures forever. When Benkler (2006) [3] examines that technology enables collaboration and enables wealth to be created in these networks, he probably underemphasizes the need for closed networks and how society itself is open in one aspect, but closed through many enemies of openness [4]. Thus highlighting that, as information society progresses, we need to research in much more detail our understanding of the human values of open/closed information access and then use these values to define what secure or insecure practice in a network society is.

We see from the field of Information Security (InfoSec) research that much focus of current research is towards developing algorithms and techniques to lock

information [5]. We also see that most research in InfoSec highlights that security in the design of Information Systems (IS) is generally an afterthought [6][7]. As more and more information systems are being deployed on networks, all research in InfoSec points to the need of centralizing the role of InfoSec in the design and development of IS artifacts [8].

On the other hand in IS research, the focus of systems development is geared towards matching design to the contextual use of the system. Understanding the current processes of an organization and fitting the technology artifact to the organization's current process has been prescribed time and again [9][10]. In this paper, we argue that this process of developing systems to fit the current business process, results in inscribing insecurities that may be inherent in the existing social processes. The paper suggests that if contexts of use are inherently insecure in nature, these insecurities become part of an application's development and use. Designers of the technology artifacts need to take special care to realize that network society might have different rules of information access compared to existing non-networked society from which the process is being taken. Through the example of a large-scale, country wide implementation of a health information system and its consequent security certification by the ministry of IT, we look at how best-practice security recommendations are lost in implementation. The paper anonymizes the system which is implemented (further referred as *HMIS system*) and the country of implementation (further referred as *AFIN*) to prevent any misuse of information provided here. The paper also tries to minimize direct references in literature that point to this *HMIS system* and *AFIN* country to avoid identification. Like every security disclosure, the author wants to mention that the information provided herein is only for research purposes and any misuse of the information cannot be attributed to the author directly or indirectly.

The next section (Section 2) of the paper introduces the Health Management Information System (HMIS), its conceptualization, use and the context in which it was designed. Section 3 of the paper describes the process of security certification of the *HMIS system* and findings of the security certification process. In Section 4 of the paper there is discussion and analysis of the findings. Using the analysis, the paper co-relates the context of design to "contextual insecurity". We discuss how most improvements from the security certification are lost in implementation. The concluding remarks are made in Section 5 and provide directions for future research.

2. The HMIS – Context, Design and Use

Health Information is generally considered to be private information in most parts of the world [11] [12]. This includes patient records, health provider records, health institution records etc. Different Access Control Lists (ACL) are required to be maintained depending on the granularity of the data and read/write permissions, but nevertheless these need to be provided and considered well in advance in the design of HMIS systems.

The *HMIS system* presented in the paper is primarily an aggregate health data repository for public health analysis and reporting of data. The basic unit of data is

called data element which is generally a numeric representation of total number of individuals who have a disease or have been treated or reported. There are also logistic and financial data elements which represent stocks of drugs or any other health resource. These data elements then contribute to generation of indicators that report statistics of say, disease prevalence in a given area or helps in management of resources available in the area. Although aggregate-level data is the general use of the system, over the past couple of years, a patient records module has been incorporated into the system and the individual records from the patient records module are now used to generate aggregate data values or indicators for the system. Such use of the system as an electronic patient record is restricted to limited area of implementation, but has been widely advertised as the solution to improving data quality.

2.1 Research Methodology

The *HMIS system* has been developed through Scandinavian action research tradition in IS development, such as user participation, evolutionary approaches and prototyping [13] [14] [15]. The system is part of a global network of action researchers and aims to generate knowledge by taking part in the full cycle of design, development, implementation, use and analysis. The above mentioned steps are done together with all the involved parties before the interventions are adjusted accordingly, and the next cycle begins again [16]. The author of the paper has been involved in all the phases of research mentioned above in *AFIN*. The author has participated in action research for the last 3 years through a non-profit organization, which has been involved in the implementation of the *HMIS system* for more than a decade now. The author has played a central role in the process of security certification of the software, done by the Ministry of IT of *AFIN*. The research has been done within the framework of interpretive research [17]. Data was collected through different channels of communication with developers of the *HMIS system* on one side and the security testing agency on the other side. The author has been involved in customization and training of the application and the interpretation involves documents from implementations, manuals and being part of meetings to customize the system in different states in *AFIN*. The research for this paper has been done by the author over a period of 2 years, where more than a year was spent in customization and development of the system and about 8-months as part of the certification process. Along with the security testing, functional testing and performance testing was also conducted for this *HMIS system*. The author was involved in these testing processes as part of a larger team. Most of the data collected from functional testing and performance testings are not part of this paper, but do provide the author with insight and help in interpretation of the observed phenomenon. A large fee was charged by the Ministry of IT to perform this testing and was an important factor for the system to be implemented on government infrastructure. The author was employed by the non-profit organization during the period of research.

2.2 Context of Design, Development and Implementation

The *HMIS system* has been designed, developed and implemented in developing countries around the world. The action research project that is at the core of this *HMIS system* is involved in research activities in developing countries in Asia and Africa. This system is thus built around the idea of supporting health systems in these developing countries. The system has been in use over 20 different countries around the world, sometimes as pilots or district-sized implementation, but also has been implemented as country-wide health management information system. In *AFIN*, it has been used by a number of states, but is not implemented as the National HMIS. Nevertheless, these state-wide implementations are online systems that can be accessed over the internet and there are separate implementations for each state. There are anywhere between 100-5000 facilities that report data into these systems and nearly thousands of users in each state using this system. Thus, in *AFIN*, the system can be called as a large-scale web application.

Before the use of electronic systems and computers, the health system in *AFIN* has primarily made use of paper forms to report data from health facilities. These paper reports are created by community health workers who operate from facilities and provide health services to the community. The community health worker maintains registers of patients and the services provided to them. These registers are classified separately, based on the type of health program or services offered by the health worker. Thus, the patient record is created by the community health worker and is available only at the facility in which the health worker has provided services to a person. This data from the registers is then aggregated by the health worker every month and reported according to a standardized facility form and its data elements. The aggregated reports are taken by the health workers and submitted to the higher level, which then aggregates all the reports received from health workers to create another form. This form is then sent higher and the higher level aggregates and sends it higher. This hierarchical chain ensures that all data from lower levels are seen by the higher levels and the higher levels can allocate resources to the lower levels.

The *HMIS system* has been designed to mimic the organizational hierarchy of health system and data can be entered by the respective facilities/organizational units by logging onto the system, where they are able to see their own unit and all the units below them. There are Access rules that can be created in the system, which allows the administrator of the system to limit the levels/datasets that is available to any user. The *HMIS system* is also designed to allow flexible methods of aggregation when viewing data at higher levels. There are many useful analysis and reporting tools that can be used the facilities to manage their own data and analyse it for their own activities. In the patient module of the *HMIS system*, the patient record can be opened by any facility from the organizational unit hierarchy. This is because in the context of *AFIN*, migration is a common phenomenon. As an example, it is the social norm in *AFIN* that after a woman gets pregnant; she goes from her in-laws house to her parent's house for delivery of the baby. The previous treatment received by the woman needs to be available at the other facility where the woman has migrated, so that continuity of care can be provided. At the time of writing of this paper, the HMIS system can only deal with migrations that happen in the same state, i.e. if the organization unit to which the patient has migrated is in the same implementation of

the system. This means that exchange of records across different installations of the system is not possible and only patient migration in the same installation is possible. This is an important distinction to understand, so that we understand that patient records are technically not exchanged between systems, but only accessed by other users from the same database.

In *AFIN*, not all the health facilities have access to internet and many do not have a computer available. At such places, the *HMIS system* is deployed at a closest facility where computer is available, but due to lack of internet, offline installations of the system are also made. These offline installations export data to the central online system via USB sticks which are imported into the online system from computers located at another village/town where internet access is available. This combination of online and offline systems is a reality in most countries where the system is implemented and is an important characteristic of the context. The offline installation is exactly the same application as the online application. Only that they are not part of the internet and are restricted in use only by the facility in which it has been installed. Thus, there is a hybrid model of deployment in offline and online modes. With respect to the patient module, in cases where there is no internet or computer available, the whole patient record on paper moves to the higher location where computer with internet access is available. This patient record may be entered into the *HMIS system* by the health worker themselves or by data entry operators who are hired at district offices because the health workers generally do not have enough computer skills. This is an important property of the context because it means that the data entry operator acts as a proxy between the health worker and the system.

The software is customized according to the requirements of each implementation. In *AFIN*, this means that every state has different data elements, organization units, reports. There are new features that are requested by these states very often and local developers are involved in customization of the *HMIS system* for the state. These local developments are then analyzed by a global team of software developers and after negotiations are made part of the central application that is available for use in other countries.

3. The Security Certification Process and Findings

The Ministry of IT in *AFIN* is responsible for managing data and server infrastructure for state governments. Thus, for the *HMIS system* to be hosted on government infrastructure it has to pass through a security certification process. The complete web application testing process involves functional testing, performance testing and security testing. This paper focuses on the security certification process, although the 3 were done in parallel by the testing agency and multiple processes were followed in sync between the three testing.

The Open Web Application Security Project (OWASP) methodology [18] was used by the testing agency for testing the *HMIS system*. OWASP is a popular open group of security analysts, who discuss and share the trends on InfoSec. Through the discussions, OWASP releases the top ten security vulnerabilities in web application and these are updated on a regular basis. Based on the top-ten list of vulnerabilities,

different ways to test and fix these issues are mentioned by the project and these have been further referred in the paper as OWASP methodology. As part of the security testing by the government agency, there were 2 attempts allowed to clear the security certification process. After each attempt of testing a report was submitted by the testing agency to the non-profit organization that is implementing the *HMIS system*. The following were the findings of the first attempt:

No	Category	Observation	Action taken
1.	Input Validation	No input validation on certain form fields	1 issue unsatisfactory
2.	Authentication & Session Mgmt.	1.SSL not used 2.Password sent as clear-text 3.No password complexity imposed 4.No password lockout	4 issues unsatisfactory
3.	Access Control	1.Session ID sniffed and XSS attack performed 2.No audit trail for critical functions and failed logins	2 issues unsatisfactory
4.	Error Handling	1.Various error messages	1 issue unsatisfactory
5.	Data Protection	1.Sensitive information can be stored in proxy 2.Clear text passwords are stored 3.TLS not used for data exchange 4.No secure key exchange 5.No secure algorithm 6.No Key length defined 7.No digital certificate	7 issues unsatisfactory
6.	CSRF Attack	1. Delete user is vulnerable including self-deletion 2. Changing password does not require old password	2 issues unsatisfactory

From the table you can see that the finding were not at all favorable after the first testing of the *HMIS system*. The system had been in use for over 4 years throughout the world with these issues, but yet they were listed out by the testing agency for the first time. A total of 17 issues out of 25 top OWASP issues were unsatisfactory. Most of the issues were dealt with by the developer team easily by just installing an SSL certificate and some quick changes to the source-code. Not that these changes were

complex, but because security was never considered in the development of the system these had been ignored for over 4 years of deployment.

After the second round of testing a total of 4 issues were found by the security agency and reported the developers of the system. These issues were slightly more complex and meant creation of a “Captcha” service that would be able to prevent brute-force attacks, by showing a human-recognizable image when password were typed incorrectly for certain number of times. Another issue was that if there are continuous mistakes in the password the user is logged out for a certain amount of time, before they can re-use the system. This was suggested by the testing agency to prevent Denial-of-Service (DoS) attacks. Other 2 issues were related to data security and were regressions (new issues appear when old issues were fixed) of the XSS flaw and required detailed debugging to solve. Nevertheless, after the second attempt, these issues were solved and re-submitted for security testing.

The testing agency performed its third and final test and did not find any remaining security vulnerabilities in the system. Although as a researcher in InfoSec, the author of the paper knows there were other vulnerabilities that were missed out by the testing agency. These are discussed in the Section 4 of this paper.

After the certification was confirmed, the author of the paper announced it to the global developers’ team:

“Hurray! We get the certificate once functionality (ed: testing) is completed. They will send a template that will have instructions for (ed: testing agency) and this template will be attached with our certificate. Finally I must say this has been a looong one but good for legitimizing the HMIS system use in government”

In response, a global core developer responded

“Fantastic news. We may be got off lightly on a few things or maybe you made some more changes I didn’t see. Still looks like a good result to me. I agree 100% about the legitimizing. I think there is a broader implication that FOSS projects can and should be able to (and be seen to) measure up to these testing regimes. So for (ed: government of AFIN) to issue such a certificate to a FOSS project like ours is really a cause for great celebration”.

The quotes shown here are important to understand that the global community of software developers realized that such acknowledgement and security improvements in the system were overall a good thing. The point that such certifications help in institutionalization of the system is also understood from these conversations.

4. Discussion & Analysis – Towards contextual insecurity

The case of the *HMIS system* described earlier is probably a common one in the developing country context. The reasons for this have been discussed in the literature because security is an afterthought in system design. Also, in developing countries making the system work and then sustain is often a bigger challenge. Thus, security in these contexts is considered to be useful, but often as a lower priority.

4.1 Lack of use of Digital Certificates and SSL

Digital Certificates enable the user to identify the authenticity of the server as the certificate is given to the server by someone whom the client considers trustworthy. The Digital Certificates must hence be purchased from a source that has a seal of authenticity and users recognize that source. When web browsers see a digital certificate on the server, the communication by default is through a secure channel known as SSL. Although it is common-sense in modern web technologies that any internet-facing web application should be hosted through https (using Secure Socket Layers), the *HMIS system* all around the world is deployed over http. This means that all data sent from the client browsers to the server are sent as plain text and can be intercepted by anyone, possibly modified and such modifications might be impossible to detect. The security certification process mentioned this in 8 unsatisfactory observations, but after the certification was given, there have been numerous implementations of the *HMIS system* and yet they have all been deployed without SSL or Digital Certificate. The reason for this can be two-fold. One explanation can be simply to avoid complexity/cost of communicating over SSL (including cost of Digital Certificate). The other more complex challenge is distribution of keys to offline installations. Ideally when using digital certificates, one would want to sign the exports coming from an offline system to be identified by the online system when importing. This process can be thought of as if a health worker and accepting officer, both sign the facility form every month and only accept the forms if both have signed and validated the data. In practice, the officer does not look through the register of patient records and hence cannot validate the data. Thus, in practice, they do not sign the forms of data exchange and the same insecurity has been inscribed into the application. It has also been observed by the author that health workers and district health officers will often deny that the data in *HMIS system* is not their data and it has been changed by someone else. If the security principle of non-repudiation had been implemented in the *HMIS system*, then these claims would not have been possible.

4.2 Lack of patient privacy

In the context of *AFIN*, migration of persons receiving treatment from health facilities is a common phenomenon. To ensure continuity of care, the system must be able to search and open patient records from any system. But this also means that health workers from any location will be able to look for any patient's record. This can be thought of as a privacy nightmare and in many cases an illegal access of records. Since in practice, a migrated patient would take their patient card and visit another facility and receive treatment, similar feature has been built into the system. The contextual insecurity in this case is to cater for the process of migration. Instead of thinking of secure ways to manage patient records to deal with migration, giving access to all health workers in a networked society is simply unacceptable.

One solution that has been discussed by the author with the *AFIN*'s health agencies is the use of patient consent when exchanging medical records. When another health worker would like to view a patient's health record, the patient can either using biometric ways (e.g. fingerprint) or through a password, give access to their record to

the health worker at the migrated location. This solution has been discussed and appreciated, but no implementation of this solution has been done.

4.3 Lack of Encryption

The data in the *HMIS system* are stored without any form of encryption. This means that a system administrator who has access to the database can look at the records of any person and have access to modify the records without leaving any trace in the system. Another issue that was not discovered by the security testing agency, but needs to be highlighted by the author is the lack of encryption in export files. When offline installations export data and carry these export files in USB sticks, they are represented as plain-text xml files. These XML can be changed by anyone and still will be considered to be valid by the online installation when importing. In practice, a health worker writes the patient records in the register and keeps it at the facility. This does not require the health worker to use any codes to represent information and can be written in any way which she can understand and comprehend. Even when carrying the monthly reports to the officer, she carries the aggregate form with herself and not the patient register. If the same principles from non-networked society, such as plain-text data storage and no security in the medium of exchange are put into practice in networked society, we will have contextual insecurities and chances of data theft.

4.4 Deployment problems and user competence

Although “Captcha” and user-lockout were added to the system as part of the security certification, the global team of developers removed that functionality out of the system in the later version. In practice, it has been seen that users can deliberately type incorrect password and be locked-out to avoid working on the system. Other developers have mentioned that captcha and such security features are not practical on offline installations and since we did not want to maintain two versions of the application it has been removed from the system. This is another example of contextual insecurity because as systems that are online, there are bound to be brute-force and DoS attacks on the servers.

Another common contextual insecurity is the use of passwords and creation of simple passwords. Thomson & Von Solms (1998) [19] have shown that humans who are less technically savvy tend to have common passwords across multiple applications and systems. In the *HMIS system* implementation, we see that there are often same passwords that are given to all the organization units and the only factor of difference is the username. If one knows the username of another user, since the passwords are same, the user can login as the other user and modify the system. The majority of the users of the *HMIS system* might be considered technically unsavvy users. Thus the system does not have built-in requirement for complexity of password creation like compulsory use of special characters.

4.5 Contextual Insecurity – Analysis of the concept

From the discussion we see that most issues highlighted by the security certification agency with respect to OWASP are because of the context in which the system has been in use.

Where processes of use have lack of security (insecurity), these are transferred from the context of use into the technology artifact. Inscription is a concept from Action-Network Theory which the paper uses. The term examines the way designers interpret the world around them and inscribe these into the technology artifact, as well as more implicit translations being negotiated in the context of use [20]. Thus, the insecurity within an artifact which is inscribed because of the context of use has been referred to as Contextual Insecurity.

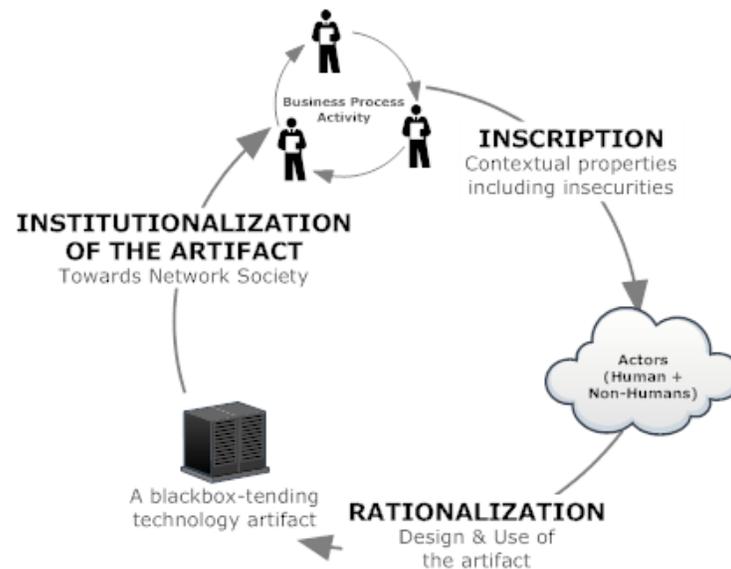


Figure 1: Contextual Insecurity Framework

Contextual insecurities are long drawn processes that have been practiced in networked society. In one of our case of exchange of forms, we see a form of social trust between the health worker and health officer to whom the forms are submitted every month. This process of form exchange in the non-networked society does not call for encryption or secure medium of exchange. In fact, because the health worker and health officer can see each other physically, they can trust each other's existence and validity of the data becomes an abstract social binding. On the other hand, in a networked society, encryption, secure medium and validating of identity are key pillars on which it stands.

When we look at a process of business activity, we see there are numerous interactions that happen between people, technology or both. These interactions might be part of the non-networked society (where there is no electronic technology

mediating) or can be part of the networked society (where exiting technologies are studied). We see that when technology artifacts are designed, many localizations are done by the actors to fit the context. The actors in our case include the government policy, the security testing agency, the OWASP framework and tools, the implementing non-profit organization and the global team of developers. Each of these actors attempts to inscribe the observed business process activity according to pre-existing rules. The government policy tried to inscribe in the HMIS system the requirement of passing security certification. The security testing agency applies the OWASP framework and uses the tools to test the artifact based on some recommended best practices. The implementing non-profit organization and the global team of developers attempt to inscribe the context's use-cases into the system, while fulfilling the needs to the other actors and creating a balance. The interaction between actors to reach a common goal is the called Rationalization where design of the system, modifications to meet security certification is part of this testing process. In other times, the trainings, customizations, implementation and use, helps in creating a technology artifact, which tends to become black-boxed with more and more rationalization. The technology artifact thus always tends towards become black-boxed and as more and more social interactions happen through this artifact, it becomes a common-place in society and then is considered to be part of every business process. Institutionalization of the artifact results in then changing the business process activity.

When looking at our case of the *HMIS system*, we see that along with the functional requirements, even current practices that did not require security considerations in non-networked society became inscribed. But as shown by other actors, some of these inscriptions are in fact insecurities. These contextual insecurities although for the sake of negotiations (getting the certification) are made to go away, since they have been in use and institutionalized in the system, they stay in the system. Thus, even if we observe that there can be problems of data tampering, the factors of inertia are lot stronger and cause people to ignore the insecurities. From our observation, we see that as time progresses these insecurities become accepted as the social norm and become insecurities of society itself. Since these are then part of the process activity itself, we then get a blurred view whether these were ever insecurities in the first place.

The making and breaking of what we interpret as contextual insecurity is a continuous one. Regular cycles of inscription, rationalization and institutionalization happen and these continue to change our notions of insecure/secure practices.

5. Conclusion & Future Research

The paper argues that contextual insecurities need to be considered by designers of information systems when looking at functional requirements. The paper shows the need to realize that contexts help inscribe insecurities in the technology artifact and these are generally ignored by popular security testing frameworks. The paper also shows how rules of non-networked society cannot be directly translated into

implementation in networked society. New understanding of applying security in the network must be developed and implemented by the information systems.

For good or bad, contextual insecurities are inscribed in an artifact. It is also important that security testing agencies recognize the fact that contextual insecurities are going to be part of any system. Discovering the reasons for these problems by referring to functional requirements and context of deployment should be an important part of popular frameworks such as OWASP. InfoSec has mostly focused on how to harden information in systems, but has rarely looked at the reasons why the security problems arise. Looking at it from the worldview of culture, context and social structures is a good avenue for future research.

References

1. Castells, M. *The rise of the network society*. Wiley-Blackwell (2000).
2. Ludlow, P. *WikiLeaks and Hacktivist Culture*. *The Nation*. 4, 25–26 (2010).
3. Benkler, Y. *The wealth of networks: How social production transforms markets and freedom*. Yale Univ Pr (2006).
4. Popper, K.R. *The open society and its enemies: Hegel and Marx*. Routledge (2003).
5. Siponen, M.T., Oinas-Kukkonen, H. A review of information security issues and respective research contributions. *ACM SIGMIS Database*. 38, 60–80 (2007).
6. Geer Jr, D., Hoo, K.S., Jaquith, A. Information security: why the future belongs to the quants. *Security & Privacy, IEEE*. 1, 24–32 (2003).
7. Mouratidis, H., Giorgini, P., Manson, G. Integrating security and systems engineering: Towards the modelling of secure information systems. *Advanced Information Systems Engineering*. p. 1031–1031 (2010).
8. Baskerville, R. Information systems security design methods: implications for information systems development. *ACM Computing Surveys (CSUR)*. 25, 375–414 (1993).
9. DeLone, W.H., McLean, E.R. Information systems success: the quest for the dependent variable. *Information systems research*. 3, 60–95 (1992).
10. Heeks, R. Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*. 18, 101–112 (2002).
11. Gostin, L.O. Health information privacy. *Cornell L. Rev*. 80, 451–1756 (1995).
12. Rindfleisch, T.C. Privacy, information technology, and health care. *Communications of the ACM*. 40, 92–100 (1997).
13. Sandberg, A. *Socio-technical design, trade union strategies and action research*. *Research Methods in Information Systems*, North-Holland, Amsterdam. 79–92 (1985).
14. Bjerknes, G., Ehn, P., Kyng, M., Nygaard, K. *Computers and democracy: A Scandinavian challenge*. Gower Pub Co (1987).
15. Greenbaum, J.M., Kyng, M. *Design at work: Cooperative design of computer systems*. CRC (1991).
16. Susman, G.I., Evered, R.D. An assessment of the scientific merits of action research. *Administrative science quarterly*. 23, 582–603 (1978).
17. Walsham, G. Interpretive case studies in IS research: nature and method. *European Journal of information systems*. 4, 74–81 (1995).
18. Stock, A., Williams, J., Wichers, D. OWASP top 10. OWASP Foundation, July. (2007).

19. Thomson, M.E., Von Solms, R. Information security awareness: educating your users effectively. *Information Management & Computer Security*. 6, 167–173 (1998).
20. Akrich, M. The de-description of technical objects. *Shaping technology/building society*. 205–224 (1992).

Do Your Homework with Culture before acting in New Media

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Abstract. Many information systems fail in terms of opposite effects and cultural problems. There are huge amount of software that users are not using properly in the manner they were supposed to be used. This could also be the case with the new media. What do we know about this potential problem in the cultural context? This paper explores the theme by analysing different characteristics of the culture within a company. The focus of this article is of the top management key role in creating the corporate culture. Especially through culture issues we concentrate on the influencing affects the management support systems (MSS), management communication, computer support cooperative work (CSCW) (Bannon & Schmidt 1989), management and leadership styles, and their integration within the whole enterprise. This article brings together many issues, which effect on not only the desired ways but also can bring unwanted results. The same can happen with the new media if we do not do our homework.

Keywords: Culture, Management support systems, MSS, management, leadership, management information systems, organisation theory

1 INTRODUCTION

How corporation is acting in the social media (digital channels) is an issue, which concerns the company itself and its interest groups (Merisavo, 2008, p. 2). As one example, employer can be fired employee in writing negative issues to the social media of their employer or they can improve their corporates sales by writing thinks, which creates good will to the company (Helsingin Sanomat 2011) (TT/The Local 2011). Someone can summon people to appear in court of writing in the social media. (Helsingin Sanomat 2011). These are the limited examples of the cultural conflicts and the same kind can happen in the development, installation, and use of MSS (Leidner & Kayworth 2006). The area is interesting because cultural conflict can incur damage to corporate's actions and they can harm the possibilities in reaching corporates goals (Schein, 1991, p. 47-). From the examples, we can see in practise how the culture can affect an unwanted way and how we can express it. "No organization can be honest with the public if it is not honest with itself" (Bennis 2009). This paper makes a multidisciplinary view to the problem and it covers the culture, management, leadership, and communication and management support systems. *It shows that culture is all-embracing embodiment with many sources of misunderstandings. This work also points that in organisational environment (internal/external) includes many variables, which can lead to undesirable results.*

The perspective of this paper is the top management (the unit of analyse) and organisational. The New Media is understood as a tool which can support leadership activities (communication, social networking) and it can be used in the organizational and inter organisational networks (Adam 1995). The Management support system (MSS) is a combination of other systems (e.g. executive information systems, Decision support systems) (Carlsson et al. 2009; Hartono et al. 2007). MSS are management supporting tools and the New Media is a resource in development communication and collaboration systems (Hearn et al. 2009; Fuller & Valacich 2008; Yates et al. 2008). This is the reason, why this paper combines MSS and the New Media. In this article, we are calling these the communication (CSCW) and management support systems (CMSS). *The article points out the background in using the communication methods as a strategic choice.* Before making decision, management needs carefully think how to use CMSS and how it can help in reaching business goals.

The latest review article of the culture and IT is “A Review of culture in Information Systems Rehears: Toward a Theory of Information Technology of Culture Conflict” (Leidner & Kayworth 2006). This work is covering and respectable, but its starting point is the information technology. In this work, we take the managements view to the culture and especially to the CMSS. We explored the articles with the keywords and their combinations and examining the key books. We also used management information systems, executive information systems, business intelligence, CSCW, and the New Media as a keyword. This is a multilevel review with the top management lens to the culture, CMSS, management, and leadership. Many authors have pointed out opposite or different thinking in the organisation theories; culture, management, leadership, and CMSS, but there are no articles, which brings them together.

The main aim is to show that there is a lot of work to do inwardly before company is ready to meet the challenges using the new media as communication supporting tool. The main result of the paper is that there are a great number of sources that could conduct to the unwanted results, and this brings them together and clarifies the need for understanding the desired changes before implementing the CMMS. We are claiming that “Do your homework” is extremely important before implementing the new CMSS. We also point that there is limited amount of studies concerning the area.

Section two is an introduction to modern and postmodern organisation theories and its affects the culture. It shows the power of the culture in organisations and address different perspectives to organisation theories. This part paves the way to other sections.

The next part takes a closer look at the culture, its essence, meaning, management, and change. It addresses the relationship between management and culture and shows that the culture is manageable and it is influencing the decisions concerning the CMMS. Cultural actions are one source to contradictions and this part addresses some of them.

The fourth part of the paper combines management, leadership, and CMSS to the culture. It points out that information systems implementation can bring opposite results compared with management’s aims and there is the same danger with the CMMS. Leadership and management theories are separate but also working together as we notice later and this is the reason why differences in management paradigms and leadership styles mean many variations in the CMSS. This part also exposes the difficulties and dependencies of culture and information systems.

To the end, this paper makes some conclusions and successions. The main conclusion is that we have to study the present cultural issues and we have to understand the directions where management wants to change them. The change of culture is top managements homework and information systems developers must understand the goals of changes in development solutions to the CMSS.

2 ORGANIZATION THEORIES AND CMSS

Organisational theories are one embodiment of different believing of the reality and it covers many cultural issues as we can see later. Mary Hatch writes one of the latest culture books in 2006 and this was the reason why we used it as a source. She grouped different organizational theories to three categories: modern, Symbolic-interpretive and Postmodern. These three groups give us a clear picture of their features concerning their base believing's. We adopted the table 1 from Hatch (2006, p. 56). It gives us the idea of thinking about the CMMS through different organisation theories and in practice, different starting points can conduct different solutions.

	Modern	Symbolic-interpretive	Postmodern
Reality is	Pre-existing unit	Socially constructed diversity	Constantly shifting and fluid plurality
Knowledge is believed to be	Universal	Particular	Provisional
Knowledge is developed through	Facts and information	Meaning and interpretation	Exposure and experience
Knowledge is recognized via	Convergence	Coherence	Incoherence, fragmentation deconstruction
Model for human relationship	Hierarchy	Community	Self – determination
Overarching goal	Prediction and control	Understanding	Freedom

Table 1 Cultural types (Hatch, 2006, p. 56)

The New Media is technology based communication methods, which makes easier to create, participate and management the content in the organisation. Company can have employees, suppliers, customers, and stakeholders as parties in this communication. The New Media and web 2.0 can work tandem with the conventional communication tools as, phone, fax, and corporate intranet. When, we are implementing new media there are three questions where we need

answers: who is communicating, what is the content, and what media are being used (Hearn et al. 2009.) These questions are relevant, but management needs to consider the goals of using new media, decide the communication strategy, consider other impacts (culture, organisation, management, leadership and technology), and give the resources to the implementation. There are a lot of complicated choices concerning all three questions and a danger to unwanted results. We show in next chapters that organisational thinking has many links to culture, management, leadership, and CMSS. However, before we go further, it is worth look at closer the culture in the organisation. We show that it creates the basic rules, which covers the whole organization. We also show that cultural conflicts can be one reason to unwanted results.

3 WHAT IS CULTURE IN ORGANIZATION

For people culture is a shared way to construct the actuality, it gives means to understand common way events, actions, situations, discussions, objects, and situations. Culture can be expressed with shared values, meanings, believing, understands and means (Seeck, Hannele; Eräkivi, 2008.) Culture is “generally defined as a set of values and cognitions shared by members of a social unit” (Moore & Burke 2002). These issues are deeply inside of the social unit and its members learn them through socialization and by experience in the organization (Schein, 1991, p. 59). *If Enterprise fails creating a shared way of thinking or creating a common meaning of enterprise existence, development and intentions of CMMS can lead to the unwanted results.* Culture has a special meaning, it covers all the actions that corporate takes, and according to this, we have closer look at the culture magnitude, models and its change.

3.1 Culture, what does it mean

Many authors have been studied management and national culture through a four-dimensional framework. These dimensions are Individualism versus Collectivism, Large or Small Power Distance, Strong or Weak Uncertainty Avoidance and Masculinity versus Femininity (Hofstede 1981; M. Martinsons et al. 2009). These studies shows create differences in corporate cultures comparing them in different nations and companies. (Hofstede, 1983.) Martinson et. al. (2009) pointed out that these differences means that same management solution is not probably working in all cultural environments and there is no ideal culture to IT-based organisational change. Considering CMMS implementation, we must find the fit to the implementation context.

People must see culture as a political phenomenon and they can see it a management tool, which can be, manipulated (N. Iivari 2006). Because culture is manipulative, and manageable we can use it as a power tool for avoid the unwanted results. When we are implementing the new communication system, it means change. So there is a need for question: What are the manipulative parts of the culture? In addition, when we are discussing this manipulation, we must

consider how we can make the changes to the culture. Therefore, we have a look at the culture components a little bit closer in the next chapter.

3.2 Cultural components

Hatch (2006, p. 19) represented the dynamic conceptual model of organization (see Figure 1) and it is representing the theories and their relationships. The biggest circle around all others indicates that all others are relations of power and we can understand national culture as one variable of an environment. Hatch (2006, p. 251) writes: “One way to think of the relationship between power, conflict and control is that conflict is a manifestation of the continuous struggle over control that power relations imply.” We can see power as an organizational issue, which is in many ways a characteristic of management, leadership, and decision-making. Hatch sees the power as a core element in her conceptual model and culture is one part of it. Johnson & Schoes (1999, p 73) gives us another standpoint, because they see culture as a paradigm.

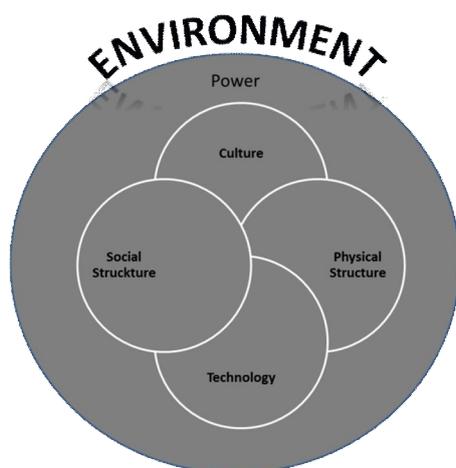


Figure 1 a Conceptual model of organization (Hatch & Cunliffe, 2006, p. 19)

They say that, management cannot oversimplify organizations culture understanding because the culture is mostly something that is attending in different situations, when organization is achieving its goals. Therefore, we can see culture in day-to-day conversations and discussions, activities, symbols. It is extremely important to understand this wide aspect because they give the glue for the paradigm and they reinforce the presumptions within the paradigm. Organization members take the granted actions of organization through culture (Johnson & Scholes 1999, p. 73.) “The cultural web is a representation of the taken-for-granted assumption, or paradigm of an organization and the physical

manifestations of organizational culture” (Figure 3) (Johnson & Scholes 1999, p. 73)

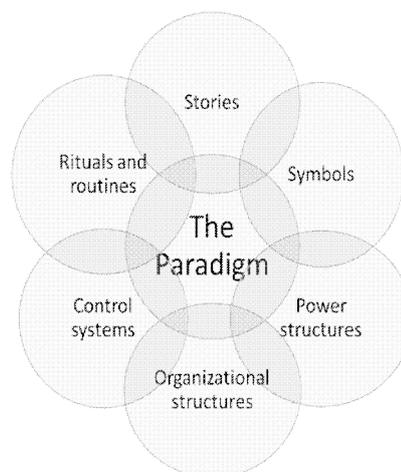


Figure 2 The Cultural web (Johnson & Scholes 1999, p. 74)

Schein (1991) sees culture with three levels and they are dependent each other. Culture has many levels as we can see in Figure 3 (Schein, 1991, p. 32). Schein (1991, p. 31) says that culture has many parts as organization, physical premises, communication rules which are learned to newcomers, basic values and conceptual content and assumptions. These all and especially conceptual content and assumptions makes every day working and communication and interpretations possible. Basic assumptions, artefacts, and values are distinct parts and they should keep exactly separate to avoid conceptual hazards. These levels create the working rules in organization for different purposes. Artefacts are the most visible, because people generate them. Artefacts are for instance physical and social environment, spoken language, and group’s social acting. The second level is values, which are basics for the actions and to solutions in different situations. People are creating the artefact through their values and if the artefact is useful, it comes to basic assumption. The greatest part of acting will not be understandable if we do not understand basic assumptions. Basic assumptions are solutions, which are working from time to time, and these working solutions come axiomatic. Originally, feelings and values are supporting the hypothesis to come real to the organization. These basic assumptions are working in “one loop learning solutions” (Argyris 1977). Schein (1991, p. 36) writes, that to exchange these assumptions organizations must execute Argyris (1977) “double loop learning” -method.

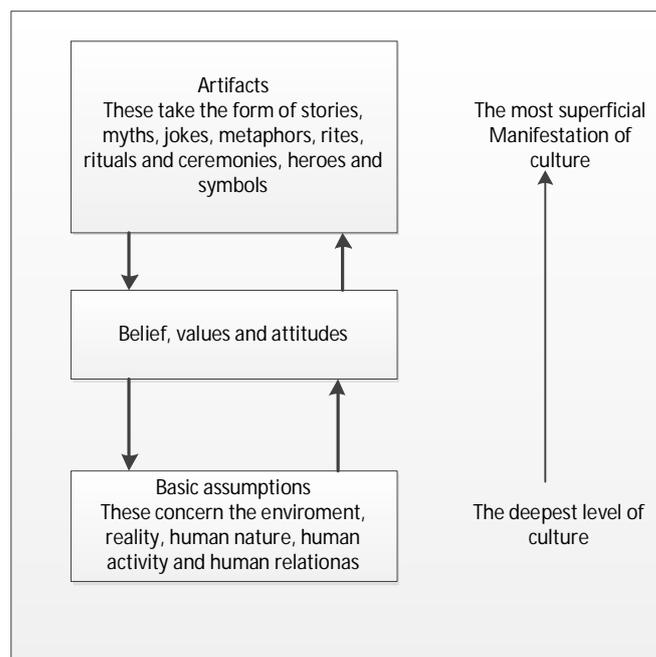


Figure 3 Levels of culture and their interaction (Schein 1991, p. 32)

We should understand the culture issues much better because they are affecting everyday working, people's wellness, and motivation (Schein 1991, p. 47). Schein (1991, p. 319) also says that culture is dynamic. Cultural difficulties can lead to flops in integrating a new technology because old occupational practises and the self-image are changing. People must learn the new methods of work and create new social communication (Schein 1991, p. 53.) Schein (1991, p. 47-63) makes an extensive list of cultural effects and trouble. These are affects on strategy, unsuccessful merges corporate acquisitions and diversify attempts, fails in integrating new technology, conflicts between social groups, ineffective meetings and communication strikes between people, unsatisfied socialization, low productivity, the poor cognizance of culture or misunderstandings, dynamic consequences, over emphasizing the process instead of meaning and confuse parts with the whole. If we change only controls systems (often information systems or management accounting systems) and leave other points without attention, we can create mismatched systems (Johnson & Scholes, 1999, p. 79). When, we are developing or changing the CMSS the same problem can arise. Therefore, there is a need to understand culture as a construct, which has many influencing parts. Other authors have pointed out the same kind cultural effects (Moore & Burke 2002; Boytsun et al. 2011; Brown 2008; Glickman et al. 2007).

The competing value model gives also one sight to cultural issues (Quinn & Rohrbaugh 1983). There are four dimensions: structure, control, internal and external. This model has been used in many studies (N. Iivari, 2006; J. Iivari & Huisman, 2007; Linnenluecke & Griffiths, 2009). Iivari & Huisman (2007)

conducted four culture types from the competing value model based on two distinctions change versus stability and internal focus versus external focus. Four types are group culture, adhocracy, hierarchy and rational cultures. These culture types give us four starting points which can give also the unwanted result.

There is no doubt; cultural issues have an important role in everyday life. Authors have persuaded us that neglecting culture can lead to the series of trouble. The new CMSS instantiation means integrating the new technology and especially using the New Media means the new artefact, which can have extensive influence. However, culture is an instantiation done by management. New technology often means creating new culture or cultural change. The next chapter gives some ideas how we can change the culture.

3.3 How can we create corporate culture

Management communication and the daily activities by examples are the most powerful culture creators (Glickman et al. 2007). One example of culture movement from the traditional management to the modern management culture is presented by Senge (1994, p. 340). Senge (1994) says that the leaders in learning organization are designers, stewards, and teachers. These roles of leadership mean that leaders have responsibility to build organizations where “where people continually expand their capabilities to understand complexity, clarify vision, and improve shared mental models – that is, they are responsible for learning.” Cultural changes extend also to corporate boards (Charan & Colvin 2010). Moving to the modern management is concern the form of the organisation and its basic believing’s (see table 1). Management is amalgamating organizational and corporate culture, because managers create and supply the culture (Schein, 1991, p. 19). Corporate management is acting as an engine, when dialectics is going on, and when they are disclosing and delivering important information and when they are creating shared rules. Wondering, mope about, uncovering, does not create trust; instead they create misinterpretations, frustrations and antipathies in interactions (Pitkänen 2006.) Pitkäsen (2006) thesis one salient point is the trust culture. When management succeeds freeing people’s tensions in organizations, we can see enormous power in the good and the bad. Leadership and learning are those processes, which are primarily influencing controllable in facing different cultures and values. There are four cultures, which create the quartet. These four models are the network- , service, quality, and dialogue cultures. These include the power needed in controllable culture movement with two different cultures and in creating the trust culture. He also says that tensions become apparent in business, environment, system, and

interactions. He also proved that there is a danger to the conflicts in all these dimensions. Positive affect on the results in the business is the leaded outcome from the change management.

“The culture is a result of learning based on common experiences of the community and the changing of culture is a leaded process” (Pitkänen 2006, p. 210)

For now, we have noticed many embodiments of the culture. The authors created all these aspects from the cultural viewpoints. As mentioned, the management and leadership have a huge role in creating and changing the corporate culture, but in these areas, there is also danger to unwanted results. Now it is time to look at these roles.

4 MANAGEMENT, LEADERSHIP, CULTURE AND INFORMATION SYSTEMS

The management gives to people in saddle strings to one's bow to handle different management problems (Strategic management, long range planning, process management, process re-engineering, best practice, perception management, crisis management etc.) (Aaltonen 2007). With leadership, leaders handle these management mantras in their organisations. We can say that, leadership is the process of influencing others towards achieving some kind desired outcome (De Jong & Den Hartog 2007). However, strategy, leadership, and management affect culture (Pitkänen 2006, p.57) as we can see the next section.

4.1 Many forms of management culture

We can understand different management styles as paradigms, which have vigorous reflection to organizational activities and how organization is reaching its goals and how it creates the corporate culture. Management culture studies identify some mainstreams of the management paradigms. They are scientific management, human relations movement, structural analysis, organizational culture theory, innovation theory, strategic management, and quality management (Seeck, Hannele; Eräkivi 2008.) We can keep the Seecks list of the paradigms quite old (it was adopted from Guillén in the year 1994) (Seeck & Laakso 2010), but management paradigms are changing, because of rapid changes in economic conditions an invariably crowing complexity business life (Clarke & Clegg 2000; Abrahamson 1997). There are also other findings, which show that different companies in the same industry can have the same kind of culture, and findings, which prove that all companies have an individual culture (McKelvey, Bill; Aldrich 1983).

One of Jim Collins (2005, p. 178) idea is a discipline instead of a bureaucracy to achieve excellence. With the idea, he means how to become the best, winning organization. An enterprise can have two opposite forces: a discipline culture and an entrepreneurship working moral. Instead of the bureaucracy and hierarchy, the company can create a new working culture combining mentioned culture and working moral. As a result, there is transcendent and constant profit formula (see

Figure 4). A new enterprise is creative and growing. It is its way to an unknown future with visionary enthusiasm. Growing makes enterprise complex. The company is getting new customers, new staff, and its coming borrowing and flitting around. Then comes the professional management and it creates rules and bureaucracy to get the things in order. In addition, at the same time, the hierarchy is growing with consequence low motivation and killing entrepreneurship.

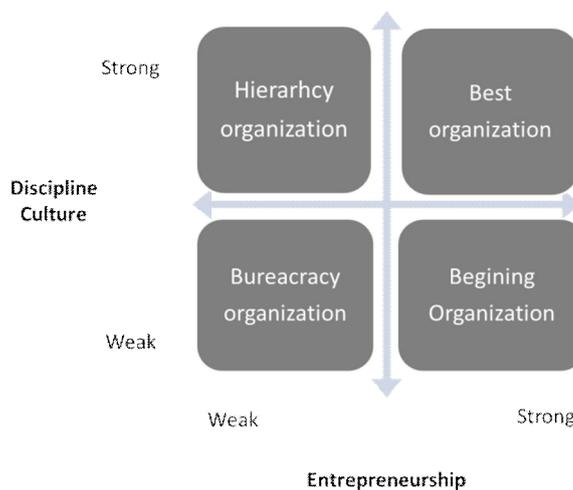


Figure 4 By creative discipline from good to best (Collins, 2005, p. 178)

The creative keen company has come borrowing and ordinary with averageness. The meaning of bureaucracy is to compensate no expertise and discipline. This is a trouble, which could be gone with the right people (Collins, 2005, p 176.) Collins (2001, p. 46) also created the “fifth level leadership,” where he combined personal characters, team membership, issue management, people leadership and fifth level (own acting). The discipline culture includes disciplinary power, which is “embedded in social structures and technologies, which essentially the control of social action” (Robey & Boudreau 1999). Collins solution is to create the new discipline culture. Discipline means a rigours attitude to a goal, which is to become the best organization. It means no compromises in decisions and their executions.

One of the latest developments of strategic management is fast strategy (Doz & Kosonen 2008). One of its features is of the top management team collaboration culture. This means that a CEO and the top management team is working as equal’s in the team when they are making strategy decisions. This means that the responsibility is concern, the management team member’s work, and all others work too (p. 132). One idea of this kind of agility strategy is that

organization is multidimensional. Its fastness is born by balancing different viewpoints and dimensions carefully (p.237). This kind of culture needs the advanced communication systems, because the idea of equal decision makers requires lot of information and a shared knowledge creating systems (p.156). Doz and Kosonen wrote plenty strategic and leadership principles and that is why we can keep fast strategy as a strategic management innovation. Management innovations are evolving and learning organisations presents new ideas (Malhotra 2000) and “Managing Flow” (Nonaka et al. 2008). These all are combined management systems, because they include management principles and leadership behaviour philosophies. These examples represent different management philosophies and the challenges of adopting and using them. The philosophies are changing through time and the desired change can lead different solutions compared present. Next, we have a look at mentioned leadership behaviour philosophies by analysing Leadership.

4.2 Leadership and believing’s

The management is creating the culture trough the leadership. In table 2 we can see two antitheses (Goleman et al. 2010):

Leadership Style	Leader characteristics	How style builds resonance	Impact style on (business) climate	When style is appropriate
Visionary	Inspires, believes in own vision, empathetic, explains how and why people's efforts contribute to the 'dream'	Move people towards shared dreams	+++	When changes require a new vision, or when a clear direction is needed, radical change
Commanding	Commanding, "do it because I say so", threatening, tight control, monitoring studiously, creating dissonance, contaminates everyone's mood, drives away talent	Soothes fear by giving clear direction in an emergency	Often --	In a Crisis, to kick-start an urgent turnaround, or with problem employees, Traditional military.

Table 2 Leadership styles

Schein (1991, p. 233) kept culture as a manipulative issue, and because leadership is behavioural, it affects culture. Schein (1991) also showed evidences that cultural changes are slowly and its conscious change is job of the management. Therefore, if we illustrate leadership change from the commanding culture to the visionary culture, we can imagine the time it takes and we could confront crisis and embarrassment (See Table 2).

The best companies are capable to environmental changes and they are excellence in adopting and adapting new technology. Technology is accelerator of dynamic not an initiator. The best companies do not start their movement to excellence with new technology (Collins, 2005. p 207.) The new technology is usable when it is suitable for Collins (p. 143) three circles, which are: 1) Where about we are excited, 2) Where we can be the best in the world, and 3) What is infusing to economic results. There are also other opinions of the technology. Robey and Boudreau (1999) wrote that the advanced information technology is either a determinant or enabler of radical organizational change.

As a conclusion of these viewpoints to management methods or paradigms we are convincing ... Some styles are naturally supporting the use of CMSS. Especially Dotz & Kosonen pointed out the meaning of communication in a company that is using the agile strategy.

4.3 Information systems, their meaning and culture

Information technology can change social structures and transforms the classical conceptualizations of work. This means physical pulls away, reduced command control and it creating new ways to integrate people and work in different part of organization and between organizations. It can have influence on power and responsibilities because it makes possible to decentralise decision making, reduce hierarchical levels, makes possibilities deliver information easier and faster to all who needs it (Hatch & Cunliffe, 2006 p. 161, ref. Huber 1990.) Therefore, when we compare these issues to cultural characteristics, and we can notice that many management decisions concerning information technology and information systems are affecting straight cultural issues. At the same time, we can have complexity and a high rate of change (Huber 1990; Leidner & Kayworth 2006). You can find these issues in Figure 5.

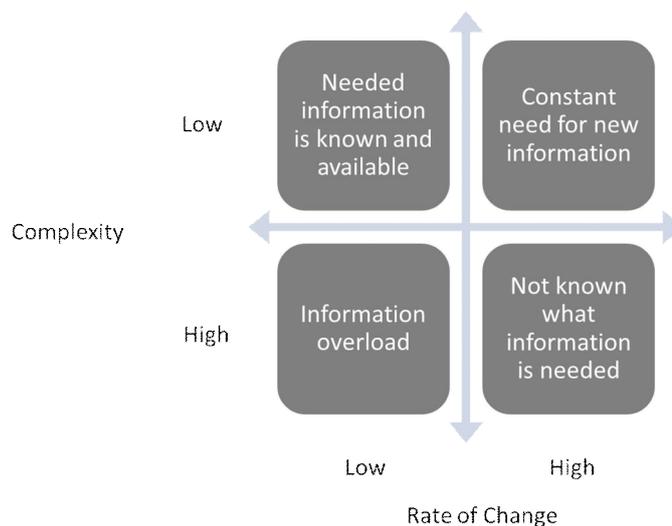


Figure 5 Links between conditions in the perceived environment, uncertainty, and information (Hatch & Cunliffe, 2006, p. 79)

We are now coming back to Robey and Boudreau (1999) because they represented the theory “logic of opposition”. They pointed out four theories, which can act as the logic of opposition. This means that the desired outcomes can necessitate an opposite results. These were organizational politics, organizational culture, institutional theory, and organizational learning (see table 3).

<i>Theories</i>	<i>Nature of Logic</i>
<i>Organizational Politicks</i>	Groups with incompatible opposing engage in political activity (using information technology as a resource) from which organizational changes emerge.
<i>Organizational Culture</i>	Information technologies are produced and interpreted as cultural artefacts that may symbolize a variety of values, beliefs, and assumptions. Integration: Culture is portrayed as unified and consistent, opposing organizational change. Differentiation: Culture is composed of subcultures. Conflicts occur at the boundaries separating two or more subcultures. Fragmentation: Culture is viewed as inherently ambiguous and contradictory. Opposing and irreconcilable interpretations may be entertained simultaneously, both within and across subcultures
<i>Institutional Theory</i>	Institutionalized patterns and practises sustain an organization's legitimacy and are unlikely to change. Information technologies may be adapted to institutional practises or used to reform them
<i>Organizational Learning</i>	Existing organizational memory may impair new learning. Information technologies both enable and disable organizational learning.

Table 3 Theories Using Logic of Opposition (Robey & Boudreau 1999)

Schein (1991, p. 137) gives a light illuminating example from MIS assumptions where we can notice, that culture is directly affecting it. When installing the Management information system, which includes many suppositions of processes, it gives to management all information from all parts of organization. Management can share or not these suppositions as assumptions. These assumptions can be:

- Information system includes important information (opposite to personal information processing)
- All levels of management have access to the same information (opposite assumption work as private assets)
- Huge information amount improve management process (opposite assumption that information is needed only of those important functions that manager is acting, decreasing information lead to better management)

- Management processes are effective by on line information for everybody (opposite to systematic hierarchical delay between different organizational levels – boss gets the information first)

We cannot make the assumptions of the existence processes, because management are changing them, if processes differ from the hiding assumptions (Schein 1991, p. 137.) Technology and knowledge working are affecting organizations increasingly and these changes are making organizations more complex. This is leading to subcultures inside organization, which corporate is creating when new different technology is gaining ground (Schein 2010). There can be another streamline when the company is adopting the same kind of information technology to use in different parts of the organization and it can lead to contradictions (Robey & Boudreau 1999). A good example this kind of development is the installation of ERP system. The new huge information system needs many settings and there are always basic assumptions, which are working in average situations, and these settings can lead to no access to information that was earlier available and this is affecting power relations (Rom 2008). Considering this more detail and thinking about information systems, there are many issues, which are forceful to the features of the system to avoid unwanted consequences and conflicts. The conflicts can occur for many reasons as vision conflict, system conflict and contribution conflict (Leidner & Kayworth 2006).

There is a danger that technology is leading the cultural changes without managements meaning. Management can use new information for many purposes and in retailing, it makes possible to control all cash work in detail. It can also create a control mechanism, which serves command, and control culture. Therefore, information system can upgrade the requisite skills of some employees and at the same time downgrade others skills (Robey & Boudreau, 1999, ref. Buchanan and Bobby, 1983.) Of the management point of view CMSS is supporting corporates aims to reach its goals and it is important that they are compatible to the corporate culture (Yates, Wanda J Orlikowski, & Jackson, 2008.) This is not easy; if in the same company have many management systems, which use different software and technology (Schein 2010). Therefore, there are many choices to do and we have to ask where the CMMS is helping management and leads better performance. If company wants to avoid unwanted results, CMMS must have clear purpose and goals

The new media and its technology are creating possibilities for new social participation and these are affecting in the business world (Humphreys 2005). Enterprises have to be awake with this issue, because the new technology enables many new ways of interacting with employees, partners and customers and some

of them can be very powerful if they fit the culture. The company can use The New Media and its technology for many purposes internally and externally. It can be a tool supporting marketing or supplier relationships. The company can bind partners in reaching desired results in business and it can be used management and leadership communication supporting tool. All these are choices, which cover cultural aspects. This article gives the background of these choices. This paper suppose, that especially the companies that are working in the consumer markets are creating new common action rules for employees and they are coming more open to the new media. New forms of marketing and interactions with consumers will be seen (Achrol & Kotler 1999).

5 CONCLUSIONS AND FURTHER WORK

5.1 Implications of results to science

Many theories have pointed out opposite views, unwanted results or opposite effects on the same phenomenon. All organisations have their own limits. “Organisations fail to learn from their experience in systems development because of the limits of organisational intelligence, disincentives for learning, organisational designs and educational barriers” (Lyytinen & Robey 1999). We have one research tendency, which covers information systems failures (Lyytinen 1996; Lyytinen 1988). Virtual teams use technology-mediated interactions and we have group work studies and media richness theory. There is probably any other work covering opposite thinking and contradictions in culture, management, leadership and CMSS. This article leverages the view of failures in information systems to the top management work (management theories) and covers their limits. “Information system success” in a second research tendency, which starting point for a study is the information system (DeLone, William & Mclean, Ephraim 2003; DeLone & McLean 2002; DeLone & McLean, Ephraim 2001; Petter et al. 2008). This article brings together the culture, management, leadership and information systems possibilities to present the unwanted results. If we take a closer look, what we know of culture, strategy, management, leadership, and information systems and their influences we have to admit that the knowledge is fragmented.

The article shows that the possibilities to unwanted results are complicated and to understand the reasons we need a broad and detailed outlook to the problem area with many theories. Most IS studies are done in the lens of the IS discipline covering management and leadership (Sidorova et al. 2008). As showed, there are many contradictions in other areas and source of opposite effect on the information systems. Companies are changing their culture, organisations, management and leadership methods. These changes have a link to company’s goals. In avoiding unwanted result the future needs of CMSS must fit these goals.

The article tries to create links between organisational theory, culture, management paradigms, leadership styles, change and CMSS. The literature gives us references that there is a link. Which are the variables and the links, leaves a room to research?

5.2 Implications of results to practice

Before flying to the new media, we have to plan how to use the New Media and this is the homework to the management. Neglecting social context, the culture, a market by the time, the locale, and politics gives us an incomplete picture of information system phenomena, because information technology (design and use) are embedded a natural way to their context.

How to avoid unwanted results or opposite effects? This is a practical question and this work does not give a full answer to it but some implications of the result we can bring to practice.

The management's responds to environmental changes with changing the management paradigms and leadership styles (Abrahamson 1997). The change is happening in many other areas too (technology, networks, knowledge) and this makes big challenges for managers and information systems developers. We must understand all these changes and be able to produce a right solution. We need a lot of knowledge, which we have to furnish in creating understanding about these changes. This paper point that all organisations are individual and they promote different aspect in their actions. Before implementing applications for the CMSS, we have to study these issues carefully and set the goals in cultural and economic sense. We need understanding about present culture and top management desired culture. We need understanding present management, and leadership paradigms and the top management goals of the future.

Leadership styles are based different types of knowledge creation and believing's and they are contradictory (see table 2). It can be the same with management paradigms. The attitudes and aims to the CMMS need deeply considering and we need clear understanding about its nature and its effects. This belongs to the ground work before implementing CMMS.

This is why, we need clear goals, the clear codes of behaviour and clear meaning for the CMSS. When we are discussing many forms of CMSS, they all effect in strategy and management systems level.

Top management creates political matters, culture, values, and ethics and the choice of an attitude to different situations is in their hands (Pearce & Robinson, 2005, p. 345-; Schein, 1991, p. 234). The top management and the corporate board are high-powered to strategy (Tricker 1994). Because the culture changes are slow (Schein, 1991) and culture is affecting all around organization and its interest groups, we can keep the cultural aspect rather strategic than operational issue. This is the reason why culture issues belong to the top management. For information systems professionals there is a strong need to trace the top managements actions and desires and especially to understand culture to produce demanded CMSS without opposite effects. We can see management solutions and paradigms as methods solving management problems, information technology and CMSS supporting this and leadership as a style how the managers solve problems with people.

All the perspectives in this article can be a source for contradictions and opposite effects on the development and use of CMMS. Culture is multidimensional embodiment and before starting the development of CMMS, studying actual corporate strategy is critical issue (vision, values, strategic situation, strategic goals, and strategic plans), management methods and paradigms, leadership styles, organization, technology and especially culture entirely to understand present situation. Nevertheless, this will not really help us if there are many movements going on the organisation. We must have clear knowledge of this desired future in all aspects. This is the groundwork in the development of CMMS.

The main claim in this paper is that, when we are studying present cultural issues or its influence or dependencies to the information systems we are always late. We are running into the new world with new ideas and old paradigms are getting elder. There is room for new thinking, new paradigms, new ethics, new values, and new leadership. The movement of management and leadership is continuous and CMSS should support it properly.

5.3 Limitations

This work is limited to the articles and the focus was in the culture and new media with the lens of top management. This work gives only one picture of the topic and it is based on authors thinking. This is also this papers scientific limitation. This work does not involve technical limits, system development problems, network infrastructure issues, security problems, communication problems, strategic choices, decision making, decisions implementation,

information system use or impacts in use of CMSS and these all can probably lead to unwanted results.

5.4 Further research

The author did not find any studies concerning communication systems and management paradigms or leadership styles. Discussing of human resource information systems, there is great deal undone research (Poutanen 2010). Communication systems are supporting management activities and this is why there is a need to cover these issues in research. The New Media research in companies is really limited (Hearn et al. 2009).

We can see from Seecks (2008) analysis that different management paradigms live in harmony in different companies (It is limited, because it was done from annual reports). Some of them are more common than the others are, but how they are affecting the CMSS development, implementation, and use. We do need comprehensive knowledge of this.

From the literature, we got references that national culture, strategy, management system and leadership styles are linked to the corporate culture. What connections do these have to culture? What does the desired future culture affect on CMSS (see Figure 6) and what kind of combined management paradigms are the variables? These are also the questions, which need more attention.



Figure 6 General view of culture issues, management and CMSS

6 REFERENCES

- Aaltonen, M., 2007. Multi-ontology, sense-making and Management. *Liiketaloudellinen Aikakausikirja*, (3), pp.347-352.
- Abrahamson, E., 1997. The Emergence and Prevalence of Employee Management Rhetorics: The Effects of Long Waves, Labor Unions, and Turnover, 1875 to 1992. *The Academy of Management Journal*, 40(3), p.491.
- Achrol, R.S. & Kotler, P., 1999. Marketing in the Network Economy. *Journal of Marketing*, 63, p.146.
- Adam, F., 1995. Information flows amongst executives: their implications for systems development. *The Journal of Strategic Information Systems*, 4(4), pp.341-355.
- Argyris, C., 1977. Organizational Learning and Management Information Systems. *Accounting, Organizations and Society*, 2(2), pp.113-123.
- Bannon, L.J. & Schmidt, K., 1989. CSCW : Four Characters in Search of a Context. In *ECSCW '89. Proceedings of the First European Conference on Computer Supported Cooperative Work*. London, pp. 358-372.
- Bennis, W., 2009. What's Needed Next: A Culture of Candor. *Harvard Business Review*, (June), pp.54-61.
- Boytson, A., Deloof, M. & Matthyssens, P., 2011. Social Norms, Social Cohesion, and Corporate Governance. *Corporate Governance: An International Review*, 19(1), pp.41-60.
- Brown, H., 2008. *Knowledge and innovation: a comparative study of the USA, the UK, and Japan*, New York: Routledge.
- Carlsson, S. a et al., 2009. An Approach for Designing Management Support Systems. *Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology - DESRIST '09*, p.10.
- Charan, R. & Colvin, G., 2010. A Harsh New Reality. *Fortune*, pp.97-100.
- Clarke, T. & Clegg, S., 2000. Management Paradigms for the New Millennium. *International Journal of Management Reviews*, 2(1), pp.45-64.
- Collins, J., 2005. *Hyvästä Paras* M. Tillman, ed., New York: Tallentum Media.

- De Jong, J.P.J. & Den Hartog, D.N., 2007. How leaders influence employees' innovative behaviour. *European Journal of Innovation Management*, 10(1), pp.41-64.
- DeLone, W.H. & McLean, E.R., 2002. Information systems success revisited. *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*, 00(c), pp.2966-2976.
- DeLone, W.H. & McLean, Ephraim, R., 2001. Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, 3(1), pp.60-88.
- DeLone, William, H. & Mclean, Ephraim, H., 2003. The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 19(4), pp.9-31.
- Doz, Y.L. & Kosonen, M., 2008. *Nopea Strategia: Miten strateginen ketteryys auttaa pysymään kilpailun kärjessä* 1st ed. M. Laukkanen, ed., Pearson Education/Talentum Media.
- Fuller, R.M. & Valacich, J.S., 2008. Media, Tasks, and Communication Processes: A Theory of Media Synchronicity. *MIS Quarterly*, 32(3), pp.575-600.
- Glickman, S.W. et al., 2007. Promoting quality: the health-care organization from a management perspective. *International Journal for Quality in Health Care*, 19(6), pp.341-8.
- Goleman, D., Boyatzis, R.E. & McKee, A., 2010. Leadership Styles - Goleman on creating resonance. , p.1. Available at: http://www.valuebasedmanagement.net/methods_goleman_leadership_styles.html [Accessed January 29, 2011].
- Hartono, E., Santhanam, R. & Holsapple, C., 2007. Factors that contribute to management support system success: An analysis of field studies. *Decision Support Systems*, 43(1), pp.256-268.
- Hatch, M.J. & Cunliffe, A.L., 2006. *Organization theory: modern, symbolic, and postmodern perspectives* 2nd ed., New York: Oxford University Press.
- Hearn, G., Foth, M. & Gray, H., 2009. Applications and Implementations of New Media in Corporate Communications. *Corporate Communications*, 14, pp.49-61.
- Helsingin Sanomat, 2011. Bloggarin Ihana Elämä. *Helsingin Sanomat*, (16.1.2011), p.D1.
- Hofstede, G., 1981. Culture and Organization. *International Studies of Management and Organization*, X(4), pp.15-41.
- Hofstede, G., 1983. The Cultural Relativity of Organizational Practices and Theories. *Journal of International Business Studies*, 14(2), pp.75-89.

- Huber, G.P., 1990. A Theory of Effects of the Information Technologies Advanced on Organizational Design , Intelligence, and Decision Making. *The Academy of Management Review Management*, 15(1), pp.47-71.
- Humphreys, J.H., 2005. Contextual implications for transformational and servant leadership: A historical investigation. *Management Decision*, 43(10), pp.1410-1431.
- Iivari, J. & Huisman, M., 2007. The Relationship Between Organizational Culture and the Deployment of Systems Development Methodologies. *MIS Quarterly*, 31(1), pp.35-58.
- Iivari, N., 2006. Discourses on “Culture” and “Usability Work” in Software Product Development. *Acta Univ. Oul. A 457*, p.136. Available at: <http://herkules.oulu.fi/isbn9514280725/> [Accessed January 5, 2011].
- Johnson, G. & Scholes, K., 1999. *Exploring Corporate Strategy* 5th ed., London: Prentice Hall Europe.
- Leidner, D.E. & Kayworth, T., 2006. Review: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict. *MIS Quarterly*, 30(2), pp.357-399.
- Linnenluecke, M.K. & Griffiths, A., 2009. Corporate sustainability and organizational culture. *Journal of World Business*, 45(4), pp.357-366.
- Lyytinen, K., 1988. Expectation Failure Concept and Systems Analysts’ View of Information System Failures: Results of an Exploratory Study. *Information & Management*, 14, pp.45-56.
- Lyytinen, K., 1996. Tietojärjestelmien epäonnistuminen ja riskien hallinta. *Systeemyö*, (4), pp.8-9.
- Malhotra, Y., 2000. From Information Management to Knowledge Management : In *Knowledge Management and Business Modell Innovation*. p. 115.
- Martinsons, M., Davidson, R.M. & Martinsons, V., 2009. How Culture Influences Organizational Change and Information Systems. *Communications of the ACM*, 52(4), pp.118-123.
- McKelvey, Bill; Aldrich, H., 1983. Populations, Natural Selection, and Applied Organizational Science. *Administrative Science Quartely*, 28(1), pp.101-128.
- Merisavo, M., 2008. *The interaction between digital marketing communication and Customer Loyalty*, Helsinki School of Economics.
- Moore, J.E. & Burke, L.A., 2002. How to Turn Around in IT “ Turnover Culture .” *Communications of the ACM*, 45(2), pp.73-78.
- Nonaka, I., Toyama, R. & Hirata, T., 2008. *Managing flow: a process theory of the knowledge-based firm*, Palgrave Macmillan.

- Petter, S., Delone, W. & Mclean, E., 2008. Measuring information systems success : models , dimensions , measures , and interrelationships. *European Journal of Information Systems*, (17), pp.236-263.
- Pitkänen, J., 2006. *Jännitteet Kulttuurien Törmätessä, Yrityskulttuurin Vaikutus Muutosprosessissa*. University of Tampere.
- Poutanen, H., 2010. *Developing the Role of Human Resource Information Systems for the Activities of Good Leadership*. University of Oulu.
- Quinn, R.E. & Rohrbaugh, J., 1983. A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis. *Management Science*, 29(3), pp.363-377.
- Robey, D. & Boudreau, M.-C., 1999. Accounting for the Contradictory Organizational Consequences of Information Technology: Theoretical Directions and Methodological Implications. *Information Systems Research*, 10(2), pp.167-185.
- Rom, A., 2008. *Management Accounting and Integrated Information Systems How to Exploit the Potential for Management*. Frederiksberg C: Samfundslitteratur Publishers.
- Schein, E.H., 2010. The Role of Organization Development in the Human Resource Function. *OD Practitioner*, 42(4), pp.6-12.
- Schein, E.H., 1991. *Organisaatiokulttuuri ja johtaminen* 3rd ed. R. Liljamo & A. Miettinen, eds., Helsinki: Weilin + Göös.
- Seeck, H. & Eräkivi, O., 2008. Rationaalista vai Normatiivista ideologiaa? Johtamisoppien Käyttö Vuosikatsauspuheessa Suomen Metsä- ja Metalliteollisuudessa 1980-2005. *Hallinnon Tutkimus*, (2), pp.15-32.
- Seeck, H. & Laakso, A., 2010. The adoption of management paradigms in Finnish management research 1937-2007. *Journal of Management History*, 16(2), pp.174-194.
- Sidorova, B.A., Evangelopoulos, N. & Valacich, J.S., 2008. Uncovering the Intellectual Core of the Information Systems Discipline. *MIS Quarterly*, 32(3), pp.467-482.
- TT/The Local, 2011. Workers Canned for “Disloyal” Facebook Post. *Internet*, p.1. Available at: <http://www.thelocal.se/31216/20110103/> [Accessed January 10, 2011].
- Yates, J., Orlikowski, W.J. & Jackson, A., 2008. The Six Key Dimensions of Understanding Media. *MIT Sloan Management Review*, 49(2), pp.63-69.

Technology or Process First? A Call for Mediation Between ESM and BPM Approaches in Organizations

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Abstract. Enterprise Systems Management (ESM) and Business Process Management (BPM), although highly correlated, have evolved as alternative and mutually exclusive approaches to corporate infrastructure. As a result, companies struggle to find the right balance between technology and process factors in infrastructure implementation projects. The purpose of this paper is articulate a need and a direction to mediate between the process-driven and the technology-driven approaches. Using a cross-case analysis, we gain insight into two examples of systems and process implementation. We highlight the differences between them using strategic alignment, Enterprise Systems and Business Process Management theories. We argue that the insights from these cases can lead to a better alignment between process and technology. Implications for practice include the direction towards a closer integration of process and technology factors in organizations. Theoretical implications call for a design-oriented view of technology and process alignment.

Key words: Enterprise Systems, Business Process Management, Strategic Alignment, Case Study

1 Introduction

Implementation of Enterprise Information Systems (EIS) or just Enterprise Systems (ES) today is not a critical issue. Like Pavlovs dogs, executives learned the lesson: risk from implementing ES should be mitigated by minimizing the level of customization and scope of ES projects. Adaption of the business process to the company specific challenges will then have to be dealt with later. However, many ES mature companies have experienced that even after several years the main concern is not process-driven system improvement but consolidation the ES itself. As a consequence, business opportunities are lost.

The discussion about the either to put the enterprise into the enterprise system [1] or the opposite appears to be a prevailing discussion in the ES literature. It is well-formulated by [2] as Apart from all the normal problems of IS project

management, the novel difficulty for teams implementing ES software is to decide which mix of configuration, customization and process change is best for the organization.

This paper indicates that this pendulum perhaps have swung too much towards technology jeopardizing the process perspective. But also that the new technology allows for new adoption patterns, and consequently that new approaches are needed. The new approach will be based on both technology and process approaches using a mediating perspective between the two. We begin our argument by claiming that aligning systems and processes is a key issue for Enterprise Systems Management (ESM) and Business Process Management (BPM) altogether. However, due to historical differences, the two domains have been developed independently and are used as alternatives rather than conjunctives. We illustrate the technology-first and process-first approaches by describing and analyzing two cases from two separate companies. Based on the discussion we provide a set of differences which we argue are key elements in mediation between systems and process management in companies. Our concluding remarks include a research direction towards converging the two management strategies.

1.1 Research Methodology

The aim of this study is to identify managerial guidelines for designing enterprise systems and business processes using a balanced ESM and BPM approach. The study focuses on the mediation between the technology first approach or ESM and process first or BPM approach.

The new approach is based on a cross-case analysis [3] of two case studies in large mature enterprises embarking on an ES journey. Each of the cases has been used in larger and wider participatory studies done by the authors of this paper. The cases were written based on archival material and interviews, and were prepared in collaboration with practitioners in each organization.

The analysis of the cases is built on a combined theoretical framework based on BPM and ESM models such as: strategic alignment, IT engagement, implementation and process improvement approaches. Then the two cases and their design approach are presented and proceeding section of the paper summarizes, analyzes and discusses the mediation between the technology first (ESM) approach and process first (BPM) approach.

2 Two Approaches to Aligning Systems and Processes

Strategic alignment between business and information technology is one of the persistent discussions in the field of Information Systems. The concept of strategic alignment has been found to be of great practical use. Henderson and Venkatraman proposed a seminal model for business IT alignment the Strategic Alignment Model (SAM) which defines the range of strategic choices facing managers . It was intended to support the integration of Information Technology (IT) into

business strategy by advocating alignment between and within four domains [4]. Many years later, despite the general agreement that we need to align business and information technology, there is an ongoing discussion on how to achieve this. The ESM and BPM approaches each have their answer, as we discuss below.

2.1 Enterprise Systems Management (ESM)

The field of ES has basically emerged and matured over the last decade [5]. One strand of the ES literature presents ES as generic systems, which can be recycled across similar organizations and now increasingly also across different industry sectors or organizational forms (e.g. from the private to the public sector). ES can be characterized as multi-everything artifacts multi-industry, multi-function, multi-processes etc. [6]. The systems are designed to manage business systems globally, drive compliant business processes worldwide and deploy country-specific capabilities to operate anywhere in the world [7]. Industry-specific versions are available for many industries such as financial (banking, insurance), public services (health care, public administration), manufacturing (consumer products, pharmaceuticals) and service (utility, retail) [8]. ES are thus viewed as transformative technologies containing universal logics that can be applied to all kinds of organizations [9, 10] based on the way companies operate in general [1]. Jacobs and Weston (2007) explain that Generic ERP software packages are already increasingly tailored to specific market segments. Preconfigured software modules incorporating best practices and standard business processes will simplify future implementations, [11] and this illustrates the understanding of the universal ES with best practices and standard business processes that can be diffused to different market segments.

ES software is accordingly, unlike tailor-made software, not designed for the precise needs and requirements of an organization, but instead a semi-finished product that the organization has to tailor to its needs. Tailoring could be configuration (setting up parameters) and/or customization (adding non-standard features to the software by programming) [2]. Organizations are advised to go for vanilla implementations (i.e. configuring without customizations) by consultants [12] and academia [13, 2] or at least to minimize customizations as much as possible [14] vanilla implementations have thus become institutionalized advice and practice. The reason is that vanilla ES implementations are easier, cheaper [15] and quicker [16] and furthermore reduce future maintenance and upgrading costs [12]. The vanilla like implementation is exactly what Davenport [1] refers to when he metaphorically formulates putting the enterprise into the enterprise system.

However, the consequences of this ERP standardization orthodoxy (inspired by [17]) might be major changes to current practices (see also [18]) and, as Willis and Willis-Brown argue, the outcome is standardized practices that only minimally meet the needs of the unique business operation. [16] So, although ES ships as complete, though flexible, ready to implement solution[s] [19], they do come with built-in assumptions [2] often referred to as best practices based

on industry standards anticipated to be the most rational and progressive business processes available. Organizations have to replace their current practices with these best practices through a re-engineering process [20], particularly with vanilla implementations. This might be a problematic process depending on the difference between the current practices and the best practices embedded in the ES, and some organizations find it very difficult to accept the standardized solutions. The problems with misfit or misalignment are well treated in the IS literature (e.g. [21, 18, 22, 23]).

2.2 Business Process Management (BPM)

According to Gartner, BPM refers to a set of management disciplines that accelerate effective business process improvement by blending incremental and transformative methods. BPMs management practices provide for governance of a business process environment toward the goal of improving agility and operational performance. BPM is a structured approach that employs methods, policies, metrics, management practices and software tools to manage and continuously optimize an organizations activities and processes [24]. Tools and technologies play a distinct role in this understanding of BPM, and the discipline has implications for four aspects of the business: strategy, governance, organization and culture.

It has been found that most organizations will benefit from adopting BPM and that they will realize value in three stages, each of which lays the foundation for additional value in the stage that follows [25]. First Productivity-related value: During the first stage of value creation, you look for quick improvements in your business processes. Second, Visibility-related value: During the second stage of value creation, as a consequence of enhanced business process visibility, you will increase agility. Third, Innovation-related value: During the third stage, agility is further enhanced through emphasis on creativity and innovation. The exploration of the broader business process will lead to greater awareness of new ways of doing business, from launching new products to crafting new service offerings. BPM can lead to innovation of processes, which in turn can lead to superior operational performance. This is sometimes referred to as operational innovation [26] and the benefits of BPM obtained through process innovation are substantial. Operational innovation is about rethinking business processes. It is a powerful tool because operational excellence and process innovation have a ripple effect on all areas of performance. Operational innovation results in direct performance improvement, leading to superior market performance and strategic advantages. Finally, operational innovation is not easy for competitors to replicate so it is a sustainable advantage.

BPM is one way to systematically transform an organization towards operational innovation. It will steadily increase business process agility, which will lead to a change in the organizational culture, and, in the end, will deliver sustainable business benefits. Howard Smith and Peter Fingar see the contemporary BPM concept as a third generation process management concept [27]. The first wave was driven by the early scientific management movement and the second wave

by the business process re-engineering thinking. The third wave BPM enables companies and workers to create and optimize new business processes on the fly. Change is the primary design goal. Through agile business processes, value chains can be monitored and continuously improved [27].

The core of the BPM concept is based on people, technology and business. Another dimension is the process management lifecycle. This is further emphasized through a process leadership dimension dealing with process governance and ownership. To create a solid structure, people, technology, and business must be aligned continuously, and the process management lifecycle needs to be sustained and enhanced.

3 Case Study

The paradigms of BPM and ESM have come to the point where they need to align in order to provide a consistent global organizational infrastructure and at the same time allow for operational innovation. However, the coexistence of ESM and BPM as two separate management approaches has triggered development of mutually exclusive sets of industrial practices: on the one hand systems are perceived as mere infrastructure for processes and on the other hand processes are viewed as a by-product of systems. [27] We gain insights into these practices by analyzing two cases dealing with the redesign of an ES and a process respectively. We identify and illustrate the differences between the cases in order to propose a mediating strategy mitigating the risks and leveraging strengths of both approaches.

3.1 Technology First - Alpha Case

Alpha is a medium sized European Telecommunications Company with about 3.000 employees, which has existed since the start of liberalization of telecommunication in Europe in the beginning of the 1990s. Alpha provides fixed line, mobile, and broadband services for business and residents.

Alpha has since the late 1990s used an industry specific ERP application for billing, rating and other business support services. A small dealer application was integrated with the ERP platform to configure and enter subscriptions for services (configuration #1, figure 1).

However the dealer application was not supporting the business processes sufficiently amongst other due to hard-coded product configuration data for subscriptions, which was difficult to keep up to date. Another problem was the lack of focus on customer relationship management (CRM) within the business processes and the supporting information infrastructure (ERP application, dealer application and other applications).

Management decided therefore to formulate a CRM strategy in 2000, which was influenced by the industry discourse at that point of time about that customers has lost their uniqueness and become an account number, and companies

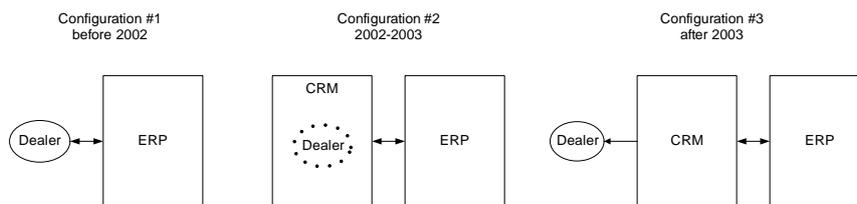


Fig. 1. Different configurations for enterprise systems platforms

should re-establish the uniqueness or customer focus in order to create loyalty [28]. This carefully prepared CRM strategy was clearly a business strategy specifying business goals such as to double customer base. The business strategy was then used to specify the requirements to the IT infrastructure (architecture and processes) [4]. Alpha undertook an IT procurement process in order to find the CRM application with the best fit to the requirements among three possible CRM applications. A specific application was selected in autumn 2001 based on a thorough selection process.

Part of the implementation strategy for the selected CRM application was to close down the dealer application and to transfer the functionality to the standard CRM application. This decision was well aligned with overall enterprise architecture (EA) principles such as to standardize on fewer integrated applications and establish middleware layer to replace point-to-point integration between applications in order to remove IT infrastructure spaghetti. These principles were established at company level by enterprise architects and executed in the CRM project as well as other projects, and illustrates how the architectural linkage were operating in Alpha with the middleware component as a technical linking mechanism [29].

Furthermore the ERP application was heavily customized in order to fulfil specific Alpha requirements and business processes, which became a major problem for the organization as they were more or less locked into the current ERP configuration and even small enhancements were costly. The CIO consequently decided that the implementation strategy for the (new) CRM application should be configuration only, which means technology first and to put the enterprise into the ES [1]. This approach is characterized as technology transformation alignment perspective where business strategy drives the IT strategy, which then drives the IS architecture without taking possible constraints from the organizational infrastructure and processes into account [4]. The strategy also implied focusing on business process optimization as an integrated part of the implementation that is a concerted approach according to Robey et al. (2002) [30] and applying BPM as a lifecycle approach [31] starting with documentation of processes, discussions about how processes and ES can be optimized, measuring processes before and after implementation etc. However, the configuration only strategy had the highest priority despite the focus on business process optimization.

The business and IT strategy decisions in Alpha match the characteristics of the unification operating model [32] where the EA decision with highly integrated applications through middleware enables a high degree of business process integration and the CRM application enables a high degree of business process standardization across the business units such as the dealers.

The implementation of the CRM application went on and one of the first deliverables from the project was the dealer functionality embedded in the CRM application. However the consequences of configuration only strategy was that the business process increased from seven steps to 21 steps (although varying flows depending on subscription type etc.). The new dealer functionality implied automation of several manual tasks, but was anyway a much more complicated process than earlier for the dealers, and very time consuming as well (from about 5 minutes to about 20 minutes for a subscription).

The outcome of the design process was discussed at executive level where business executives for the dealers argued that this system was a step backward and would create major problems for the dealers. However, the CIO forced through a decision to launch the CRM application with the complex dealer functionality in beginning of 2002 (configuration #2, figure 1). The target was that minimum 80% of all subscriptions were made by the dealer functionality and a maximum of 20% were done by paper. This target was never achieved because of the complexity of system with the many steps, limited functionality to support web-based solutions in the standard CRM application and the lack of web competences for the consultants involved in the design of the dealer solution. Lot of retraining, performance optimization and other stabilizing activities were initiated during 2002, but the automation level stayed below 50%, which was very unsatisfactory as the business benefits were not achieved.

After long time pressure from business executive it was finally decided to build a new dealer application, which was designed to be highly integrated with the CRM application that is a bolt-on application with tight coupling [33]. This new dealer application was launched in summer 2003 (configuration #3, figure 1). The automation level for subscriptions increased to above 90% after a stabilization period, which is satisfactory for the Alpha organization. The information infrastructure at Alpha has changed a lot since 2003, but the dealer application is still in operation.

One way to analyze the case is to use the linkage mechanism in the IT engagement model [29]. There was an appropriate architectural linkage ensuring that the CRM system was built in a standardized, integrative way, but this was poorly aligned with the goals (and performance) of the dealer business units, which resulted in the dysfunctional operation of the dealer system, and indicating big problems with the alignment between business and IT (alignment linkage). This supports the argument from Fonstad and Robertson (2006) that business, architecture, and alignment linkages have to be in place in an efficient way in order to implement company-wide initiatives like CRM. However the alignment linkage was established in several ways, with the steering committee for the CRM project as the most prominent with participation of business and IT executives.

Nevertheless the CIO forced the execution of the configuration only strategy due to the power balance in the steering committee, probably warranted by the industry and society discourse about vanilla implementations, which means that having alignment linkage mechanisms does not in itself lead to effective alignment between business and IT.

The lessons learned for Alpha could be summarized as an organization following the receipts from industry experts, consultants and academia about:

- Preparing a careful CRM (business) strategy, which is then aligned with the IT strategy and finally executed through the IS infrastructure [4]
- Establishing a sound enterprise architecture with highly integrated applications through middleware [32]
- Defining linkage mechanism more or less according to the IT Engagement model [29]

These rational receipts were enforced by a powerful CIO (IT monarchy according to [34]) but a compromise deviating from the overall CRM strategy and EA principles was negotiated in order to harvest the business benefits. This has shown to be a successful decision, also in longer term, as the dealer application is still in use!

3.2 Process First - Beta Case

Beta is a large, European-based company with subsidiaries in over 50 countries. The corporate divisions share a centralized service repository which includes a global IT unit as the sole IT service provider in the company. There is no well-established process centre of excellence; however a number of grass-roots initiatives have been launched in the subsidiaries and the company is willing to utilize them as learning cases.

The setting for one of such learning cases is a roughly decade-old acquisition, operating largely under new management but still using an independent instance of the corporate ES. The system was implemented in 2001 using standard methodology recommended by the vendor. The implementation project yielded a comprehensive set of step-by step work instructions for the users. However, during the following years, the company noticed that the complexity of work practices was on a steady, sharp incline while the data was becoming less and less reliable. In order to improve the performance, in mid 2009 the management initiated a project to collect and address the existing issues. The initial analysis revealed that the issues were cross-departmental and therefore a process approach was chosen to address them. Using process mining [35], process audit [36] and interviews with the employees a process was selected representing the best match to the targeted issues.

During the analysis the company found out that the work instructions in the system did not provide an end-to-end process design, as previously assumed. For instance when using the system, the employees were required to query external databases, make phone calls, communicate by email or even conduct manual numerical calculations in order to feed the system with the necessary data. The

vendor claimed that the implementation of the system would equal implementation of standardized best practice processes. However the supplied work procedures and transactions lacked the necessary business-side support. Combined with the missing process management practices, this caused a disparity between the process in the system and the process in the organization. For that reason it was decided that simple system automation was not sufficient and a full-blown process management initiative was started.

The focus was placed on three levels where the systems improvements were decided to be controlled by the process redesign and the process redesign was conducted under the conceptual guidance of BPM. The approach where the strategy defines the organizational infrastructure, which then determines the IS infrastructure is an example of the strategy execution perspective on strategic alignment [4]. The IT unit was expected to deliver the functionalities required by the organizational infrastructure; however, as described below, defining the specifications took place with some consideration of the constraints posed by the system.

The process to be established was a process which was spanning the middle-office and supply chain and was being executed in a complex way. The project Core Team was lead by the project manager, who was also a business applications manager in the division and as such had in-depth knowledge of the current and future state of the systems and other related IT projects.

In early 2010 the project started with analysis of the issues and scoping of the process. Subsequently, all possible information about the current state of the process was collected based on the inputs from process participants. Then the Core Team and projects Steering Committee worked on defining the direction of the redesign effort. After some discussions it was decided that reduction of complexity was the most appropriate goal. The Core Team started to reduce the number of tasks and define business rules required in order for that to happen. At this time, the Business Applications manager acted as an architecture linkage [29] by assessing whether a proposal was possible from the systems perspective or if there was a new functionality that needed to be implemented. Some decisions were shaped by the perceived willingness of the central IT unit to conduct the required implementations and developments, others on the results of recent discussions related to the implementation of new modules in the system. Finally, the assessment took place from the perspective of compliance with the future systems landscape, namely a migration to the corporate instance of the ES which at that time was not yet disclosed to the rest of the organization. The business rules, including IT functionalities required to reduce process complexity, were submitted by the Steering Committee as business cases. When approved, they were divided into individual work packages and assigned to functional representatives under the coordination of the project manager.

From the system perspective, the company used a middle-road approach with minor modifications to the system, e.g. implementation of workflows or developments of several minor add-on features [37]. The modifications to the system and design of processes were carried out in a concerted way [30] because the

system acted as a design constraint throughout the project. The work packages were highly dependent on the delivery of these functionalities from the central IT unit. A significant amount of resistance and delay was observed for those developments. The central IT units claim was that it was not possible to do the developments in a timely manner because it was not involved in the process redesign yielding the IT requirements and that those requirements came as a surprise.

At the implementation stage of the project, the Core Team and the Steering Committee reported a number of challenges related to the approach:

- The scope of the project based on BPM principles turned out to be wider than the organization was accustomed to.
- Many of the challenges reported during the project pointed to insufficiently established linking mechanisms which were informal and largely based on the knowledge and willingness of a single individual.
- The project struggled to find the overall direction for process redesign. Notably absent was a clear business process strategy framework allowing for answering fundamental questions at the outset, such as whether the focus should be on standardization, outsourcing or improving the flexibility of the process.
- Using process participants as designers did not always work as intended. For some it was difficult to critically assess and redesign the work practices they were trained to do for many years. Fears were also reported of job loss related to reducing complexity and manual effort.

Despite these difficulties, the project was perceived positively by the management of the company. The approach turned out to be a viable, reliable and transparent way of managing the organization using BPM [31] through analyzing the business and identifying and implementing solutions. Within six months of the implementation, the company observed the anticipated business benefits, e.g. a decrease in master data-related errors, consistent work methods, improved customer service and reduced manual effort. This encouraged further projects based on the same approach.

4 Discussion

Following the two case studies it is possible to deduce that they started in different places but operated within the same domain of processes and IT systems. Considering the type of activity involved, both organizations were involved in design activity. Following the discussion by [38], design is a concept lying at the intersection of a process, an artifact, and a plan. In other words, designing means creating a specification (or a plan) for an artifact which when applied will provide utility to the recipient. In our study, both Alpha and Beta worked towards a specific objective (customer orientation and complexity reduction) using a process (IT systems and process development) to work out an actionable specification (the CRM module and process documentation). Despite the disparate goals, they ended up changing both processes and IT systems.

This indicates that IT systems and processes are in fact two sides of a common design and that the companies failed to recognize this interdependency by prioritizing one over the other. Below we discuss how this situation contributed to the problems they experienced and call for an approach which mediates IT systems and processes designs. Table 1 includes a summary of key variables used to analyze the cases.

Table 1. A Comparison of the Alpha and Beta Cases

	Technology First - Alpha Case	Process First - Beta Case
Business objective	Becoming more customer-oriented	Reducing complexity in the business
Primary implementation artifact	A new CRM system	A new business process
Scope of business change	<ul style="list-style-type: none"> •Software tailoring, implementation, and subsequent re-implementation •Unintended establishment of a more complex process and subsequent complexity reduction 	<ul style="list-style-type: none"> •Implementation of a new process and process organization •Implementation of a number of tailoring changes to the IT system (e.g. workflow automation)
Strategic alignment perspective and roles [4]	<ul style="list-style-type: none"> •Technology transformation alignment perspective •CRM strategy (business strategy) drives the IT strategy which then drives the IS architecture without taking possible constraints from the organizational infrastructure and processes •Top management defines CRM as a strategic priority •IT management redesigns the system platform based on the requirements of the strategy •IT acts as the driving force behind the implementation of the CRM functionalities 	<ul style="list-style-type: none"> •Strategy execution alignment perspective •Business strategy with a full-blown process management initiative that defines the organizational infrastructure, which then determines the IS infrastructure •Top management formulates business strategy based on BPM principles •The IT management is responsible for implementing changes according to the specifications from the project •IT is viewed as a cost center responsible for delivering the specified functionalities
Discovered problems	<ul style="list-style-type: none"> •Three-fold increase in process complexity and four-fold increase in labor intensity •Power struggle between CIO and line management •Organizational resistance to adopting the new system 	<ul style="list-style-type: none"> •Lack of involvement of central IT in process design, resulting in frustration •Lengthy development of IT functionalities, delaying the implementation of the process

Interestingly, even though the companies set out with different foci, their design activities ended up operating within the domains of both processes and IT

systems. It is safe to assume that Alpha, selecting the new CRM platform, did not intend to jeopardize the operation of the subscription process. As time showed, although the application followed the CRM strategy requirements closely, it was not acceptable from the dealers' perspective. The resulting three-fold increase in the number of steps created organizational resistance which threatened the success of the project itself and the strategy of reorientation towards CRM at large. At the same time Beta, working in disengagement with the IT department, developed a process which in the end required a significant amount of ES rework. The IT organization did not recognize the requirements as belonging to a supported standard and so the completion of the implementation of the process stalled because it depended heavily on technical factors.

Given the seemingly straightforward representation of the two cases using [4] it would be easy to argue that the two approaches constitute two types of planned change processes with different assumption [39] leading to the configuration or managerial decision on the optimal set of elements in the framework. This would be in agreement with the contingency approach applied to ES adaption. However, the contingency theory has been criticized for a simplistic view of the relationship between structure and technology, failing to address the complex setting in which corporate projects are carried out [40].

This was indeed reflected in our cases. Implementing the new software, Alpha redesigned the process, albeit not deliberately. On the other hand Beta, putting a process in place, had to change the design of the IT system. Viewing the system and the process as the anticipated artifact in the Alpha and Beta cases, respectively, shows how systems and processes were a part of a common change endeavor.

Instead of a planned change process, we view the ES adoption process as a wicked design problem [41]. [42] defines the design approach as complementary to intelligence and decisions and therefore adapting design as a management perspective has significant implications. Perhaps the most important one deals with the problem solving paradigm. Addressing a specific, complex situation requires designing a specific solution spanning elements of numerous problem-solving artifacts [41]. With this notion in mind we call for an approach that integrates appropriate aspects of both technology first and process first based on the particular setting.

In this sense, alignment is not a top-down policy but a balanced blend of process and technology factors. Balancing these factors requires a bilateral relation between processes and IT systems, where they influence each others shape. This is possible when both artifacts are viewed as inseparable and act as a single part of the design activity. In other words, systems and processes interact on a continuous basis in order to form a matched, mediated design outcome. Thus we argue that a mediation-based approach should be oriented towards a conjoint design. The discussion should not be on whether to apply the process-first or the technology-first approach, but rather how to apply a "process *and* technology - first" approach.

5 Conclusion

We started this paper by arguing that system and process alignment is a key issue. We have showed how organizations use two different approaches to achieve this based on theory and cases. Consequently, we pointed the weaknesses of these approaches and articulated the need for a mediated approach to balancing process and technology factors in companies.

The design oriented methodology is relevant for many large enterprises as a new paradigm for transforming a traditional implementation oriented IT function into a process-oriented IT organization. The magnitude of this design, however, goes beyond the IS function and includes strategic alignment mechanisms, process governance, BPM organization, process methodologies, HR management, change management and process auditing. Snabe et al. [43] The benefits from using this approach also relate to the sustainability of the results. We have seen that the effect of many centrally decided re-engineering projects have vanished as soon as the management attention disappeared. On the other hand the long term benefits of user participative process improvements have often been very different from planned.

In this paper we have not addressed the mediation methodology itself. In this relatively simple study we have only focused on the need for a new approach and very little on its actual shape. The next step of our research process will consider how the proposed design perspective can explain and support additional evidence and guide further development of the approach. In a longer term our ambition is to formulate validated normative methodologies and a framework that integrates and mediates between ESM and BPM approaches in business organizations.

References

1. Davenport, T.H. (1998). Putting the Enterprise into the Enterprise System. *Harvard Business Review*, 76(4), 121-131.
2. Seddon, P.B., Willcocks, L., and Shanks, G. Introduction: ERP - The Quiet Revolution?, in: *Second-Wave Enterprise Resource Planning Systems: Implementing for Effectiveness*, P.B. Seddon, L. Willcocks and G. Shanks (eds.), Cambridge University Press, Cambridge, 2003, pp. 1-19.
3. Yin, R.K. (2008). *Case study research: Design and methods*. Sage publications, INC.
4. Henderson, J., and Venkatraman, N. (1993). Strategic alignment: Leveraging information technology for transforming organizations. *IBM systems journal*, 32(1), 4-16.
5. Schlichter, B., and Kraemmergaard, P. (2010). A comprehensive literature review of the ERP research field over a decade. *Journal of Enterprise Information Management*, 23(4), 486-520.
6. Kholeif, A.O., Abdel-Kader, M.G., and Sherer, M.J. (2008). *Enterprise Resource Planning: Implementation and Management Accounting Change in a Transitional Country*. Palgrave Macmillan.
7. Oracle Meet the Challenges of Globalization, Oracle E-Business Suite, Brochure, 2008.

8. SAP Industries, available at <http://www.sap.com/industries/index.epx> (accessed 6th December 2009)
9. Bendoly, E., and Jacobs, F.R. Strategic ERP extension and use, available at <http://site.ebrary.com/lib/royallibrary/Doc?id=10110292> (accessed 16. December 2009)
10. O'Leary, D.E. (2000). *Enterprise Resource Planning Systems: Systems, Life Cycle, Electronic Commerce, and Risk*. Cambridge University Press.
11. Jacobs, F.R., and Weston, F.C.T., Jr. (2007). Enterprise Resource Planning (ERP) - A brief History. *Journal of Operations Management*, 25(2), 357-357.
12. Hildebrand, C. The Value of Sticking with Vanilla, available at http://www.oracle.com/profit/smb/122808_ziegele_qa.html (accessed 25th March 2009)
13. Parr, A., and Shanks, G. Critical Success Factors Revisited: A Model for ERP Project Implementation, in: *Second-Wave Enterprise Resource Planning Systems*, P.B. Seddon, L. Willcocks and G. Shanks (eds.), Cambridge University Press, Cambridge, 2003, pp. 196-219.
14. Beatty, R.C., and Williams, C.D. (2006). ERP II: Best Practices for Successfully Implementing an ERP Upgrade. *Communications of the ACM*, 49(3), 105-110.
15. Fitz-Gerald, L., and Carroll, J. (2003). The Role of Governance in ERP System Implementation. In *Proceedings of Australasian Conference on Information Systems*, Perth, Western Australia.
16. Willis, T.H., and Willis-Brown, A.H. (2002). Extending the Value of ERP. *Industrial Management & Data Systems*, 102(1), 35-38.
17. Pries-Heje, L. (2010). Four different paradigms for process design when implementing standard Enterprise Systems. In *Proceedings of CONFENIS 2010*, Natal, Brasil,
18. Soh, C., Kien Sia, S., and Tay-Yap, J. (2000). Cultural fits and misfits: Is ERP a universal solution? *Communications of the ACM*, 43(4), 47-51.
19. Soh, C., and Sia, S.K. (2004). An Institutional Perspective on Sources of ERP Package-Organisation Misalignments. *The Journal of Strategic Information Systems*, 13(4), 375-397.
20. Dillard, J.F., and Yuthas, K. (2006). Enterprise Resource Planning Systems and Communicative Action. *Critical Perspectives on Accounting*, 17(2-3), 202-223.
21. Kien, S.S., and Soh, C. An Exploratory Analysis of the Sources and Nature of Misfits in ERP Implementations in: *Second-Wave Enterprise Resource Planning Systems: Implementing For Effectiveness.*, Cambridge University Press, Cambridge, 2003, pp. 374-387.
22. Sumner, M. (2009). How Alignment Strategies influence ERP Project Success. *Enterprise Information Systems*, 3(4), 425 - 448.
23. Wei, H.-L., Wang, E.T.G., and Ju, P.-H. (2005). Understanding Misalignment and Cascading Change of ERP Implementation: A Stage View of Process Analysis. *European Journal of Information Systems*, 14(4), 324-334.
24. Melenovsky, M.J. *Business Process Management as a Discipline*, Gartner Inc., p. 6.
25. Melenovsky, M.J., and Sinur, J. *BPM Maturity Model Identifies Six Phases for Successful BPM Adoption*, Gartner Research, Stamford, CT, p. 14.
26. Hammer, M. (2004). Deep Change - How Operational Innovation Can Transform Your Company. *Harvard Business Review*, 82(4), 84-94.
27. Smith, H., and Fingar, P. (2003). *Business Process Management (BPM): The Third Wave*. Meghan-Kiffer Press.
28. Chen, I., and Popovich, K. (2003). Understanding customer relationship management (CRM). *Business Process Management Journal*, 9(5), 672688.

29. Fonstad, N.O., and Robertson, D. (2006). Transforming a company, project by project: the IT engagement model. *MIS Quarterly Executive*, 5(1), 1-14.
30. Robey, D., Ross, J., and Boudreau, M. (2002). Learning to implement enterprise systems: an exploratory study of the dialectics of change. *Journal of Management Information Systems*, 19(1), 17-46.
31. de Bruin, T., and Doebeli, G. An organizational approach to BPM: the experience of an Australian transport provider, in: *Handbook on Business Process Management*, J. vom Brocke and M. Rosemann (eds.), Springer, Berlin, 2010, pp. 559-577.
32. Ross, J.W., Weill, P., and Robertson, D. (2008). *Define Your Operating Model, Designing a Foundation for Execution*. Harvard Business School Press.
33. Pollock, N., and Williams, R. (2009). *Software and Organizations: The Biography of the Enterprise-wide System or How SAP Conquered the World*. Routledge.
34. Weill, P., and Ross, J.W. (2004). *IT governance: How top performers manage IT decision rights for superior results*. Harvard Business School Press.
35. Van der Aalst, W.M.P., and Song, M. (2004). Mining Social Networks: Uncovering interaction patterns in business processes. *Business Process Management*, 244-260.
36. Hammer, M. (2007). The process audit. *Harvard Business Review*, 85(4), 111.
37. Parr, A., and Shanks, G. (2000). A Taxonomy of ERP Implementation Approaches. In *Proceedings of 33rd Hawaii International Conference on System Sciences*, 1-10, IEEE, Hawaii.
38. Hevner, A., and S. Chatterjee (eds.) *Design Research in Information Systems - Theory and Practice*. Springer, 2010.
39. Huy, Q. (2001). Time, temporal capability, and planned change. *Academy of Management Review*, 26(4), 601-623.
40. Barley, S. (1990). The alignment of technology and structure through roles and networks. *Administrative Science Quarterly*, 35(1), 61-103.
41. Pries-Heje, J., and Baskerville, R. (2008). The design theory nexus. *MIS Quarterly*, 32(4), 731-755.
42. Boland, R. Design in the punctuation of management action, in: *Managing as designing: Creating a vocabulary for management education and research*, R. Boland and F. Collopy (eds.), Stanford University Press, 2002, pp. 14-15.
43. Snabe, J.H., Rosenberg, A., Miller, C., and Scavillo, M. (2009). *Business Process Management - The SAP Roadmap*. Galileo Press.
44. Møller, C. (2007). Process innovation laboratory: a new approach to business process innovation based on enterprise information systems. *Enterprise Information Systems*, 1(1), 113-128.

Critical Business Process Management Issues in Electronic Government Projects – A Case Study

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Abstract. Contemporary governments are expected to find ways to utilize ICT to facilitate their daily administration and to provide better services to citizens, businesses, and government agencies, in the form of what is referred to as E-Government. In this paper, we argue that everything in government boils down to processes, and that a better understanding of business process management concepts and tools is much needed. The empirical setting of our study is based on a single case, in which we investigate an E-Government implementation project in the city of Oulu. Six critical issues that require special attention were identified: change management, top management support, business process mindset, process rethinking not automating, stakeholders' involvement, and the use of financial assessment.

Keywords: E-Government, Business Process Management, Open Source Software

1. Introduction

Electronic Government or E-Government has been described as “ways to utilize ICT to help governments to facilitate their daily administration and to provide better services to consumers, businesses, and government agencies” [1].

Public service provisioning is a basic government task, and providing them electronically (i.e. over the Internet) has been a major requirement for a contemporary government. In order to establish a robust service imbedded in an E-Government solution, the governmental organization should have a clear understanding of the underlying concepts and technologies involved. *‘Like in business, everything in government boils down to processes’* [2], therefore, offering public services in a process-form is one major way of managing the relationship between the customers and the governmental organization as the service producer. This research draws an explicit connection between E-Government and business process management (BPM) as a method for managing the relationship between government, citizens and companies.

Despite its roots in the work of Adam Smith (1776) and Frederick Taylor (1911), BPM as an identified management approach first arose in the mid 1990s [3]. Advances in IT have made available business process management systems (BPMS), that is, tools that automate and control organizations' business processes life cycle ([3] and [4]). Just like in business, everything in government boils down to processes[2]. In other words, the core of E-Government is the execution of administrative processes[5], therefore, we argue that a better understanding of the mechanisms that govern the implementation of BPMS in E-Government is critical and timely.

The objective of this study is to highlight the importance of BPM in governmental context, as an alternative to the traditional functional department approach. In the empirical setting, we aim at identifying the critical issues arising during the implementation of an E-Government project, and to present a set of recommendations when implementing similar projects. To this end, the paper is organized in the following fashion: in section 2, we present several perspectives that are believed to be essential in the E-Government literature; section 3 portrays the empirical setting; in section 4, we present our findings and analysis; and finally we conclude and summarize the paper in section 5.

2. E-Government

2.1 Definition

There is a great number of definitions for electronic Government, or E-Government, depending slightly on the perspective taken. What is common, however, for all the available definitions (e.g. [6], [1], [5], and [7]) is the central role of ICT, and the Internet in particular, to facilitating and enhancing the access to and delivery of different kinds of government services and operations for the benefit of consumers, businesses, employees, and other stakeholders. Nevertheless, E-Government is not just about making existing forms and services available online; it provides the opportunity to rethink how the government should provide its services to its customers and employees, as well as businesses, in a way that is tailored to the users' needs[8].

ICT used by E-Government can be viewed from a dimensional perspective. Two ways of amalgamating E-Governments are: *horizontally* by integrating multiple Web applications across government agencies; and *vertically* by combining multiple levels within the same agency[9].

E-Government is typically understood to cover four different categories: *Government-to-Consumers (G2C)* is a category that includes all types of interactions between a government and its consumers; *Government-to-Business (G2B)* refers to E-Commerce in which government sells products/services to businesses and vice versa; *Government-to-Government (G2G)* covers the activities that take place between units of governments including those within one governmental body; and finally *Government-to-Employee (G2E)* is a model that is intended to improve the efficiency and effectiveness of the relationship between the government as an employer and its employees (e.g. [6], [10], and [11]).

From a corporate governance viewpoint the principles of stakeholders' management in corporate governance calls for, first of all, the identification and inclusion of all stakeholders in developing the E-Government solution. Of great importance is also weighing the technological development choice against broader social cost, as well as developing governmental strategies to align stakeholders' interests, replacing the failure attempts to integrate every stakeholder's expectations[12].

Heeks and Stanforth [13] adopt a view of the actor-network (ANT) theory in an attempt to explain E-Government projects trajectory, and they argue that any E-Government project trajectory-whether success or failure-is determined by the project's capacity to maintain both a local and a global network, and to impose itself as obligatory point of passage between the two networks.

2.2 E-Government development Level Model

A lot of effort has been devoted in E-Government literature to finding a way of measuring the E-Government development level. These include Deloitte's six-stage model, UN's five-stage model, Moon's five-stage model, Layne & Lee's four-stage model, and Gartner's four-stage model. The Five-Stage Development Level Model[1, 14] can be used as a guideline for evaluating the E-Government development or maturity by examining the presence or absence of online services in each of the five stages of emerging, enhanced, interactive, transactional and seamless presence (see Fig1).

In *Emerging Presence* a single or a few independent government web sites provide formal but limited and static information. With *Enhanced Presence* government web sites provide dynamic, specialized, and regularly updated information, and with *Interactive Presence* the government web sites act as a portal to connect users and service providers, and the interaction takes place at a more sophisticated level. With *Transactional Presence* the users have the capability to conduct complete and secure transactions, such as renewing visas, obtaining passports, and updating birth and death records through a single government web site; and finally, with *Fully Integrated or Seamless Presence*, the governments utilize a single and universal web site to provide a one-stop portal in which users can immediately and conveniently access all kinds of available services[14].

While the three first stages are mostly dealing with automation of existing processes, the last two are more about comprehensive transformation of government services as a whole. The most challenging steps, or leaps, that governments face are the *cultural* leap from interactive to transactional presence, and the *political* leap from transactional to seamless presence. The political leap is expected to require a great deal of financial and human resources, but on the other hand, to also result in greatest benefits of integration. E-Government is largely coupled with the complexities associated with the public sector context [15], and also this complexity is expected to increase with development from one stage to the next. Consequently, as earlier studies have pointed out, a large number of E-Government initiatives - in some estimates 85% of them - have failed [13].

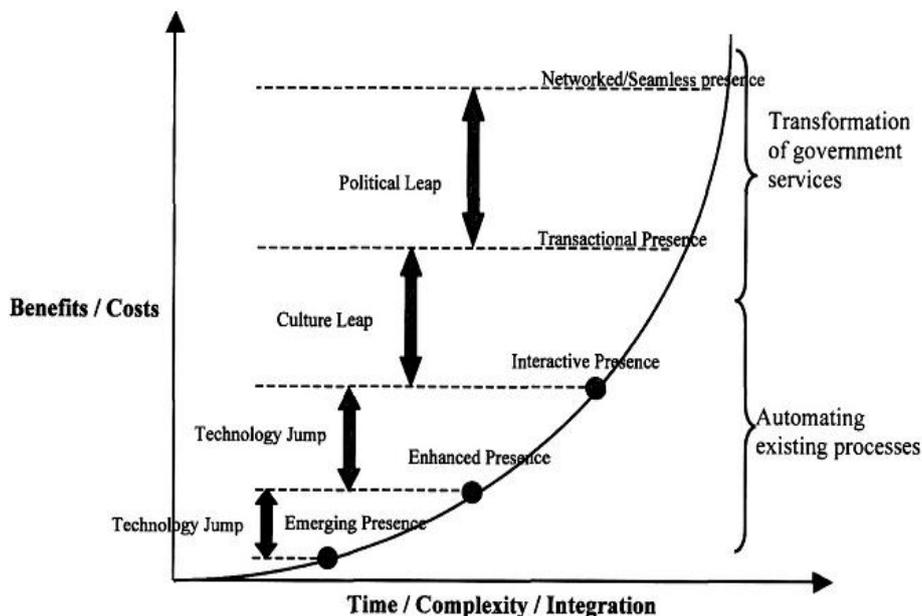


Figure 1 Five-Stage Model of E-Government Implementation[1, 14]

2.3 Business Process Management in E-Government

A process has been defined as 'a coordinated and standardized flow of activities performed by people or machines, which can traverse functional or departmental boundaries to achieve a business objective that creates value for internal or external customers' ([3]; p.3). A business process is viewed as a set of logically related tasks performed to achieve a defined business outcome[16], or 'a set of activities within an enterprise with a structure describing their logical order and dependence whose objective is to produce a desired result'[17].

Business processes may be classified in different categories depending on the perspective. One perspective[18] views them as *functional* vs. *cross-functional*; *customer* vs. *administrative*; and *manufacturing* vs. *service*. Another perspective[19] categorizes them as *core* (central to business operations), *support* (e.g. accounting, IT, etc.), *management* (concerned with organizing and controlling business resources), and *business network processes* (with scope beyond organizational boundaries).

There is a large body of literature (e.g. [2], [5]) investigating E-Government with a particular emphasis on process management. Some[8] studied E-Government projects as an organizational change initiative, and stress that importance of top management and their role in communicating a vision for change. While others [20] suggest that E-Government is, simply, a form of enterprise modernization effort, and that in this area

(E-Government), business process modeling and business process reengineering (BPR) are the dominant topics.

Business Process Management System (BPMS) is an information system that provides a set of tools and services needed to manage the business process of an organization[4]. Generally speaking, IT implementations typically go through four development stages: they start by gathering the business requirements, which is usually the *business analysts*' task. Then the requirements are passed over to the *functional analysts* who would draft functional specifications to determine what functions each system would perform, after which the *technical analysts* configure the systems according to the data collected from the previous stage. Finally, the *programmers* start developing the solution. At each layer, the business requirements have to be communicated, discussed, and potentially changed. Thus, by the time the requirements are implemented in the system, they usually do not satisfy the original requirements [3]. BPMS solves such problems by allowing business process owners, or business analysts, to be directly involved in designing the IT solution. With the help of BPMS, business analysts can design highly detailed business processes using a visual modeling tool, which automatically generates code that sometimes can be deployed without IT development help. And if IT development is needed, IT developers can work on the same processes that were designed by the business people and embed any required logic using a scripting language that is also included in the BPMS packages.

2.4 Open Source Software (OSS) in E-Government

General understanding of Free/Open Source Software (FOSS) and its role in the public sector is poor, and as well as under-researched[21]. By definition, OSS must comply with the following criteria: (1)Free redistribution; (2) Access to source code; (3) Allowing the distribution of derived works; (4) Integrity of the author's source code; (5) No discrimination against persons or groups; (6) No discrimination against fields of endeavor; (7) Distribution of license; (8) License must not be specific to a product; (9) License must not restrict other software; (10) License must be technology-neutral¹. Both European Interoperability Framework (EIF) version 1.0 (2004 release)² and version 2.0 (2010 release)³are built on the principles of *Openness*, *Reusability* and *Interoperability*, and advocate the consideration of OSS when/if possible.

In their investigation on eight UK E-Government instances migrating from proprietary software to OSS, Waring and Maddocks [22] looked at the major reasons for migration. The identified reasons included *cost savings* (short-term savings from licensing and implementation costs, and long-term savings from maintenance and upgrade costs); *reliability*; *scalability*, that is, the ability to test systems at pilot sites, and when proved trouble-free, roll it out to a larger group, was found to be important; *customizability*, meaning the ability to customize software by allowing access the

¹ <http://www.opensource.org/docs/osd>

² <http://ec.europa.eu/idabc/servlets/Docd552.pdf?id=19529>

³ <http://blog.webwereld.nl/wp-content/uploads/2009/11/European-Interoperability-Framework-for-European-Public-Services-draft.pdf>

source code and tailor the applications to their specific need; and finally freedom from *vendor lock-in*, denoting an obligation to commit one and only one software provider were identified as essential reasons to adopt OSS. In another study [23], it was found the major benefits could be easily realized through *interoperability* between all governmental constituents and stakeholders, by avoiding *vendor lock-in*, and through *flexibility*, especially with the increased use of Internet. Aligned with those findings are those of Cassell's [21] study on the four European cities of Vienna, Munich, Schwäbisch Hall, and Treuchtlingen.

On a more general note, policymakers who require that governmental procurement officials give preference to OSS were criticized[24]based on two levels: technological and legal. Technologically, software procurement preferences can impede the benefits of choice, competition, and innovation that flow from technical solutions based on multiple interoperable sources, especially that contemporary IT eco-system permits consumers to combine the best proprietary with the best open source products to forge a tailored ideal solution. Legally the software procurement preferences contravene well-established principles of equal protection and non-discrimination set out in most federal or state law, constitutions, and governing Electronic Commerce laws.

3. Empirical Study

3.1 Research Method

This study is an exploratory single case study, investigating an on-going project in the Finnish Public Sector: the E-Government implementation in the Finnish city of Oulu. A case study is a research strategy comprises an all-encompassing method covering the logic of design, data collection techniques, and specific approaches to data analysis[25]. It is not the intention of this study to judge whether the implementation was a success or a failure, since this research is but a snapshot in the project lifecycle, based on the notion that an E-Government project trajectory is a long and ever-winding journey that should not be judged as successful or failure based on a single point in time[13]. The purpose of this research, however, is to reveal some of the problems related to such implementations in the Finnish Public Sector, and to provide a guideline for future implementations. To this end, data collection methods included a semi-structured case protocol, multiple documents, as well as individual personal interviews with identified key persons in the project, including the project manager of the city of Oulu, and the Chief Project Officer of the IT-partner. Interviews acted as the primary source of data, while other sources like the Internet was a rich source for secondary data. The use of multiple sources of evidence provided depth and richness and enhanced the construct validity of the study[25]. Construct validity was further supported by having key informants review draft case study reports and give their confirmation on its content. To ensure reliability a thorough case study protocol was prepared, and all procedures followed in this study were documented.

3.2 Research setting

The city of Oulu is, in general, a technology-oriented city: it has one of the biggest technology universities in the Nordic countries, the main Nokia mobile phones have been designed in Oulu and a number of high-tech companies operate there. Oulu is the biggest city in Northern Finland, with population of 131,585 in 2008.

In this study, we investigate the implementation of an open source BPM solution that was adopted by the city of Oulu. However, this implementation is but a small fragment of an ongoing E-Government project that is aimed at creating an electronic city portal which provides a communication point between the city and its customers. The principal aim of this project of Oulu is to produce municipal online services in one place, under one login and uniform in use.

3.3 Implementation project

The project started with the City of Oulu realizing that serving its customers the conventional old-fashioned way is a waste of resources and leads to customer dissatisfaction. The project manager stated: *'Transacting one's business with a city or municipality is often considered awkward, frustrating and time-consuming, especially when it comes to completing various forms and applications'*. The city of Oulu, in cooperation with its private sector IT-partner, have decided to adopt a fully fledged BPM-focused E-Government that is completely based on OSS technologies (e.g. Intalio BPM suite, Liferay Portal application, Red Hat GNU/Linux platform, the Jboss application server, the Apache web server, and the MySQL database). The implementation took the following form:

Phase 1: OmaOulu Portal (July 2007 – May 2008). The aim of this phase was the launch of the website “www.OmaOulu.fi” (“MyOulu.fi”). This phase was a basic implementation, and it took ten month to complete. The purpose of that phase was to create a technical platform for the city of Oulu (i.e. E-Government Portal), and to produce municipal online services in a uniform fashion. On top of that platform all other electronic services would be built. At its early launch stage, it provided Oulu citizens with a customizable personal page, email, calendar and social networking capabilities, all based on strong user identification.

Phase 2: Portlet / Content Creation (May 2008 – November 2008). The second phase was to create the content of that city portal, and the biggest content was “electronic forms”. The portlet is a technical platform which enables end users to list and view these stored electronic forms. By August 2008, discussions had been made on the most suitable business solution. By November 2008 the BPM tool was chosen.

Phase 3: Automating Processes (January 2009 – January 2010). Once the technical platform and requirements were in place, forms and processes have been ready to be modelled and automated. By the end of the research investigation, there have been two ready processes that were developed by *IT-partner*. In addition, three

more processes were under development internally (i.e. by the IT department of the city of Oulu).

3.4 Pilot Process

The first process (i.e. pilot process) was ready by March 2009, and it was tested by a selected group of users. This process is meant to automate the processing of “road-advertisement-permission” application, where customers, typically SME’s, request a permission from the city to use a road banner to advertise a product. Usually this sort of processes was handled manually: customers would print the required form from city’s official website, complete the form, and then mail it or hand it to the city officials. After treatment, the City of Oulu would mail the decision to the customer. If a customer wanted to inquire about the status of his or her application, (s)he would do so by telephone.

After launching the new e-service, the scenario would change so that the customer would logon to his or her account and initiate the process by applying for a road-advertisement-permission. (S)He fills out the electronic form, specifies the decision receiving method (i.e. electronically, by mail, etc.), and then submits the form.

The employees of the city of Oulu receive a notification on their ‘Task List’ on their electronic desktops that a new application has been submitted and waiting for processing. They look into the application and perform the required checks and make their decision. Once the decision has been made and the application forwarded to the next step of the process, the instance disappears from the employees’ task list.

In his/her ‘Status Report’ the customer can monitor the current status and location of his/her application. When the final decision is made, a notification is sent to the customer’s own account. Assuming that the permission is to be granted, the customer receives it in a PDF-format file in his/her ‘Document Bank’.

The project team in Oulu drew the first process draft using pen and paper. This draft is based on discussions and interviews with end-users to capture their opinion on what needs to be done (i.e. how the work should flow in the business process). Then this hand-made drawing was transformed into a Microsoft Word template, and more discussions and interviews with end-users were made. Several iterations were made, and suggestions from the user’s side were taken into account before the process was ready to model in the BPM tool. Finally the draft process was used as a guide for modeling the process on the BPM tool and in accordance to the Business Process Modeling Notation (BPMN) standards. Complying with the BPMN standards, the process model was made up of four pools representing all the participants of the permit application process:

- 1) **Customer(e.g. SME, citizen)**, who applies for the permission, and whose role after applying for the permit is to simply access his/her account and check for the municipal response.
- 2) **The Actual Process**, which starts by receiving the permit-application and which connects the participants together.

- 3) **Handler, or the municipal employee(s)**, representing who is/are in charge of looking into the application and deciding whether or not a customer is eligible to getting the permission.
- 4) **Stakeholder**, who may be considered as third party, specifically those are in charge with keeping roads in order (i.e. Road Chief, and Maintenance Guy). The only role they have from our process viewpoint is to receive information about the permit decision, in case a customer is granted a permission to plant an advertisement on the road.

It is worth noting that this implementation was rather simple from the technical perspective, yet it was one of the most difficult one to complete, as it involved a lot political discussions and justifications. The project manager explains that it was such a tough task to bear the responsibility of explaining to the city employees why this change is needed, and that he considers it as a big achievement to explain to them that they are not going to lose their jobs.

4. Analysis and Findings

Six critical issues were identified in during the implementation under study. Next, we will present those issues as observed from the data, relate them to literature, and suggest how each issue could be dealt with.

1.1 Change Management

Case: Change management has been identified as a very influential problem in city of Oulu case, and resistance to change led to several implementation difficulties. It is noted that because employees' resistance was so fierce, the IT implementation had been utilized to mere automation (at least in the current stage). The chief project officer at the IT-partner explains: *"Oulu, at the moment, is still feeling the pain of how IT can affect the other governmental silos inside the city. They are now in the beginning of doing the change, and they are not yet half way"*.

Literature: Change management is one of the most highly reported critical issues in technology implementations [3, 8, 26-29]. By change in this context, we mean technology-driven organizational (or technochange) as suggested in the work of [30].

Solution: The literature provides a plethora of recommendations to deal with resistance to change. Just to mention a few, the use of *IT change facilitators* (i.e. team members who should be neutral to any proposed solution and serve to empower both business and IT people to arrive at a solution); and *IT change advocates* (i.e. charismatic people who know how to affect people to change)[26]. Another suggested solution [31] is to build a comprehensive business case that describes the current situation and the conceived benefits from change provides a meaningful tool to mitigate resistance.

1.2 Top Management Support

Case: It was noted that the project team had hoped his team could have received more commitment from the top management, which would have made their job a lot easier. It is obvious that the message was clear on the strategic level (e.g. Oulu aims at remaining in the technological forefront of the region, and it wants to achieve the highest level of customer satisfaction) however, on the execution level things were not as clear. In several occasions the implementation team was left alone to solve issues that arise without proper support from the top management. The project manager believes that top management support could/should have been better. In his own words, he describes his experience: *‘The problem is that top management gives too much freedom to the users in designing the processes. If users say “we can do this”, only then management would say “ok, we can do it”. If we go to the top management and say we “will do something this way” they would tell us to go and discuss it with the users’*.

Literature/Solution: The lack of top management support is a recipe for failure. Without top management support, progress in any project will be very difficult [8, 15, 29]. Thus it is suggested that a Chief Executive Officer (CEO), President, or any executive manager of the corporation be the project champion. Also it is recommended for project management to have a direct connection with the project champion[3]. That speeds up the project and reduces any resentment that might arise.

1.3 Business Process Management Mindset

Case: Oulu’s main objective is the creation of in-house Web-based services without the need for technical vendor support. Although such objective is believed to be achievable, it was noted that it was not going to be an easy job. Technicalities aside, the employees in the city of Oulu needed more understanding of the concept of BPM, as the functional department was the dominating mindset. Also, we observed that the lack/or low understanding of business process modeling was a major problem in the project. Although, the management have had some processes modelled, they did not actually represent the reality. The chief project officer at the IT-partner explained that BPM was such a young issue in Finland, and that he did not recall any company doing a full blown BPM.

Literature/Solution: BPM needs to be understood as a different approach to management, that is, as a shift from traditional vertical department-based approach towards a horizontal process-based approach[32]. Just like in enterprise system (e.g. ERP), BPMS requires a clear understanding of the organization’s processes, and acquiring a different mindset which views the organization as a system of interlinked processes, the management of which requires concerted efforts to map, improve, and adhere to organizational processes[3]. Regardless of the selected BPM technology, process mapping (i.e. modeling) is a fundamental step, and makes all the difference. Some studies⁴ show that participants with business process modeling knowledge

⁴ <http://education.gsu.edu/ctl/FLC/Borthick-InstrEffect06.htm#summary>

outperformed their peers who did not possess that knowledge, in every single audit task.

1.4 Process Rethinking instead of Automation

Case: Although a BPMS solution is meant to be a key enabler for process improvement, the implementation under study was a mere process automation project. When the project manager was asked about any potential process improvements that were included in the project, he expressed his dismay with the objective being service process automation, and explained that he had wished if top management would have suggested performing some process improvements rather than just digitalization.

Literature: In the large body of literature on BPR - be it in the form of *radical rethinking* [33], *quick hits* [34], or *process improvement* [20] - it is argued that BPR efforts are not/should not be about automation (i.e. moving from manual to electronic while doing the same thing), and BPR in E-Government is no exception. E-Government is not just about putting existing forms and services online; it provides the opportunity to rethink how the government should provide the services to its customers in a way that is tailored to users' needs[8].

Solution: This was indeed a typical process automation instance. However, one could argue that for a pilot project things need not get complicated. This was such a large scale project, and that the first implementation was purposefully made simple acting as a proof of concept. Then, in a later stage step process improvement and engineering activities may be applied when the technology has proven solid and functional.

1.5 Stakeholders' Involvement

Case: In terms of including employees and customers in the development of the E-Government project, we could find almost no involvement from the customer side (e.g. citizens, SME's). Employees, on the other hand, have had too much influence - as was illustrated earlier - which at different occasion made the progress in the project difficult. However, it was noted - during one interview - that employees' understanding of the customers' requirements were sufficient to develop a solution that would meet customers' expectations.

Literature: There has been several calls for attention with regard to this critical issue. Scholars' [12, 13, 27-29, 35] common advice is that employees and customers should be closely involved in the process of developing E-Government services.

Solution: The solution to this problem lies within: governments must abandon the "*build it and they will use it*"[8] approach, and adopt a more sophisticated view of the people it is serving. It is recommended the governments adopt refined view of stakeholders' management in E-Governments[12], which takes into account: the identification and inclusion of all stakeholders in developing the E-Government solution; weighing the technological development choice against broader social cost; and developing governmental strategies to align stakeholders' interests.

Other scholars offer four general recommendations to managers with special focus on employees and customers: *employees and customers* should be closely involved in the process of developing E-Government services; *employees and customers* must be trained to make them effective co-producers of the new services/processes; *managers* should understand that, with the introduction of new e-services, certain customers will require more time and support from the employees; and finally *the time saved* as a result of the introduction of E-Government must be wisely utilized, otherwise, it will be occupied by other administrative tasks in an unplanned and disorganized fashion [35].

1.6 Financial Assessment

Case: No financial assessment efforts could be identified in the Oulu project. The only available financial information concerned the cost for development and training of the BPM software suite.

Literature/Solution: For organizations implementing BPM solutions, the main objective of process monitoring and controlling is to provide the necessary data basis for continuous process change management[3]. This information could be used to evaluate the business processes performance, and to measure the soundness of the of the IT investment. Cost/Benefit Analysis (CBA) is a common method [36]to measure the soundness of the IT investment. It aims at analyzing selected monetary effects such as: reduced processing times, reduced transport times and reduced storage costs (e.g. for paper archives) and comparing it with the investment costs. Another common method in the field of evaluating IT investments is Total Cost of Ownership (TCO), where several alternatives are compared and the optimal alternative is chosen [11]. Some suggest the use of an Activity Based Costing (ABC) model [34], which when combined with customer requirements; together allow planners a better picture.

5. Summary and Conclusions

Providing public services over the internet has been a major requirement for a contemporary government. In our study, we drew a direct link between E-Government and business process management as a method for managing the relationship between government and customers. The aim was to identify the critical issues that face Governments when implementing an E-Government project. From the Oulu case, we identified six critical issues that need to be seriously considered when implementing projects of similar nature. These critical are: change management, top management support, business process mindset, rethinking the work, involving all stakeholders and support the decision with some financial assessment techniques.

As always, also our study has its limitations. While some limitations are associated with case study as a research approach, other limitations are related to this particular instance of study. One major limitation of case study, in general, is its limitation in providing statistical extrapolation across the board. Nevertheless, the actual value of case-based research lies in the ability to provide analytical generalization as compared

with that of survey research, to present statistical generalization[25]. On the other hand, this particular instance of research represents a ‘snapshot’ view of the data and whilst the cases are recent they do not provide an ongoing analysis of the implementation in Oulu.

In our future research, we will aim at providing an insight into the role of public-private-partnership (P-P-P) in the decision making process, and how this type of cooperation could be utilized to benefit all parties involved.

6. References

1. Siau, K. and Y. Long, *Factors Impacting E-Government Development* Journal of Computer Information Systems, 2009(Fall 2009; 50, 1; ABI/INFORM Global; pg. 98).
2. Kavanagh, E., *Citizen Auditors-Web-Enabled*. Open-Source Government; Public Manager, 2006(Spring 2006; 35, 1; ABI/INFORM Global; pg. 20).
3. Chang, J.F., *Business Process Management Systems - Strategy and Implementation*. 2006: Auerbach Publication - Taylor & Francis Group.
4. Arora, S. (2005): *Why BPM Cannot Be Ignored*.
5. Becker, J., L. Algermissen, and B. Niehaves, *Procedure Model for Process Oriented E-Government Projects*. Business Process Management Journal, 2006(12, 1; ABI/INFORM Global; pg. 61).
6. Evans, D. and D.C. Yin, *E-Government: An Analysis For Implementation: Framework For Understanding Cultural And Social Impact*. Government Information Quarterly, 2005. **22**: p. 354–373.
7. Srivastava, S.C. and T.S. Teo, *E-Government Payoffs: Evidence from Cross-Country Data*. Journal of Global Information Management, 2007. **15**(4).
8. Burn, J. and G. Robin, *Moving Towards e-Government: A Case Study of Organisational Change Processes*. Logistics Information Management, 2003. **16**(1): p. 25.
9. Choudrie, J. and V. Weerrakody, *Horizontal Process Integration in E-Government: the Perspective of a UK Local Authority*. International Journal of Electronic Government Research, 2007. **3**(3).
10. Wong, K.F., M.K. Tam, and C.H. Cheng, *E-Government - A Web Services Framework*. Journal of Information Privacy & Security, 2006. **2**(2): p. 30.
11. Turban, E., et al., *Electronic Commerce –A Managerial Perspective*. 2008: Pearson Prentice Hall, International Edition.
12. Tan, C.W., S.L. Pan, and E.T.K. Lim, *Managing Stakeholder Interests in E-Government Implementation: Lessons Learned from a Singapore E-Government Project*. International Journal of Electronic Government Research, 2007. **3**(1).
13. Heeks, R. and C. Stanforth, *Understanding e-Government Project Trajectories From An Actor-Network Perspective*. European Journal of Information Systems, 2007. **16**, 165–177.

14. Siau, K. and Y. Long, *Synthesizing e-Government Stage Models – A Meta-Synthesis Based on Meta-Ethnography*. Journal of Industrial Management & Data Systems, 2005. **105**(4): p. 443-458.
15. Grant, G. and D. Chau, *Developing a Generic Framework for E-Government*. Journal of Global Information Management, 2005. **13**(1).
16. Davenport, T.H. and J.E. Short, *The New Industrial Engineering: Information Technology and Business Process Redesign*. Sloan Management Review, 1990. **31**(4): p. 11--27.
17. Aguilara, S. and S. Ruth, *Business process modeling: Review and framework*. International Journal of Production Economics, 2004. **90**: p. 129-149.
18. Batson, R.G. and T.K. Williams. *Process Simulation in Quality and BPR teams, Quality Congress*. in *ASQ's Annual Quality Congress Proceedings*. 1998.
19. Al-Mashari, M. and M. Zairi, *Revisiting BPR_ a holistic review of practice and development*. Business Process Management Journal, 2000. **6**(1): p. 10.
20. Sundberg, H.P. and K.W. Sandberg, *Towards e-Government: A Survey of Problems in Organisational Processes*. Business Process Management Journal, 2006. **12**(2).
21. Cassell, M., *Why Governments Innovate: Adoption and Implementation Of Open Source Software by Four European Cities*. International Public Management Journal, 2008. **11**(2).
22. Waring, T. and P. Maddocks, *Open Source Software Implementation in the UK Public Sector: Evidence from the Field and Implications for the Future*. International Journal of Information Management 2005. **25**: p. 411–428.
23. Simon, K.D., *The Value of Open Standards and Open Source Software in Government Environments*. IBM Systems Journal; 2005, 2005. **44**(2).
24. Sieverding, M.L., *Choice in Government Software Procurement: A Winning Strategy*. Journal of Public Procurement, 2008. **8**(1).
25. Yin, R.K., *Case Study Research Design and Methods*. 3rd ed. Vol. 5. 2003: Sage Publications.
26. Markus, M.L. and R.I. Benjamin, *The Magic Bullet Theory in IT-Enabled Transformation*. Sloan Management Review, 1997. **38**(2): p. 14.
27. Irani, Z., T. Elliman, and P. Jackson, *Electronic transformation of government in the U.K.: a research agenda*. European Journal of Information Systems, 2007. **16**: p. 327–335.
28. Elliman, T. and Z. Irani, *Establishing a Framework for e-Government esearch: Project VIEGO*. Transforming Government: People, Process and Policy, 2007. **1**(4).
29. Rose, W.R. and G.G. Grant, *Critical Issues Pertaining to the Planning and Implementation of E-Government Initiatives*. Government Information Quarterly, 2010. **27**.
30. Markus, M.L., *Technochange Management: Using IT to Drive Organizational Change*. Journal of Information Technology, 2004. **19**(4).
31. Bierhals, G., *A Case Study on The Swedish National Police: How to Avoid Locking Yourself in While Saving Money*. 2009, OSOR.eu.

32. Andersen, B., *Business Process Improvement Toolbox*. 1999: American Society for Quality.
33. Hammer, M. and C. J., *Reengineering the Corporation*. 1993: Harper Collins, NY.
34. Shin, N. and D.F. Jemella, *Business process reengineering and performance improvement: The case of Chase Manhattan Bank*. Business Process Management Journal, 2002. **8**(4).
35. Akesson, M. and B. Edvardsson, *Effects of e-Government on Service Design as Perceived By Employees*. Managing Service Quality, 2008. **18**(5).
36. zur Muehlen, M., *Workflow-based Process Controlling-Or: What You Can Measure You Can Control*. Workflow Handbook 2001. Future Strategies, Lighthouse Point, FL, 2001: p. 61-77.

TOWARDS A VALUE PERSPECTIVE
IN BUSINESS PROCESS MANAGEMENT
—
ON THE DESIGN OF PROCESS-ORIENTED
ACCOUNTING INFORMATION SYSTEMS

Extended abstract of approved dissertation proposal
for the doctoral consortium at IRIS 2011

Dissertation stage: Proposal defended (August 2010)

1 RESEARCH MOTIVATION

Many researchers have described expectations and objectives associated with the adoption of business process management (BPM) within organizations (e.g. Davenport, 1993; Hammer and Champy, 1993; Harmon, 2007). Among other things, BPM is considered an important approach to the management of organizations since to a large extent organizational performance is built into its business processes (Balasubramanian and Gupta, 2005, p. 680). Once an organization has committed itself to adopt BPM decision makers need accurate process performance data and metrics to make the right decisions about their processes (Harmon, 2011). Managers need to understand how, where, and when a business process creates value in order to decide which processes should be redesigned, supported or eliminated. In particular, managers need to know “what is the contribution of business processes” (cf. Yen, 2009, p. 866) in order to properly coordinate their BPM activities.

Despite the need for considering economic criteria, however, process management decisions are usually based on qualitative or technical criteria or plausibility considerations (Buhl et al., 2011; vom Brocke, et al, 2010). Neglecting economic criteria may result in (1) wrong process design decisions, (2) improving business processes with regard to insignificant performance goals rather than improving significant performance aspects, (3) focusing on irrelevant business processes, and thus (4) making wrong investment decisions with regard to business processes (Keen, 1997). Being essential, however, a value perspective in business process management that explicitly takes economic criteria into account has so far not been established and is only slowly emerging (e.g. cf. vom Brocke et al., 2010, Braunwart et al., 2010, Buhl et al., 2011).

In general, there are two types of information systems which appear to be well suited for supporting decision making in BPM: process aware information systems (PAIS) and accounting information systems (AIS). *Process-aware information systems* have been proposed as a vital means to facilitate the adoption of BPM within organizations and many studies exist that report on PAIS implementations (Dumas et al., 2005) with enterprise resource planning systems and workflow management systems being the most widely implemented types of PAIS. PAIS support the design, implementation, and execution of processes based on process models (cf. Dumas et al., 2005). *Accounting information systems* on the other hand are among the first types of computerized information systems which have been adopted to provide the information managers need for decision making. Since their advent in the 1960s, most AIS implement the conventional double-entry bookkeeping accounting model usually referred to as “traditional accounting” in order to provide financial reports for internal and external parties (cf. McCarthy, 1982).

Despite their relevance for supporting management activities, AIS do not seamlessly integrate within the overall data and information processing facilities of an organization (e.g. cf. Grabski and Marsh, 1994; McCarthy, 1982). In particular, contemporary AIS hardly or only partially provide information that is useful for decision making in the context of business process management. Although some process-oriented extensions to the conventional accounting model have been proposed (e.g. see (Cooper and Kaplan, 1991), AIS are still not process-aware (Geerts and McCarthy, 1999). Only recently this has been re-confirmed by a leading BPM practitioner’s forum stating that current approaches to accounting do not provide information that is useful to support decisions about business processes (see Harmon, 2011). PAIS, on the other, provide data related to process structures and process states. While this data could be used to verify if processes are executed in compliance with their process models it cannot be disclosed, how processes create value, where and when that value is created and why a process has to be redesigned in order to ensure value creation. What is needed therefore is a link between PAIS and AIS. Such a link has not yet been developed but it would allow for providing *process-oriented evaluation structures* thus supporting a foundation for establishing a *value perspective in BPM*.

2 RESEARCH PROBLEM, OBJECTIVES, AND APPROACH

This Ph.D. work aims at developing a value perspective in BPM. To this end, prospective research focuses on the problem of providing information on processes which can be used to assess the value contribution of an organization's business process. Since it is assumed that this information has to be provided by accounting information systems the research focuses on the design of artefacts that together enable a process-oriented accounting. The central research question guiding these efforts can then be stated as follows:

RQ1: How should process-oriented accounting information systems be designed to assess the value contribution of business processes?

To address this research question a design research (DSR) approach (Hevner et al., 2004) is adopted in this Ph.D. work (see comments on research design below). Adopting a DSR approach appears to be reasonable since it is conceived as being “fundamentally a business problem solving paradigm” (Hevner et al., p. 76), “offering prescriptions and creating artefacts that embody those prescriptions” (March and Smith, 1995). As opposed to behavioural IS research, aiming at ‘truth’, DSR aims at ‘utility’ for practice, i.e. at the construction of “better” IS-related problem solutions (cf. Winter, 2008, p. 470). Thus DSR should result in useful artefacts representing generic solutions to relevant business problems. It is planned that the communication of the research results of this Ph.D. is split between multiple research papers (paper-based Ph.D.). Thus, the central research question is decomposed into several research objectives with each objective being addressed by individual publications. Although each of the publications might refer to different theoretical backgrounds, the whole Ph.D. work is grounded in the “events” approach to accounting (Sorter, 1969, see also below).

As a first research objective (*ROI*) the Ph.D. work aims at *analysing the intersection of accounting and BPM, therefore synthesizing constructs of accounting and BPM*. Although both disciplines refer to similar terms there is no common understanding of core concepts like activities, (economic) events, transactions, tasks, activities, process, or value chain.

Synthesizing key concepts from accounting and BPM enables the linking of accounting and process-aware information systems. By linking these two types of information systems (IS) it is expected to arrive at a new kind of IS, i.e. a process-oriented accounting information system. Besides incorporating the characteristics of AIS and PAIS, process-oriented accounting information systems exhibit a new characteristic: they are able to provide dedicated process-oriented evaluation structures necessary to inquire about process value contributions. Thus, as a second research objective (*RQ2*) the Ph.D. aims at *specifying information models that can inform the design of process-oriented accounting information systems*. This kind of IS should essentially be able to support any BPM activities within an organization.

According to Burlton (2010) the main objective of BPM is “to ensure that the various developed capabilities of an organization are aligned with one another and together they *deliver a traceable process* performance back to the stated strategic goals and objectives of the ‘Organization-in-Focus’” (cf. Burlton, 2010, p. 6, emphasis added). To ensure that process-oriented accounting information systems enable traceability of process performance, the evaluation structure provided by this IS should allow for consistently linking strategic objectives and value statements with business process artefacts (e.g. process models and instances). Therefore, a further research objective of the Ph.D. work (*RO3*) is to *provide methods that allow for aligning processes with an organization's strategy, i.e. for designing, justifying, and measuring business process designs with regard to high level value statements (strategic statements)*. E.g. such methods could enable the assessment of the impact of process designs on strategy. They could also ensure that value models (business models) are consistently mapped business processes.

Aligning processes with an organization's strategy and accounting for the value contribution of processes should not only be limited to ex post analysis, i.e. analysis at process run-time. A business process' run-time performance – and thus organizational performance – is largely affected by the design of the business processes (cf. vom Brocke et al., 2010). More specifically, a process could not

perform on a sustained basis better than its design would allow (Hammer, 2010). It holds that the potential of affecting a business process' value contribution is significantly higher at design-time than at run-time (cf. vom Brocke et al., 2010, p. 334). What is therefore paramount for process-oriented organizations is to evaluate business processes already at design-time. As a fourth research objective (RO4) it is aimed at *extending process modelling languages with constructs to systematically discover and specify the loci of process value generation.*

3 THEORETICAL BACKGROUND – THE “EVENTS” APPROACH TO ACCOUNTING THEORY

According to Sorter (1969) two fundamentally different approaches to accounting exist: the “value” approach and the “events” approach. The “value” approach is characterized as the traditional one used by accountants (Benbasat and Dexter, 1979) and assumes that “user’s needs are known and sufficiently well specified so that accounting theory can deductively arrive at and produce optimal input values for used and useful decision models” (Sorter, 1969, p. 12). Taking a “value” perspective the purpose of accounting is thus to produce optimum income and capital value or values by associating costs and revenues to produce the right income figure or figures optimal for user’s decision models (Sorter, 1969, p. 12 f.). Accounting data generated in the “value” approach is reported in a structured, aggregated way, e.g. by means of aggregates stated in income statements or balance sheets.

Sorter (1969, p. 13) criticized the “value” approach arguing that it is impossible to anticipate all possible uses of accounting data and thus to specify optimal accounting figures and aggregates for “unknown or perhaps unknowable decision models” (ibid, p. 13). Moreover, the accounting reports produced might be subject to biases and thus become “propagandistic inferences or constructual assertions” through the use of manipulative rather than informative accounting techniques (Johnson, 1970, p. 649).

The “events” approach to accounting theory, on the other hand, suggests that the purpose of accounting is to provide “information about *relevant economic events* that allow individual users to generate their own input values for their own *individual decision models*” (Sorter, p. 13, emphasis added). Moreover, the “events” approach suggests that “less rather than more aggregation is appropriate” (Sorter, 1969) and that the user, and not the accountant, should determine the nature and extent of the desired level of aggregation. Information concerning economic events and economic entities should be kept in as elementary, i.e. disaggregated, form as possible (cf. McCarthy, 1982).

It has been shown that the “events” approach to accounting performs equally well in terms of decision effectiveness when compared to the “value” approach (cf. Benbasat and Dexter, 1979). Moreover, the approach allows for the design of multidimensional accounting information systems (cf. Haseman and Whinston, 1976). It is also asserted that the “events” approach is preferable in decision environments where uncertainty about controllable factors increase and decision processes are not well understood (Benbasat and Dexter, 1979).

Criticism about the “events” approach centres on the effort required for the decision making process. According to Benbasat and Dexter (1979, p. 747) the “events” approach requires more decision making time due to the disaggregated nature of event accounting reports. While the aggregation of event data and their grouping into useful reports could be supported by advanced querying techniques and contemporary user interfaces another more fundamental point is made by Sorter (1969). He notes that the “events” approach requires just as much *ex ante* knowledge about user’s needs as the “value” approach does (ibid, p. 14). An accountant has to decide what events are relevant and should be recorded. It is the claim of the Ph.D. work that integrating accounting and business process management may be beneficial for identifying relevant economic events and thus reduce the effort required to design and make use of event accounting information systems. Events occurring in the course of economic activities are often explicitly documented within business processes models. While business process models are created to support the design of organizational structures they could also be reused in the context of accounting to support the identification of relevant economic events.

4 PRELIMINARY RESULTS

To date, RO1, RO2, RO3, RO4 have been addresses within two conference publications and one journal publication (see Table 1). The ECIS 2011 publication contributed a first proposal of an information model for linking accounting and process-aware information systems (RO2). The proposal builds on a synthesis of accounting and BPM concepts (RO1). Consistent with the “events” approach to accounting (see above) the information model is centered on the concept of an “Economic Event” (see Figure 2). Economic events are both linked to accounting artifacts (chart of accounts, transactions, accounting documents) as well as BPM artifacts (e.g. functions, process, value chains). While the general applicability of this information model has been demonstrated future work has to focus on its evaluation. Furthermore, posting patterns are required to guide the application of the process-oriented accounting infrastructure. Future research should also investigate how BPM specific evaluation methods, like process mining, could benefit from the process-oriented accounting infrastructure, since PAIS already provide means to analyze process structures from recorded business events.

Conference	Publication title	Research objectives
European Conference on Information Systems (ECIS 2011)	Linking Accounting and Process-aware Information Systems – Towards a Generalized Information Model For Process-oriented Accounting	RO1 RO2
International Conference on Advanced Information Systems Engineering (CAiSE 2011)	The REA – DSL: A Domain Specific Modeling Language for Business Models	RO3
Business & Systems Engineering (BISE)	Value-oriented Information Systems Design: The Concept of Potentials Modeling and its Application to Service-oriented Architectures	RO4

Table 1. Publications and addressed research objectives

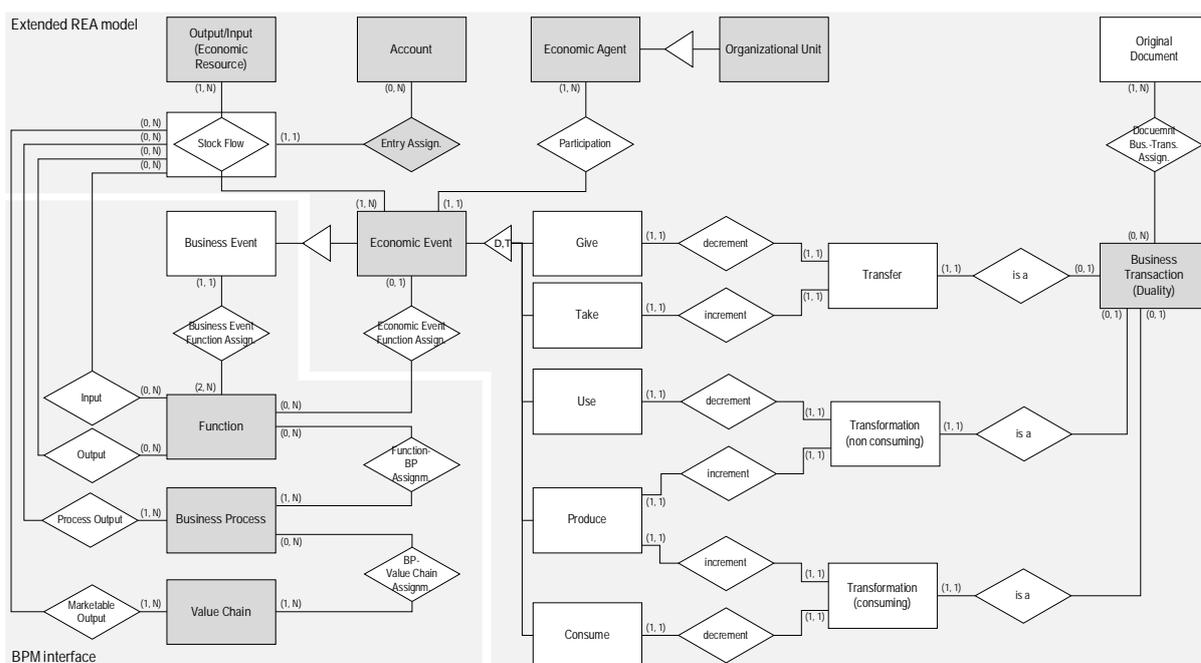


Figure 2. Process-oriented accounting infrastructure (vom Brocke et al. 2011)

The CAiSE 2011 publication contributed a proposal of a domain specific modeling language to support the conceptual modeling of economic events based on the REA ontology (McCarthy, 1982). Conceptual models based on the REA-DSL aim at facilitating the requirements elicitation process during the specification of value models (business models). In particular, a graphical notation has been proposed to model value chains and exchanges of economic value. The REA-DSL allows for linking value models with process models based on the concept of economic events. This linking contributes to research objective 3 (RO3). Besides proposing a meta-model and a graphical notation, also a REA-DSL tool as a proof of concept has been developed. This work concentrated on the basic REA principles and the value chain perspective. Future work will gradually extend the REA-DSL.

The BISE publication (vom Brocke et al., 2009) introduced the concept of potentials modelling aiming at accounting for value contributions of business processes already at process design time. To this end, the event-driven process chain (EPC) has been extended by notation elements to capture economic consequences of process design decisions within process models (RO4). While the approach is generally applicable, it could be transferred to other modelling languages as well. Moreover, this approach is not yet linked to the process-oriented accounting infrastructure shown in Figure 2.

5 RESEARCH CONTRIBUTION

It is expected that the Ph.D. contributes to business process management in that it aims at establishing a value perspective in BPM. It does so by proposing design patterns of process-oriented accounting information systems that provide process managers with the information they need to make decisions about processes. The Ph.D. work also reflects on how process managers could make use of this kind of IS in order to support process design decisions or to support ex post analysis. Either way, process managers are provided with a means to account for the value contribution of business processes.

The Ph.D. also contributes to accounting. It does so by revitalizing the “events” approach to accounting. This approach has been said to be superior compared to traditional accounting since it explicitly supports a multidimensional approach to accounting (cf. Sorter, 1969). However, by the time this approach has been proposed, there was no need for a process-oriented accounting and computerized information systems have been limited with regard to capturing and querying economic event data in a user friendly way. Today, however, process-aware information systems easily support the capturing of event data that could be readily used for accounting purposes. However, since BPM concepts are interpreted differently in the accounting domain (e.g. events and activities/actions are treated equally) little progress has been made towards providing process-oriented evaluation structures. It is expected that the artefacts developed in the Ph.D. work may finally render the “events” approach to accounting economically and practically feasible.

References

- Balasubramanian, S., and Gupta, M. (2005). Structural metrics for goal based business process design and evaluation. *Business Process Management Journal* , 11 (6), pp. 680-694.
- Benbasat, I., and Dexter, A. S. (1979). Value and Events Approaches to Accounting: An Experimental Evaluation. *The Accounting Review* (October 1979), pp. 735-749.
- Braunwarth, K. S., Kaiser, M., Stöckl, S., and Braunwarth, K. S. (2011). Value Orientation in Process Management Research Gap and Contribution to Economically Well-Founded Decisions in Process Management. *Business & Information Systems Engineering*, 3 (3).
- Buhl, H. U., Röglinger, M., and Müller, A.-L. (2010). Economic Evaluation and Optimization of the Degree of Automation in Insurance Processes. *Business & Information Systems Engineering*, 2 (1), pp. 29-39.
- Burlton, R. (2010). Delivering Business Strategy Through Process Management. In J. vom Brocke, & M. Rosemann (Eds.), *Handbook on Business Process Management 2 - Strategic Alignment, Governance, People and Culture* (pp. 5-36). Springer.
- Cooper, R. and Kaplan, R. S. (1991). Profit priorities from activity-based costing. *Harvard Business Review* May–June, 130–135.

- Davenport, T. H. (1993). *Process Innovation. Reengineering Work through Information Technology*. Harvard Business School Press, Boston, MA.
- Dumas, M., van der Aalst, W.M.P. and ter Hofstede, A.H.M (2005). *Process-Aware Information Systems: Bridging People and Software through Process Technology*. Wiley & Sons, Hoboken, NJ.
- Geerts, G.L. and McCarthy, W.E. (1999). An Accounting Object Infrastructure for Knowledge-Based Enterprise Models. *IEEE Intelligent Systems*, 14 (4), 89–94.
- Grabski, S. and Marsh, R. (1994). Integrating accounting and manufacturing information systems: an ABC and REA-based approach. *Journal of Information Systems*, 8 (2), 61– 80.
- Haseman, W. D., and Whinston, A. B. (1976). Design of a Multidimensional Accounting System. *The Accounting Review* (January 1976), pp. 65-79.
- Hammer, M. and Champy, J. (1993). *Reengineering the Corporation: A Manifesto for Business Revolution*. HarperBusiness, New York, NY.
- Hammer, M. (2010). What Is Business Process Management? In J. vom Brocke, & M. Rosemann (Eds.), *Handbook on Business Process Management 1. Introduction, Methods and Information Systems*. Springer.
- Harmon, P. (2007). *Business Process Change. A Guide for Business Managers and BPM and Six Sigma Professionals*. 2nd Edition. Morgan Kaufmann, Burlington, MA.
- Harmon, P. (2011). Activity-Based Costing. In: *BPTrends – Advisors*. http://www.bptrends.com/deliver_file.cfm?fileType=publication&fileName=advisor20110329%2Epdf Accessed on: April 10th 2011.
- Hevner, A. R., March, S. T., Park, J., and Ram, S. (2004). Design Science in Information Systems. *MIS Quarterly* , 28 (1), pp. 75-105.
- Johnson, O. (1970). Toward an “Events” Theory of Accounting. *The Accounting Review* (October 1970), p. 641-653.
- March, T. S., and Smith, G. (1995). Design and Natural Science Research on Information Technology. *Decision Support Systems* , 15 (4), pp. 251-266.
- McCarthy, W.E. (1982). The REA Accounting Model: A Generalized Framework for Accounting Systems in a Shared Data Environment. *The Accounting Review* 57 (3), 554-578.
- Sonnenberg, C., Huemer, C., Hofreiter, B., Mayrhofer, C., and Braccini, A. (2011). The REA – DSL: A Domain Specific Modeling Language for Business Models. In *Proceedings of the 23rd International Conference on Advanced Information Systems Engineering*, London, United Kingdom, pp. 252-266.
- Sorter, G. H. (1969). An “Events” Approach to Basic Accounting Theory. *The Accounting Review* (January 1969), pp. 12-19.
- vom Brocke, J., Sonnenberg, C., and Simons, A. (2009). Value-oriented Information Systems Design: The Concept of Potentials Modeling and its Application to Service-oriented Architectures. In *Business & Information Systems Engineering*, 3(1), p. 223-233.
- vom Brocke, J., Recker, J., and Mendling, J. (2010). Value-oriented Process Modeling: Integrating Financial Perspectives into Business Process Re-design. *Business Process Management Journal* (BPMJ), 16(2), 333-356.
- vom Brocke, J., Sonnenberg, C., and Baumuel, U. (2011). Linking Accounting and Process-aware Information Systems – Towards a Generalized Information Model For Process-oriented Accounting. Paper presented at the Paper presented at the 19th European Conference on Information Systems (ECIS 2011), Helsinki, Finland.
- Weber, R. (1986). Data models research in accounting: an evaluation of wholesale distribution software. *The Accounting Review* (July 1986), pp. 498-519.
- Winter, R. (2008). Design science research in Europe. *European Journal of Information Systems*, 17(5), pp. 470-475.
- Yen, V. C. (2009). An integrated model for business process measurement. *Business Process Management Journal* , 15 (6), pp. 865-875.

Talking Heads on the Internet: Social Interaction in a Multi-User Voice-Based 3D Graphical Environment

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Abstract

This paper reports on the finding from a qualitative study which investigated how long-term users of *Traveler*, a voice-based 3D online graphical environment launched in 1996 and still running, experience their social relations in relation to this specific cue-rich communication technology. The paper describes the subjective perceptions of the technology-mediated social experience such as the experience of social atmosphere in the community, of online friendship, of the meaning of the online social interaction in the users' offline lives. The paper also discusses the importance of these subjective experiences for motivation to regularly use *Traveler*. Conclusions drawn from the study suggest that it is crucial for users to have the ability to handle the technical functions of the program in order to function socially in the environment such as using the functions of the graphical program and using the voice channel in a social significant way. As a result, in order to have a positive and meaningful social experience in online it is critical for users to adapt to technical as well as to social factors. This process of adaptation is very important since the way functions are used was interpreted as social signals by users suggesting that social and technical aspects are intertwined in social practice. The paper describes this process of adaptation and the positive social effects of a successful adaptation.

1. Introduction

Some users do really trigger curiosity! One particular group of users impressed me greatly over the years I spent time online looking into various shared virtual environments. The users of the particular multi-user voice-based 3D graphical environment called *Traveler*, established in 1996, spent a lot of time in it even though the consistency of the program fluctuated, the graphics were not great, the pictorial representation crude, the amount of users tiny and they used voice communication as the main channel. Since the small amount of previous research that I found when studying voice communication in graphical environments emphasized that committed users rejected voice in favour of text-based communication (Wadley and Gibbs 2005), though pointing towards an increase in acceptance of voice communication in 3D games such as *World of Warcraft* (William, Caplan and Xiong 2007) these users were still rare, and I was puzzled. Why was that? What drew them there? What continued to draw them in? Why did they spend so much time in there? Why were they so faithful to the program and each other? Why didn't they use other programs that looked better and functioned more stably? Why?

In relation to the general pattern of development which moves towards multiple-channel applications with an increased focus on interaction (Wiberg 2005, Dourish 2004), matching the growing demand for distributed social interaction (Hinds and Kiesler 2002, Wellman and Haythorntwite 2002), this group of users becomes highly interesting to study more in depth. Even if technology trends are toward multiple channels and interaction, the vast bulk of users

in shared virtual environments still prefer text-based communication. However, a small group of users acted differently and they have preferred to interact with multiple channels for a long time.

Guided by curiosity I wanted to really plunge into their experience, taking their point of view to get the feel for what at first glance was a strange and incomprehensible commitment to this shared virtual environment. I believe that it is not only the thousands and thousands users of the same program that can increase our understanding of social interaction in shared virtual environments. I believe that we can also learn from groups of users that act off the beaten track.

This exploratory study will describe how long-term users of an online voice-based graphical environment *use* the technology and how they *experience* social interaction. The aim is to understand the role that this particular environment has for social interaction in this system, and to learn about drivers behind long-term and committed use of this small-scale program. But before listening to some of the Travelers and then trying to make sense of their experience, let me start by describing Traveler as a shared virtual environment.

1.1. Traveler: the studied 3D graphical environment

Traveler (<http://www.digitalspace.com/traveler/startpage.html>)

is a voice-based free-of-charge multi-user 3D graphical environment delivered on the Internet and built to be a social venue (see DiPaola and Collins (2002) for design intentions). It first started in 1996, and is still running.

In this particular virtual environment users are represented as graphical depictions of various types of figures such as a Pharaoh, an apple, a worm, a woman with stylish hair-do, a man with glasses etc. These graphical representations of users are called avatars. In Traveler the avatars are faces. The faces have eyes, nose and mouth. The eyes blink and there is lip sync corresponding to the users' sounds, so one can see who is talking in Traveler. The avatars can be moved around in the graphical space by key-pressing commands on the keyboard. The avatars can be moved backward or forward and rotate horizontally or vertically around their own axes.

The delivery of the voice was built to support the use of voice in conversation similar to face-to-face conversation. Comments that were made could be overlapping and anyone present could make their voice heard in the virtual environment. The technology was built so that an adjacent avatar would be heard louder than an avatar at a distance in the same virtual room. In the environment it was the position of the avatars that was linked to this sound proximity, just as in the physical world.

In Traveler, there are various places to go to. Each place has its own link and can also be reached through portals within the virtual environment. Each place is designed differently in regard to form and content. Some places are rather vast and may be forest-like areas with trees, rivers and caves. Others are small bar-like places with stools, benches, a jukebox and the like.

2. Method

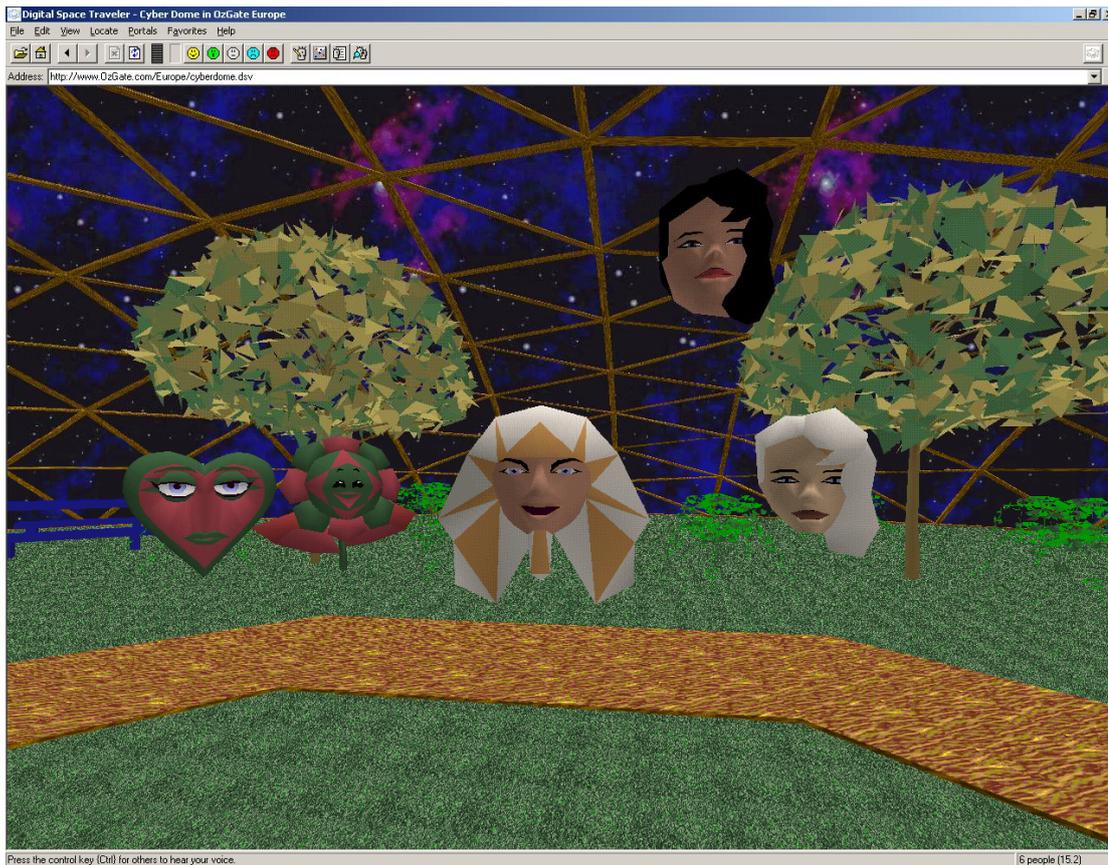
2.1 Focus group interview

To get a better understanding of users' experience and technology use, a focus group interview was held with users who had spent two years or more in Traveler on a regular basis with a strong commitment to the community. Strong commitment was defined as having an explicit role in Traveler as a so-called tech, spending a lot of time interacting with others in Traveler. To learn about the experience of social interaction in Traveler as a 3D graphical voice-based virtual environment, it is crucial to talk to people with long experience and high degree of involvement. The focus group method builds on the theory of group dynamics happening in human interaction in familiar constellations, and how humans in such circumstances more readily talk about their experiences and provide deeper insights by interacting with each other than a person-to-person interview probably would have led to (Stewart and Shamdasani 1990).

The focus group interview took place in Traveler. There were five committed regular users present and they sat in front of their computers in their individual homes, logged into Traveler. Their visual presences were indicated by their avatars. All had their speakers and microphones on, to be able to hear and talk to each other. The total time of the focus group interview was 2 hours and 10 minutes. The recorded interview was fully transcribed. After several re-readings of the transcriptions, a common procedure in qualitative media analysis (Altheide 1996), two overarching themes emerged. They were labelled 'reason to get in' and 'reason to stay put'. Each theme was built up by quotes from the participants in the focus group interview. Some quotes will be presented in the result section, exemplifying users' experience and technology use.

2.2. Participant presentation

The selection process regarding participants in the focus group interview was the following. The guardian of the server, Oz, posted a message in the OzGate website that there was a scheduled group interview for research purposes, and regular users were welcome to participate voluntarily. Two regulars showed up in the beginning of the scheduled interview and three more joined during the interview, so eventually five regulars participated in the focus group interview.



The presentation of participants is in the order of their appearance in the focus group interview that took place on 2005-12-06.

KBOzTech (the full flower in the picture): A man living in California in his forties who has been using Traveler since 2001. He was introduced to the program by another long-term user in Traveler that he had met in a music file-sharing program. His online friend needed to persuade him for more than three months before he finally decided to download the Traveler program and started to use it. The first time his friend showed him around and introduced him to the program and to other users. He normally uses Traveler on weekends since he works swing-shifts during the weeks, but now and then he uses Traveler in the mornings as well. These are his own words describing how he became a regular committed user:

KBOzTech: [the reason why he finally entered Traveler] It was the persistence of [xxx]. Each time I would see him on one of my chat programs, like ICQ or something, he'd always remind me to try it out, and so finally I decided: okay, I give it a try. He showed me around when I first came in so it was not very intimidating to me when you got some people that really like the program and know quite a bit about the program and they are there to help you out. And I really appreciate it. And on top of that I liked it so much that I myself have learned everything that is to learn about Traveler and how to use it and all that. I spend some of my time helping other people that came in and I think Oz and those, and [xxx] knew that I really liked the program because I was really helping quite a few people out. And Oz finally decided and asked me if I wanted to be a tech, and I said sure! Actually the way it works here at Oz gate, they ask you if you want to be at Oz gate first, the guy that does basic things to help people, and if you done that for a while you work your way up to the tech status.

LadyBlueOzTech (the heart in the picture): She has been using Traveler since 2003. She is a tech on the program and says she is one of the newer techs in Traveler. She works during the day and normally she is in Traveler every night after 6 PM Central time until about nine o'clock, and all weekends. It has been her regular routine for the past two years. However, she does not stay on the program the entire day. She does other things such as housework but leaves her avatar in the program and keeps the program running while she is occupied doing other things in her home.

LadyBlueOzTech: I was actually in a chat room on Yahoo and somebody came in and said that 'if you're tired of all the baloney in Yahoo try this website', and they posted it in the room and I downloaded it and came in and actually the first person that I met was KickBack [KBOzTech], and I've been here ever since.

Kiddo (the dark-haired female head in the picture): She has been using Traveler for six years, and she is a tech. She has grown children and grandchildren and teaches the piano.

KiddoOzTech: I was also actually in another chat program. I was in what is called Inplayer, it's another voice chat, it's not a 3D virtual reality thing as Traveler, it's just a voice chat, and someone there told me about the program, and I liked the idea and I came over and it was just like I found my virtual home. I came in here, and I actually went back into Inplayer to stay in touch with some of these people, but I came in over here and I kind of moved in and I been here ever since.

LadyJ (the light-haired female in the picture): She has been using Traveler for seven years. However, she has known about the program since the beginning since it is her husband, Oz, that runs the server. Before using Traveler she was not using any other chat programs. She went straight to Traveler, and has been there ever since.

LadyJ: Oz was using Traveler and talked to his friends. I stood in the back and after three years I got my own computer. Now we are sitting in the same room with a computer each and we meet in Traveler.

Oz (the Pharaoh in the picture): Oz has been using Traveler since it first started 10 years ago. He runs the community OzGate [insert link]. He has established the only community rule, 'No abuse', and cannot imagine living without Traveler, where he has many of his best friends that he has known for years but never met in person.

Oz: Yeah sure [using other programs but Traveller] Yahoo or whatever, we have them, but, and that's ok if I would like to send you an URL or something like that or if I need to send you a quickie like: hey don't forget to pick up some cookies on the way home or something like that, whatever, but why would I like to hold an entire conversation in Yahoo or in ICQ or something when we can just come here? And talking as such, even if I was great at typing say 90 or 100 word a minute I can talk slowly and careful with 150 so clearly this is a superior form of communication.

3. Result and analysis

In this section I present what I suggest as key themes regarding reasons why users spent so much time and devotion to Traveler and each other. These themes are related to both social aspects as well as technical aspects.

3.1. Reasons for getting in

Each of the committed users had a personal story about how s/he became a Traveler. These stories will be presented below in relation to reasons found (i) outside the technical setting, (ii) inside the technical setting but outside of Traveler and (iii) inside Traveler.

3.1.1. Reasons found outside the technical setting

Lady J became interested in being a Traveler by experiencing her husband interacting with his friends in Traveler for some years. While he was interacting in Traveler, she stood beside, still experiencing it. When LadyJ got a computer of her own both she and Oz could be active participants inside Traveler at the same time if they wished, sitting next to each other in the same room in their house. LadyJ said that she went straight to Traveler, indicating that she did not have much prior experience in computer-mediated communication for the purpose of chat. Her reason to become a Traveler was found outside Internet, namely in her own house experiencing the online social interaction of her husband.

3.1.2. Reasons found inside the technical setting but outside Traveler

The rest of the regulars participating in the focus group interview had previous experience of online interaction from various places.

Kiddo and LadyBlueOzTech shared the experience of using chat rooms as well as the dissatisfaction in the virtual environment they were visiting before finding Traveler. Kiddo had experience from a voice chat, but as she said:

Kiddo: Well, the problem with [name of the voice chat] was that whoever opened a room there was a moderator for that room, and there were a lot of people coming in to cause trouble and we don't have that in Traveler. Well, we do occasionally, but it was not as regulated – and just a lot of troublemakers, although there was some nice people. I met some great people, people that I still stay in touch with. Well, I came over here and I met the people at OzGate. It was just such a friendly environment, and everybody was so helpful and it was just such a peaceful environment.

The reason to start using Traveler for Kiddo and LadyBlueOzTech can be found in dissatisfaction with previous chat experiences online. They both thought that chatting online in the social milieu they were participating in was not as rewarding as they wanted it to be. They both express the wish for a friendlier place.

3.1.3. Reasons found inside Traveler

One participant in the study was at first reluctant to get into Traveler. KBOzTech said that it was his online friend, whom he had met in a music file-sharing program, that persistently tried to persuade him to go to Traveler. Since KBOzTech disliked chat rooms, he was not easy to persuade. It took him more than three months to start to use Traveler. But after being introduced by his friend in the program he stayed. The main reason from the beginning was connected with his love for music:

KBOzTech: When he told me he said you can also play music in here and you can listen to it and I said oh, really – [xxx] and I both liked music and had the same taste of music and when he mentioned the fact that you can go into a room and you could play music to everybody and listening to it, I think that was the final draw. After I heard that I finally got the courage to come in.

This exemplifies the importance of shared interest, i.e. music in combination with technical possibility. KBOzTech had spent time in the music file-sharing program. Not liking chat programs, he was actually content with using that program. However, since his friend liked to be a Traveler and believed that KBOzTech would like it too, as music could be shared in Traveler, a driver towards use in this case was linked to what types of activities can be performed in the virtual environment.

3.2 Reason to stay put

After looking at reasons to get in we need to look for further reasons in order to understand the long-lasting appreciation of the Traveler community that these regular committed users clearly express. Once inside, the users shared the experience of difficulty in explaining what Traveler is like for people who do not use it. Everybody had a story about how they tried to tell people at work what it is like, as well as friends and family members. They all found that it was hard to explain why Traveler is such a good place. Kiddo summarized how they all have tried but somewhat failed to tell others about Traveler and the meaning that Traveler as a community provides for them:

Kiddo: I was just going to say that it has been my experience that you can't explain this environment for somebody without them seeing it. I've told people about it and you cannot get the full effect, you cannot get the full idea of what you are talking about until you actually visit the place. You know I shown my children but of course my children are grown. I've shown friends and introduced them to the program and they all like wow that's cool but you can't really explain to them. You can tell them that it is a 3D environment but most people don't know what a 3D environment is until they actually see it. You know and the avatar thing then they kind of lose their minds cause here you're looking at another representation of a person. The mouth moves when they speak, the eyes blink involuntarily they have somewhat you know lifelike movements so I think it is really hard to explain what this place is like without showing them.

Still, they all had told their friends about Traveler, indicating that it is a significant experience to be a Traveler, and they do want to share that experience with their social surroundings outside Traveler and within their individual social contexts in everyday life. As one of the regulars said:

LadyBlueOzTech: I have a friend who comes over sometimes and she takes the computer downstairs and we log into Traveler and meet there. It's pretty cool.

3.2.1 Visual recognition

The users are represented by avatars. As already mentioned, user interaction in Traveler was via avatars speaking to each other. The special look of the avatar in this graphical environment was head-only. In Traveler there are a number of different avatars to choose from. The program also enables users to change colors and change the default facial expression from normal to happy, angry or surprised, for example. The functions of the program were designed to make users actively choose the way they look and also invent a name for their chosen avatar. The group photo in the section *Participant presentation* shows us how these regulars present themselves. In spite of the possibilities to change their user presentation, they use the same avatars:

LadyB: Well, we may have, we may put different names behind them, like I have a Christmas name but I'm still a heart. I do have a couple of different avatars, but nobody knows me as those avatars, so it is not comfortable for them to look at it, say a clown, and it's been me behind it, so I pretty much stick with the heart and everybody in here pretty much sticks with their basic avatar also. Oz is always a Pharaoh, LadyJ is always, I think that is Brady avatar, and KickBack is always a flower.

Kiddo: And as a matter of fact when you have another avatar just to play around or, you know, for a special occasion or so, and even though I can't see myself different in here, I don't feel right when I don't have this avatar, and I find when other people change their avatar it's hard for me to look at, it would be hard for me to look at LadyB over there and the apple avatar because that's just not her. She has been a heart ever since she got here and I would feel like I was talking to somebody else even though I was talking to her. It is just, it is funny because you get used to see what everybody looks like – even though there is a limited number of avatars, everybody paints them differently so, you know, there might be a half a dozen people in Traveler that use a heart but they're painting them differently so you know who you are talking to.

LadyJ: Yes, that is how we distinguish people.

LadyB: It's kind of like dressing up to go to a Halloween party – you dress in different clothes, you look different, but when you go home, you put on your sweats and you are comfortable and normal, and that's what it's like if we change avatars for any reasons, it is always nice to go back to our comfortable sweats.

We can see how they prefer consistency in relation to the visual presentation of their presence in Traveler, and that this preference has a social facilitation factor in it. If they look the same, users know the user behind the look of the avatar. When they enter a room in Traveler they can take a glance in the room to see who is there without explicitly asking. This indicates that it is in the interaction process that coherence becomes important, and that a user tends to adapt

to the situation since identification is facilitated by this coherence. People learn about who is using what avatar, and learn to recognize users by voice as well as by the look of the avatar.

3.2.2. Voice appreciation

The users in Traveller really like the voice-based communication for two main reasons: because they sense that they come closer to each other, and because it is fast.

LadyB: When you're in voice you hear the emphasis on people's words, you share their emotions, you don't hear that in text. I mean they can put the exclamation point and smiley faces and everything, but you don't actually hear the emotion that makes it so personable.

Researcher: So would you say that voice-based communication brings people more close to one another?

Everybody: Yes absolutely, certainly [at the same time].

Oz: We do not translate our words into type and then read them again and then send them in that slow, arcane process of communication where we can just press a button and speak.

In comparison with text-based communication, these users prefer voice communication. They think that the text restriction in the program is a good thing, fostering the use of voice-based communication. They experience voice as a means to connect more closely with one another than they would have done in text. They emphasize the nuances in the voice that can be directly heard during a conversation. It is not only that users need to be trained to use the voice channel in relation to merely transmitting voice. They also need to learn that the voice channel *should* be used rather than text messaging. In addition, as shown in the example above where everybody answers at the same time – meaning in practice that they all pressed the control key at the same time and answered my questions – the technology supports group conversation where people can have overlapping comments.

Clearly they have developed skills to use the technology for both moving around and using the voice channel, but what do they talk about? Kiddo says:

Kiddo: I would say that the main two topics are food and software and computers... in that order.

[Laughter from all.]

3.2.3. Functional and fun functions

Still, just voice communication is not enough for these users. They also appreciate the visual feature of the 3D graphical program and its other functions. The long-time users of Traveler express that there are typical way of using functions in the program that they highlight as important, common and sometimes fun. For example, forming a group for a group discussion

is one typical feature of user patterns in Traveler. When they form a group they place their avatars in a circle in the virtual environment. Since it is a voice-based environment where the voice is connected to the avatar and there is sound proximity in relation to the avatar, the circle facilitates the view of the present users as well as supporting good sound from all.

One example that showed how the use of the technology in various situations was connected with the relationship that could be found among users was an activity called ‘bonking’. The technology has collision detection, i.e. it is programmed so that avatars cannot go through each other. When they collide there is a resistance, and they can push each other’s avatar around in the virtual space. This has developed in two directions. To ‘bonk’ into another user is considered abusive behaviour, and if the regulars see this happen among users, they intervene. However, that does not happen every time. ‘Bonking’ has also become a playful activity among regulars. They do what they call ‘portal jamming’:

LB: You know, you were talking about feeling like you’re really here, like you’re really in the presence. When you are looking at somebody’s eyes you can go up to them and tell them a secret, [whispering] guess what, and they say what? It’s just like real life. To me, and we do it all the time, we go and kiss somebody on the cheek or KB goes up to Oz and says something teasing and they chase each other around in the room.

Kiddo: And we do portal jamming too and ban people down on the floor and all kinds of things and funny stuff. That is a kind of friendly and fun gesture that we do to people we know, we don’t do that to newbies or that kind of things, we do that to people we know or just playing with them.

LadyJ: When we know they won’t mind.

Kiddo: Right. I have left my computer and when I came back I was in a totally different space MANY times, or left my avatar in a room where there is water and come back found out that I’m drowning because I’ve been shut down into the water.

So there is a complexity in using the function collision detection. If users do not know each other or if they are newbies, ‘bonking’ is considered inappropriate. But if people know each other, then the same way of using collision detection is a playful act. Oz and LB clarify this difference in the following way:

Oz: Again, it makes all the difference in the world if you know somebody. With people here in this room, and I know them for years and years, so, yeah, it would be inappropriate if newbies started to bonking each other and stuff like that, that’s abuse, but let’s say, among friends like us, we get together and let’s say Kiddo go to the bathroom, and just for fun I would bonk her avatar in a portal, she wakes up in another room, it’s pretty funny actually.

LB: You know it just like, you would not throw a snowball on a complete stranger and you don’t want them to throw one at you, but it’s okay to throw one at your best friend.

This example indicates that the use of the technology has a social complex dimension. Not only do you need to learn that there is collision detection and that to collide is often regarded

as inappropriate, something to avoid. You also need to learn that there is an exception to that rule, which is connected with the type of human relations involved. Thus, users need to learn about both the technical function and the appropriate situations for using it, and the various responses that will come in these different situations. Learning to use the technology in an appropriate manner in an appropriate situation with the appropriate people is crucial, and cannot instantly be taught to users.

Learning all these issues in Traveler in order to become a devoted member of the community takes a while, but not long according to the users:

KB: Well, actually it is not hard to learn at all. It's like learning to ride a bicycle, some people learn quicker than others. When I first started, it took me a little while because there was so many things to know at first – being just overwhelmed by how the program looked, how the avatar looked and all that, just kind of blew me away, you know.

LB: I would say as a person came in here a couple of hours for two, at the most three days, they'd be moving around just like we are today.

Another important cue to learn, which is supported by the use of the technology, is turning one's avatar upside down when a user leaves the keyboard and is not available for interaction in Traveler, but still intends to come back.

Kiddo: Right, and another piece of netiquette that we do is if we are away from our keyboard, we flip our avatars upside down. So anybody who are upside down, they are not there.

All these practices take time to learn, and are also essential in order to become a member of the community. Again we learn about the crucial role of looking at the *usage* of the technology in social situations, so as to understand patterns of human-to-human interaction in such circumstances. We can see the use of functions as social interaction patterns that users learn. The two aspects i.e. the use of function and social interaction, become intertwined, sometimes so tightly that even for analytical purposes they are hard to separate. As Kiddo expresses it:

Kiddo: It's like walking and chewing gum, scratching your head at the same time – you don't think about 'okay, I need to put one foot in front of the other. I need to take my right hand and scratch my nose and chewing my gum.' You just do all these things at the same time. That's kind of the same as it is in Traveler. Once you hit the buttons down and where they are and what they do is just kind of automatic. It's just kind of a second nature.

3.3 Social atmosphere

Even though none of these individuals have met face to face (apart from Oz and LadyJ being married and living together) they have strong relationships to one another and they greatly appreciate the community spirit in Traveler. The all say that they experience Traveler as a very warm, friendly and family-like place, exemplified with comments such as:

LB: People here are so close. We exchange Christmas presents. We send birthday presents. I mean it's just a family, that's just what it is.

Kiddo: I've never met any of these people but they are my friends. They may be avatars, they might look like a heart and KB a full flower, but I know that there are actual people behind these avatars and some of them I speak with on the phone, and you know we talk about real life experiences. It's not just the virtual stuff we talk about. You know it's real friendship, it's real family environment.

Oz: You know, this made it possible to make friends for years and years and years and I can't imagine my life without it now. I can't imagine my life without these people now.

It is so significant for them to stay in touch via Traveler that they combine everyday activities with the use of Traveler. One example of such combination is having dinner together:

Kiddo: And a lot of us bring our dinners to our desks and have dinner with a friend in here.

Another example is just to sense the presence of friends by running Traveler and doing other things at home:

Oz: If you have friends coming over they can just grab some chips, sit down and watch TV. I don't need to entertain them. They are just hanging around and then they leave after two hours. It was just good to see them. We didn't need to talk so much. It's the same in Traveler. I just have it on, if I want to talk I do. If not, I just feel their presence.

LadyBlueOzTech: Well, I work during the day so I'm normally here every night after 6 pm central time until about nine o'clock, and I'm here all week-end.

Researcher: So is that typical now or has that been your regular routine for these last two years?

LB: It's pretty much a regular routine. I don't stay on the program the entire day. But I may leave my avatar in here, go do some housework and stuff but pretty much, yeah, it's pretty much my routine.

Again we can see that the use of Traveler is interwoven in their everyday life. These five committed users tell a story which highlights that the use of Traveler should be seen as an intertwined activity in everyday life rather than an 'escape' from the offline world. They do not use Traveler as a 'virtual play land' in the Sherry Turkle (1995) terminology, where they become different for an hour or two. They do not express that they separate to a large extent Traveler time from everyday life time – rather, they express how their virtual practice and experiences fit well together with their life in general.

4. Discussion and conclusion

Investigating how long-term users of an online voice-based 3D graphical environment *used* the technology and how they *experienced* social interaction in Traveler, the five committed long-term users in Traveler clearly put forward their message: using Traveler is important in their everyday life. Looking more closely at their use of Traveler, they all use it extensively during the weeks, and have done so over the years. They are all skilful in the way they handle all the functions in the program, such as colouring the avatar and moving their avatar around in the virtual environment. They share an understanding of conventional use of the technology, such as placing their avatars in a circle while engaged in a group discussion, turning their avatar upside down when they are away from keyboard (see also Becker and Mark (2002) for similar observation), and always use the same avatar coloured in the same way except when 'dressing up' for parties that occasionally take place in Traveler. They all enjoy the voice-based communication channel and feel that the voice channel brings them closer to one another.

The long-term users express a proud sensation of being a Traveler and they experience a warm and family-like connection to each other that they cherish deeply. Spending time together with their friends in Traveler is highly regarded and rewarding. These warm and meaningful experiences are seen as a driving force to enter into Traveler again and again. In spite of the fact that their social surroundings outside Traveler seem not to comprehend the meaningfulness of interacting in Traveler, they continue to tell about their usage to other people in their everyday life to share their experience even outside Traveler. Now and then they even try to convince others to join them to share friendship, knowledge, and everyday life experiences in Traveler. Traveler is seen as being their 'third good place' with its warm and family-like atmosphere experienced like a 'home away from home' (Oldenburg 1999:38-41). In contrast to 'third good places' such as coffee shops, bars and bookstores studied by Oldenburg (1999) where people leave their homes to get to their third place, users in Traveler reach their 'home away from home' *in* their homes using their domestic computer with Internet access to log into Traveler spending hours together with their Traveler friends.

Looking more closely at the way use and experience are linked, this study argues that there is a close coupling between the use of the technical functions and the social experience for these regulars. Previously presented examples such as 'bonking' indicate that the active use of the functions, and how the use becomes appropriated in different situations among close friends, have a strong bonding feature. The use of voice is yet another bonding feature, highly significant for these users since they all prefer to interact via voice rather than typing messages. This observation highlights that the graphical features and the voice function are unique in comparison with text-based environments. Here there are functions connected to graphics and voice that become essential to learn about in order to interact socially. In text-based environments, users deal with various ways of using only text for social interaction. Still, users need to learn appropriate ways to use the *text* to take part in and appreciate the online social interaction (Cherny 1999, Baym 2000, Pargman 2000).

Yet another observation that supports the inference of close coupling between the use of the technical functions and the social experience is that these long-term users spend a lot of time introducing new users to the program, with a specific focus on how to use the functions. They argue that if users learn about the program, they will have more freedom to act on their own merit in the community and decide to eventually become members of the community. The focus on learning through participation shares similarities with what Lave and Wenger (1991) framed as a 'community of practice'. Lave and Wenger (1991) suggests that participants gradually acquire accepted ways of acting within the community, hence becoming more and

more involved. In Traveler such behaviour is closely coupled with how to use the functions. In addition, all the long-term users agreed that using the program becomes second nature. They do not reflect on how they use it any longer. They just act with a social goal in mind, without paying attention to which key does what.

The studied long-term users view the technology as a provider of possibilities rather than a media with limitations. However, they acknowledge that learning to use the technology with respect to the voice function, how to choose and adjust the avatar as well as moving it around, requires some time. Just as in cue-lean media, as in the case of text-based interaction (Walther 2002), users in this cue-rich medium need to adapt to how to use the technology. Important to note is that *the way* that technology is used becomes a social cue in itself. It is clearly not enough to learn only how to use the functions as such. Users must also learn the appropriate way to use them as well as the appropriate time to blend into the community. The process of adaptation that happens over time is therefore oriented towards the *integration* of used functions into social processes. This observation is also seen as a restriction regarding accessibility to social interaction in this virtual environment. To be able to blend in, users need to accept this way of interacting and act in line with it. Hence, even if Traveler is technically available to everybody with computers with speakers, microphones, and Internet access, it is socially constrained, regardless of how positively the users experience their virtual social milieu.

References

- Altheide, D. (1996) *Qualitative Media Analysis*. Thousand Oaks: Sage Publications
- Baym, N. (2000) *Tune In, Log On. Soaps, Fandom, and Online Community*. London, Sage Publications.
- Becker, B., Mark, G. (2002) *Social Conventions in Computer-Mediated Communication: A Comparison of Three Online Shared Virtual Environments*. In Schroeder, R., *The Social Life of Avatars. Presence and Interaction in Shared Virtual Environments*. Springer.
- Cherny, L. (1999) *Conversation and Community: Chat in a Virtual World*. CSLI Publications. Centre of Study of Language and Information, Stanford, California.
- DiPaola, S., Collins, D. (2002) *A 3D Virtual Environment for Social Telepresence*. Western Computer Graphics Symposium, Vernon, Canada
<http://dipaola.org/steve/talks/skigraph02.pdf>
- Dourish, P. (2004) *Where the Action Is. The Foundations of Embodied Interaction*. MIT Press, Cambridge, Massachusetts.
- Hinds, P., Kiesler, S. (2002) *Distributed Work*. MIT Press, Cambridge, Massachusetts.
- Lave, J., Wenger, E. (1991) *Situated learning: Legitimate peripheral participation*. Cambridge University Press, Cambridge.
- Oldenburg, R. (1999) *The Great Good Place. Cafés, Coffee Shops, Bookstores, Bars, Hair Salons and Other Hangouts at the Heart of a Community*. Marlowe and Company, New York.

Pargman, D. (2000) Code Begets Community. On Social and Technical Aspects of Managing a Virtual Community. Department of Communication Studies. Linköping University. Sweden.

Stewart, D., Shamdasani, P.N. (1990) Focus Group Interviews: Theory and Practice. Sage Publications.

Turkle, S. (1995) Life on The Screen. Identity in the Age of the Internet. Simon and Schuster. New York.

Wadley, G., Gibbs, M.R. (2005) Factors influencing users' decisions to adopt voice communication in online console games. International Journal of Advanced Media and Communication, Vol. 1, No. 1, pp. 41-58.

Walther, J.B. (2002) Time Effects in Computer-Mediated Groups: Past, Present, and Future. In Ed Hinds and Kiesler, Distributed Work, MIT Press, Cambridge, Massachusetts

Wellman, B., Haythorntwite, C. (2002) The Internet in Everyday Life. Blackwell Publishing, Oxford.

Williams, D., Caplan, S., Xiong, L. (2007) Can You Hear Me Now? The Impact of Voice in an Online Gaming Community. Human Communication Research, Vol. 33. (4) pp 427- 449.

Wiberg, M.(2005) The Interaction Society: Practice, Theories and Supportive Technologies. Information Science Publishing, London.

An Empirical Investigation of Users and Intermediaries Perception on IS Success: Website Quality, User Satisfaction and Net Benefits

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Abstract. This paper summarizes an ongoing PhD study that investigates information systems (IS) success, based on empirical data conducted in the public sector. With the goal of shedding light on constructs of IS success, this research focuses on the perception of users and intermediaries' perception, and aims to answer the preliminary research question: *How do constructs of IS success perform and interact, among various stakeholder groups, in relation to the extent of user involvement in website development?* The DeLone and McLean IS success model (2003) is used as a framework for investigation. Theories derives from IS, human-computer interaction (HCI) and eGovernment literature. In order to gain insight, my empirical components includes qualitative interviews with webmasters and public sector managers, the results from a nationwide online survey among public sector employees in Norway and Denmark, and in-depth results from ranking of governmental websites in Scandinavia. The initial findings show that there is great potential in including the users in website quality improvements in order to facilitate success. This paper ends with issues the author needs to discuss before writing up the final PhD thesis.

Keywords: IS Success, Website Success, DeLone and McLean IS Success Model, eGovernment, User Satisfaction, User Benefits, Organizational Impacts, User Involvement

1 Introduction

This paper is a draft for the final contribution of my thesis, summing up the work I have previously done. My PhD thesis includes four academic papers published (or forthcoming/in progress) in various conferences/journals, during the last years. The motivation of this research has grown through discussions, with practitioners and academics, regarding measurement, impacts and benefits of information systems (IS), emphasizing websites. Measurement of IS success is critical in order to understand the value and efficacy of management actions, and investments in system development and actions for quality improvements. Most organizations are, in addition, hard pressed to assess the impacts of investments in IS and perceived benefits gained [1]. In the literature, a gap to be closed has been identified between investments in IS and perceived outcomes [2], which could be assessed from various

perspectives and levels among different stakeholder groups [1]. Moreover, we need to focus on users' needs and requirements in order to create good user experiences [3] and stimulate use and user satisfaction among some central users. The most critical reason for project failures is the perceptual gap between real users and the system designers [4]. Prior research also concluded that quality is taken for granted in IS development, and more attention should be paid [5]. Therefore, we need to re-think how to minimize this gap, thus possibly influencing and facilitating success, from both a user and an organizational point of view. One point of departure, which is the focus in this study, is to investigate performance and constructs for assessment of IS success, perceived from different stakeholder groups. On one side, we find the service providers (supply side) that aims to provide high-quality websites facilitating user satisfaction, while the other side is represented by actual users (demand side) searching for information and services in order to accomplish a specific task or goal. Although it is hard to define success factors in many organizations, and it could be claimed that it is somehow more straightforward to measure the success factor for private companies (sales, strategic position, lock-in effect, etc.) compared to the government sector (democratic issues, management, costs etc.), there is no excuse for not trying. It is also the fact that, compared to a private actor in the market, the users of governmental websites and services, in most cases, cannot just switch to a competitor.

We are, in addition, witnessing that eGovernment initiatives are, progressively, becoming a familiar part of the virtual landscape [6] and that services and online communication between the users replace, to a greater extent, the traditional face-to-face interaction. This is also a fact in other agencies outside the domain of eGovernment. Therefore, the contribution in this research study is to investigate constructs of IS success and how they perform and interact, with emphasis on the research area of human-computer interaction (HCI), which aims to facilitate usability through user driven development. Although this study draws on empirical data collected in the public sector, many of the same assumptions and IS constructs are transferable to other business areas. It is therefore hoped that the findings will also be of interest outside the public sector and among both practitioners and academics, interested in IS development and quality improvements, when focusing on user benefits and organizational impacts.

Consequently, this project sets out to investigate the following research question (at the time of writing):

How do constructs of IS success perform and interact, among various stakeholder groups, in relation to the extent of user involvement in website development?

The overall aim is to provide additional insights for how to succeed on the Web, by taking into account the users and organizations perception of success, and highlight the impacts of various approaches that is used in order to force user satisfaction and net benefits (organizational impacts and user benefits) driven by website quality improvements.

The IS success model from DeLone and McLean [1, 7] is used as a framework in the search for an answer to this question. Various empirical components, both qualitative and quantitative data, are combined and the theoretical approach derives from literature in the fields of IS, eGovernment and HCI. The stakeholder groups are, in this study context, considered to be users (demand side) and the website providers/organizations (supply side).

The remainder of this paper is organized as follows: Section 2 present theoretical perspectives and the framework used; Section 3 deals with the research approach and methodology; while Section 4 presents preliminary findings and a brief discussion. Then I sum up the findings, highlight the contribution of this study, and identify possible venues for ongoing research on the topic. Finally, a starting point for further discussions (during the seminar) to improve this paper (thesis) is provided.

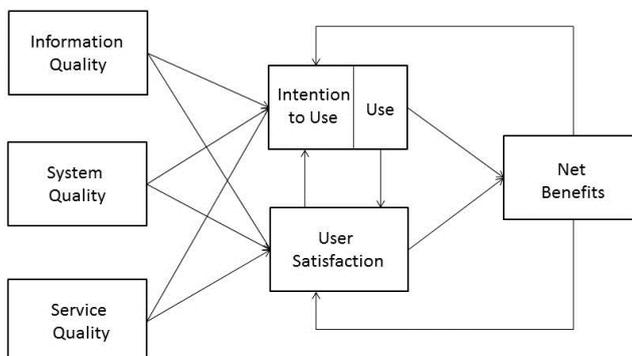
2 Theoretical perspectives and framework

Research literature in the field of information systems (IS), human-computer interaction (HCI) and eGovernment is of particular interest in this study. Each of the disciplines is briefly described below, and linked to the relevance in this project.

2.1 Information systems success

Information system (IS) is an academic/professional discipline linking the business field and the well-defined computer science field. According to Mathiassen and Nielsen [8] “Some scholars argue we need to focus on developing a unified core of concepts and theory thereby strengthening our position as a respected discipline. Others argue we should encourage diversity of frameworks and approaches and further develop our interaction with other disciplines.” [p. 2]. Investments in IS have been at the core of many organizations for decades, with an increased focus in many organizations for 10–20 years. Technology progresses and users become more discerning. Therefore, information systems do not only need to facilitate some organizational and management needs, but, ideally, also stimulate use and user satisfaction among some central user groups. Despite rising expectations fueled by heavy investment by public as well as private agencies, benefits often prove hard to identify. The field of IS research draws on the gap between investments in information technology (IT) and the perceived outcomes [2], which can be addressed in different ways, depending on the aim of the study carried out. In dealing with IS research, various frameworks and theories can be applied. Aiming to provide a general and comprehensive definition of IS success that covers different perspectives of evaluating information systems, DeLone and McLean reviewed the existing definitions of IS success and their corresponding measures, and classified them into six major categories. Thus, they created a multidimensional measuring model with interdependencies between the different constructs of success [1, 9].

Figure 1. The DeLone and McLean (2003) IS success model.



The DeLone and McLean model contains concepts of success that are perceived as important in the field of IS research, and the model has been widely tested and cited in prior research contributions [1, 7, 10]. This research study is particularly interested in understanding the perception of success from users' and intermediaries' viewpoints: in this case the perspective of the webmaster (or anyone in a similar position). The IS success model does not show positive or negative signs for success dimensions in a causal sense, but in a process sense. However, from the model, we can see that the causality drives in the same direction as the process. Website quality, of particular interest in this study, concerns system quality (which measures the desired characteristics of a website/system), information quality (capturing the content issue), and service quality (delivered by the service provider) [9]. Usage measures everything from a visit to a website, to navigation within the website and information retrieval. User satisfaction remains an important means of measuring the users' opinion and experience of the system/website usage. DeLone and McLean [3] also clearly state that net benefits need to be defined in the individual study, and can be considered from an individual, organizational or national level. DeLone and McLean [1] proposed that net benefits is the most important success measure and captures the balance of positive and negative impacts (benefits), driven by use and user satisfaction.

2.2 Human-computer interaction (HCI)

Acknowledging that information systems (IS) have a huge influence on an individual's performance and human-use of computers/applications; we need to facilitate high-quality interactions and great user experiences. We can do this by, for instance facilitating a user-friendly interface design, taking into account various usability issues and concerns, which may have an impact on the end-users. Human-computer interaction (HCI) is the study, planning and design of the interaction between people (users) and computers. It is often regarded as the intersection of computer science, behavioral sciences, design and several other fields of study [11].

We design for human use and must therefore make sure that the users are involved from the beginning of the development process [12]. Involvement of users and feedback for quality improvements is perceived as vital, and may impact the perception of success or failure, especially from a user's point of view. In order to understand the interaction that takes place between the users and the computer, various evaluation approaches can be applied; observing users, asking users, asking experts, user testing and modeling users' task performance [11]. Usability is a main subject in the field of HCI and is defined as "The effectiveness, efficiency and satisfaction with which specified users achieve specified goals in particular environments." [13]. With regard to website quality improvements, user testing emphasizes the property of being usable. User testing is a vital component of usability testing, and methods such as observation, user satisfaction questionnaires, and interviews can be applied [11]. The purpose of conducting user testing is to focus on problem areas and organize an increase in quality. The importance of this is considered to be invaluable. Although various methods of user testing can provide conflicting results, we need to favor the strengths in each of them, and be aware of the weaknesses. A combination of different approaches is often used to get a broad understanding of the efficacy of a design [11], and provides various types of feedback, which can be incorporated in the system- and design-development process.

2.3 eGovernment

Increases in efficiency, effectiveness, inter-organizational coordination, and user satisfaction are usually hard to assess. Moreover, studies point out that the majority of actual government projects end up in failure [14], suggesting that the productivity paradox of information technology (IT) [15] appears to apply even more in a public sector setting. Moreover, criteria for IS success in a public sector setting are often fuzzy at best, even though there is an increasing awareness of the need to include not only the user perspective, but also a range of public values in assessing the success of IS [7]. Virtually all public and private agencies are nowadays expected to invest to some degree in establishing a web presence. Heavy investment in the establishment of a website, and on its continuous improvements and updates required by users, however, often fail to be evaluated against well-grounded measures of success. The quest for measurement of IS success has been the object of a wide range of contributions, both theoretical and based on analysis of empirical data.

There is either no clear definition of what eGovernment is supposed to attain in organizational impacts or measurable user benefits, although prior studies conclude that eGovernment initiatives do pay off, and that public authorities profit more than the users (citizens and businesses) [16]. A number of eGovernment maturity models have been discussed and refined through time within the research community, aimed at classifying the degree of successful IS adoption in governmental bodies [17]. In some cases, the organizations are well known to the users and have great knowledge about their interests, needs and requirements. While, in other cases, little or no exact knowledge that can be used as direct input for quality changes exists. In promoting success in the public sector, web awards have been one approach that has received much attention during the last decade. According to Esteves and Joseph [18] the

implications of the awards highlight the importance of standards and measurable targets for efficient quality assessment, which can determine success or failure of projects in the public sector. Success measures in these awards are not necessarily limited to the actual website/services presented but also cover benefits gained and organizational impacts. The most common approach is studying the actual quality level of the website and refines the meaning of success to the website presentation. Impact measurements are rather the exception in web awards. One implication may be that there is, as stated, no clear definition of what eGovernment is supposed to attain, even when it comes to organizational impacts or benefit achievements. As stated by Gupta and Jana, the importance of the assessment of eGovernment performance cannot be overstated [19]. Moreover, public organizations can, for instance, create value by decreasing cost [18]. IS benefits have traditionally been assessed by rather simple financial measures, such as return on investment and cost-benefit analysis. User satisfaction is also a common measure in order to assess the success of IS systems, regardless of whether it is a system that will serve the employees within the organization, or a large number of external website users.

3 Research approach

3.1 Research stages

With the aim of covering the overall research objectives of this study, empirical data has been collected and analyzed in several stages, over a period of three years. Each of the three project stages and the work that is carried out is briefly described below:

1. Initial project stage: A comprehensive literature review on the topic has been carried out. In addition, qualitative interviews were held with webmasters and business managers in order to explore website success perceived from a practitioner's point of view. The aim of the interviews was to get insights of the measurement of website quality, user satisfaction and perceived net benefits (organizational impacts and user benefits) from an organizational perspective.
2. Middle project stage: Drawing on prior research and the findings from the interviews, an online survey questionnaire was developed, tested and conducted. In addition, various web awards inside and outside a national context has been reviewed, summarized and analyzed. The aim was to map the findings from measurement of website success, done by the government (yearly ranking of public websites) and private actors in the market, to other findings in this study and relevant literature.
3. Late project stage (in progress): The findings (from the qualitative and quantitative part) were combined. In order to summarize the project and answer the overall research question presented, an outline for the final report (thesis) for this project is under construction (the present paper). More

detailed analyzes will also be performed in the nearest future, as well as the unfinished papers (which is in progress/review) will be finalized.

3.2 Data collection and analysis

This study applies a mixed-method approach by combining both qualitative and quantitative data. In order to give an answer to the research question, the intention of combining two different methods is to favor their strengths and weakness in each of the approaches. According to Creswell [20] the central question in qualitative research is to ask for exploration of relevant phenomena in the study context, while quantitative research questions investigate relationships among variables [20]. The need for a researcher to dig into relevant issues favors interviewing as a research method, while surveys give a powerful opportunity to collect data from many respondents (individuals) at once [21].

In the qualitative part of the data-collection process, interviews were, in the first instance, held with webmasters in various organizations. I chose to use open-ended interviews because I wanted, as far as possible, to establish a situation or a conversational setting in which the informant could explain how, from a webmaster's perspective, webmasters would identify website quality aspects. Thus, I did not restrict the webmasters explanations of website quality by using a set of pre-defined categories but took care that it was possible for the webmasters to be open-minded and give meaningful explanations. To meet this objective, I briefed the interviewees thoroughly before the interview regarding the intention, background and purpose of the interview. The interviews took place in the participants own business environment (office location or meeting room). The participants were willing to share their thoughts and knowledge, and answered the questions in detail. The interviews were done in Norwegian, recorded, and notes were taken. The transcription into English was done immediately after the interview. To ascertain the reliability regarding the conversation during the interview, each participant had an opportunity to read through the interview after the transcription was completed. Following the procedures of grounded theory, three sub-steps in the analysis were performed as "open," "axial" and "selective" coding [22]. The first sub-step in the post-session analysis actually began during the session, consisting of identification and naming of concepts of interest to the investigation in the interviews (open coding). Concepts of interest were found by listening and looking for related utterances that seemed to concern the same concept. Each interview was segmented into meaningful units of text by re-reading the interviews, and then the segments were coded into categories that were again refined during the analysis.

In addition to the webmasters interviews, meetings were held with business managers in the public sector responsible for the website from a management level. The respondents were questioned about the organization's website in general, organizational impacts driven by the website, and perceived user benefits. The researcher did not define impacts/benefits in a particular way but, rather, gave the respondents an opportunity to be open-minded. During the interviews a semi-structured questionnaire was used, which is flexible and allows for new questions to

be brought up. The advantage is that the method allows the participants to describe a topic in their own words rather than being restricted to pre-defined categories, defined by the researcher. The interviews were then transcribed and verified by the informants (the same procedure as for the webmasters).

Combining this knowledge, with previous research contributions was intended to contribute to the next step in the process, which is the quantitative part of the study. Therefore, an online survey questionnaire was developed on the basis of previous research contributions and the DeLone and McLean model. The purpose of this survey was to examine website success from an organizational point of view. The respondents were to be webmasters or a person in an equivalent role. Key themes in the survey were website quality, user satisfaction, user testing, user benefits and organizational impacts – driven by the website presentation as whole. Email addresses of the respondents were collected manually by visiting each website. All of them had participated in a national web award arranged by the government in Norway and Denmark in 2009. The survey was distributed (N=1.237) in the middle of November 2010 and was closed in December 2010. The respondents received an email with an introductory letter that informed them about the purpose of the study, and a web link to the online questionnaire. It was clearly stated in the email that the respondent should be the webmaster (or a person in a similar position) in the organization. In order to maximize the response rate, I used incentives. In prior studies, research has shown that financial incentives impact the rate of response [23]. During this investigation I was not able to use incentives, as any form of private compensation for public officials is prohibited under Norwegian and Danish law. Instead I promised that respondents who provided their email addresses would receive a copy of the completed survey report (a summary of the findings). After two weeks, a reminder email was sent to all of the respondents. Those who had already participated were thanked for their participation, and those who had not answered the questionnaire were encouraged to complete the survey within a week. After four weeks the survey was closed, with 541 useful responses, representing a response rate of 44 percent. The results have been analyzed by using Excel and SPSS, and descriptive analysis and correlations have been performed. More detailed analysis is in progress at the time of writing.

In addition, this project reports on second-hand data collected from national web awards in Scandinavia (ranking of public websites in Norway and Denmark). In these countries, annual quality assessment of hundreds of websites is done to almost the same extent since the beginning of 2000. Public available data is collected from the organizers websites (www.norge.no/kvalitet and www.bedstpaanettet.dk). These data is analyzed by using both qualitative and quantitative methods, as well as governmental reports have been read carefully in order to understand the aims and goals of these initiatives.

3.3 Respondents perceived as intermediaries

Although the intermediaries cannot replace the actual users and their opinion, this study has chosen to also investigate website success from an organizational

perspective. Therefore, the informants' role in this context is briefly described. In order to facilitate IS success, this study describes the webmaster as being a pivotal figure in the delivering of websites, and they act as the immediate interface. For organizations providing information and services, the intermediary, such as the webmaster, is therefore vital in order to gain specific knowledge from citizens about what stimulates use and facilitates user satisfaction. While usability and, to some extent, user experience of websites are well defined and studied, e.g., Bai et al. [24], there are surprisingly few studies found on how webmasters perceive, experience, and explained website quality and perceived outcome/benefits of quality improvements. The webmasters play a key role [25] and the importance of the webmaster has been stated by Lazar et al. [26], " ...the person that has the greatest influence on currently-existing web sites is the webmaster..." [p. 270]. While other people in the organization may also have an opinion about the website quality, the webmasters usually have the most accountability for, and knowledge of, the website. Webmasters, perceived as intermediaries, are not purely web designers and/or purely user representatives, but are in charge of everyday design issues and technical features, and hold the main responsibility for having a website quality that meet the user's interests and needs. For public managers delivering information and services, and having an effective intermediary such as the webmaster, it is vital to gain specific knowledge from citizens about what stimulates use and facilitates user satisfaction.

3.4 Papers included in the thesis

As highlighted in the introduction section, this paper draws on four different papers. Below follows a brief outline of the four papers, and topics included in each of them, provided by presenting the abstracts (Table 1). Two of the papers are under construction/in review and therefore the content may change.

Table 1. Abstracts of the papers that aim to contribute in the project.

Paper	Abstract	Aim
1 In progress / review (a conference paper is published)	This paper investigates how webmasters explain website quality and what they consider to be important quality aspects. We held qualitative interviews with eight webmasters in Norwegian website award-winning companies. The outcome is a grounded theory model of how webmasters representing four ideal types of websites explain website quality. The findings are discussed in relation to the three website quality aspects from the DeLone and McLean IS Success Model. Although the webmasters seem to have users' interests and needs in mind, user satisfaction requirements are somewhat absent from the webmasters explanations. The paper concludes that webmasters explain website quality differently, depending on the type of website, with user friendliness and usability being common concepts.	Gain insights from an organizational point of view, and get a deeper understanding of how practitioners (webmasters) explain website quality and success.

- 2
Accepted in
a
conference
proceedings
- With the goal of shedding light on the impacts of user involvement in eGovernment environments, this study focuses on website quality and user satisfaction. To gain insights into the public sector, empirical data was collected through an online survey among public sector employees. The findings reveal that less than fifty percent of the organizations have conducted user testing of their website. However, most of them believe that they present a website of high quality. There is no clear relationship between the frequency of user testing on information quality and service quality, while user testing has a weak positive effect on system quality, perceived from an organizational point of view. Moreover, the findings reveal a positive relationship between the frequency of user testing conducted, and the extent to which the website users are perceived as being satisfied. This paper concludes that further investigation is needed in order to facilitate high quality interactions and great user experiences, and provide additional insights to the role of user testing in an eGovernment context.
- Investigate user involvement in website quality improvements and to what extent user testing is conducted among the respondents (public organizations). In addition, explore how the respondents perceive their own website performance (quality level), to what extent they find the users to be satisfied and the impacts of user testing on various constructs of IS success.
- 3
Accepted in
a journal
- The focus of this paper is to investigate measurement of website quality and user satisfaction. More specifically, the paper reports on a study investigating whether users of high-quality public websites are more satisfied than those of low-quality websites. Adopting a human-computer interaction perspective, we have gathered data from the 2009 public website awards in Scandinavia. Our analysis of Norwegian and Danish websites reveals that the use of quality criteria is highly technical compared to the traditional usability testing focus on efficiency, effectiveness and satisfaction of the actual system use by representatives. A Pearson correlation analysis of user evaluation from 296 websites that participated in the Danish web award Bedst på Nettet ('Top of the Web') showed no significant positive correlation between website quality and user satisfaction. We put forward recommendations for further investigation: (1) inclusion of real users (citizens and businesses) in real-use settings in the evaluation process could help move forward the understanding of the relationship between website quality and end-user satisfaction; (2) the lack of correlation between website quality and user satisfaction could be a point of departure for critical discussions of future implementation of public information and services
- Examining the relationship between website quality and user satisfaction, and highlight measurement of website success, based on the use of quality criteria and the evaluation methods used in national web awards. The findings are discussed by adopting a HCI perspective, and recommendations for further investigation of website success are provided.

and (3) additional and in-depth research of the measurement of website quality in the public sector, user expectations and the impacts of website quality improvements on user satisfaction.

4 In progress / review	Consumers' choice of online products and services eventually will value good website design, products, and services. By contrast, public sector websites are supply- and cost-driven, with the webmaster as a key player in designing the user interface and being the intermediary between citizens and in-house content providers. This study aims to investigate constructs of IS success in governmental websites as perceived by webmasters, and the role of user testing in the perception of these factors. Using data from an online survey of 541 webmasters of public agencies in Norway and Denmark (response rate: 44%), our analysis shows that webmasters perform only very limited user satisfaction studies and with a low sophistication level. Further, more user testing corresponds to a weaker correlation between constructs of website quality and user satisfaction, than first expected.	Aiming to investigate constructs of IS success and how they interact, correlation analysis are performed among each of the constructs (variables) in the DeLone and McLean IS success model. The findings are, in addition, correlated with frequency of user testing conducted among the online survey respondents (paper in progress). Hypothesis and regression analysis may be included in the final version of the paper.
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4 Findings and discussion

Returning to the research question addressed in this study (at the time of writing): *How do constructs of IS success perform and interact, among various stakeholder groups, in relation to the extent of user involvement in website development?*

Constructs of IS success has been investigated by using the DeLone and McLean model as a starting point and framework in this study. In order to shedding light on the users interests and needs in website quality improvements, the extent of user involvement has been of special interest. The main stakeholder groups are, in this study, considered to be the end-users and the website providers/organizations. The webmaster is perceived as being a pivotal figure and intermediaries in the delivering of websites. A clear and explicit answer to the research question cannot be given at the time of writing this paper, but the findings so far is briefly summarized below.

Website success can be assessed from various levels and perspectives, and different approaches can be used. The first paper (paper 1) investigate how webmasters explain website quality and what they, as practitioners and content-providers, consider being important quality aspects. Although the webmasters seem to have users' interests and needs in mind, user satisfaction requirements are somewhat absent from the webmasters explanations. Webmasters explain website quality differently, with user friendliness and usability being common concepts. Moreover, there is no clear link between providing a high-quality website (by winning an award), and user

involvement in website quality improvements, e.g. such as user testing. Further, and with the goal of shedding light on the impacts of user involvement (paper 2), empirical data was collected through an online survey among public sector employees. The findings reveal that less than fifty percent of the organizations have conducted user testing of their website. However, most of them believe that they present a website of high quality, although many of them do not know their users, and their actual needs and requirements. Furthermore, there is so far no clear relationship between the frequency of user testing conducted on information quality and service quality, while user testing seems to have a weak positive effect on system quality, perceived from an organizational point of view. Moreover, the findings reveal a positive relationship between the frequency of user testing conducted, and the extent to which the website users are perceived as being satisfied from an organizational perspective. More in-depth investigation (analysis of the survey results) on this issue will be carried out, but is not accomplished at the time of writing. Measurement of the relationship between website quality and user satisfaction among real users was investigated in paper 3, and whether actual users of high-quality public websites are more satisfied than those of low-quality websites. Adopting a human-computer interaction (HCI) perspective, data was gathered from website awards in Scandinavia. The analysis reveals that the use of quality criteria is highly technical compared to the traditional usability-testing focus on efficiency, effectiveness and satisfaction of the actual system use by representatives. A correlation analysis showed no significant positive correlation between website quality and user satisfaction. Therefore, (1) inclusion of real users (citizens and businesses) in real-use setting in the evaluation process could help move forward the understanding of the relationship between website quality and user satisfaction; (2) the lack of correlation between website quality and user satisfaction could be a point of departure for critical discussions of future implementation of public information and services and (3) additional and in-depth research of the measurement of website quality, user expectations and the impacts of website quality improvements on user satisfaction. In order to investigate the relationships among constructs of IS success (paper 4) and the role of user testing in the perception of these factors, analysis shows that webmasters perform only very limited user testing and with a low sophistication level. In-depth analysis will be performed in the coming weeks, to examine the relationships in more detail, and will hopefully give direct input in order to answer to the preliminary research question addressed in this project.

5 Input for further progression and discussion

The purpose of this paper is to discuss how the overall research question presented in the PhD project is tackled. Input regarding the use of theories and methods, the relevance of the gap that needs to be filled and choice of literature is very welcome. Based on the findings presented in this paper, there is no evident conclusion to be drawn as a whole. Since this is an ongoing study, and this paper is intended to serve as draft for a summary of four articles, it is desirable to discuss (during the seminar) the following issues in order to finalize the research project: (1) The research contribution as such into the existing research literature in IS, eGovernment and HCI, (2) the structure/presentation form in its entirety, with a focus on relevance, clarity

and comprehensibility, (3) how to balance the papers (topic/findings) chosen to be used in the PhD thesis, (4) the use of the DeLone and McLean model and IS constructs in this study, and finally I need to, (5) discuss which other analysis that needs to be performed in order to answer the research question addressed.

References

1. DeLone, W.H. and E.R. McLean, The DeLone and McLean Model of Information Systems Success: A Ten-Year Update. *Journal of Management Information Systems*, 2003. 19(4): p. 9–30.
2. Reddick, C.G., Information resource managers and E-government effectiveness: A survey of Texas state agencies. *Government Information Quarterly*, 2006. 23: p. 249–266.
3. Lindgaard, G., et al., Attention web designers: You have 50 milliseconds to make a good first impression! *Behaviour & Information Technology*, 2006. 25(2): p. 115–126.
4. Lee, Y. and K. Kozar, Investigating the effect of website quality on e-business success: an analytic hierarchy process (AHP) approach. *Decision Support Systems*, 2006. 42(3): p. 1383–1401.
5. Boivie, I., J. Gulliksen, and B. Göransson, The lonesome cowboy: A study of the usability designer role in system development. *Interacting with computers*, 2006. 18(4): p. 601–634.
6. Tan, C.-W., I. Benbasat, and R.T. Cenfetelli. Building Citizen Trust towards e-Government Services: Do High Quality Websites Matter? in *The 41st Hawaii International Conference on System Sciences*. 2008.
7. Scott, M., W. DeLone, and W. Golden, Understanding Net Benefits: A Citizen-Based Perspective on eGovernment Success, in *International Conference on Information Systems (ICIS)*. 2009: Phoenix.
8. Mathiassen, L. and P.A. Nielsen, Engaged Scholarship in IS Research. *Scandinavian Journal of Information Systems*, 2008. 20(2).
9. DeLone, W.H. and E.R. McLean, Information Systems Success: The Quest for the Dependent Variable. *Information Systems Research*, 1992. 3(1): p. 60–95.
10. Wang, Y.-S. and Y.-W. Liao, Assessing eGovernment systems success: A validation of the DeLone and McLean model of information systems success. *Government Information Quarterly*, 2008. 25(4): p. 717–733.
11. Sharp, H., Y. Rogers, and J. Preece, *Interaction Design: Beyond Human-Computer Interaction*. 2 ed. 2007, New York: Wiley.
12. Cato, J., *User-Centered Web Design*. 2001, London: Pearson Education Limited.
13. ISO, ISO 9241-11 - Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability. 1998, ISO.
14. Goldfinch, S., Pessimism, computer failure, and information systems development in the public sector. *Public Administration Review*, 2007. 67(5): p. 917–929.

15. Brynjolfsson, E., The productivity paradox of information technology. *Communications of the ACM*, 1993. 36(12): p. 66–77.
16. Capgemini. Does e-Government Pay Off? 2004 [cited 24.03.2011]; Available from: <http://www.eupan.eu>.
17. Andersen, K.V. and H.Z. Henriksen, EGovernment maturity models: Extension of the Layne and Lee model. *Government Information Quarterly*, 2006. 23(2): p. 236–248.
18. Esteves, J. and R.C. Joseph, A comprehensive framework for the assessment of eGovernment projects. *Government Information Quarterly*, 2008. 25(1): p. 118–132.
19. Gupta, M.P. and D. Jana, E-government evaluation: A framework and case study. *Government Information Quarterly*, 2003. 20: p. 365–387.
20. Creswell, J.W., *Research design: Qualitative, quantitative, and mixed methods approaches*. 3 ed. 2009: SAGE Publications, Inc.
21. Lazar, J., J.H. Feng, and H. Hochheiser, *Research Methods In Human-Computer Interaction*. 2010: John Wiley & Sons Ltd.
22. Strauss, A. and J. Corbin, *Basics of Qualitative Research - Techniques and Procedures for Developing Grounded Theory*. 1998, London: SAGE Publications.
23. Frick, A., M.-T. Bächtiger, and U.-D. Reips, Financial incentives, personal information and drop-out in online studies. *Dimensions of Internet Science*, ed. U.D. Reips and M. Bosnjak. 2001, Lengerich: Pabst Science Publishers 209–219.
24. Bai, B., R. Law, and I. Wen, The impact of website quality on customer satisfaction and purchase intentions: Evidence from Chinese online visitors. *International Journal of Hospitality Management*, 2008. 27(3): p. 391–402.
25. Liu, C. and K.P. Arnett, Exploring the factors associated with Web site success in the context of electronic commerce. *Information & Management*, 2000. 38(1): p. 23–33.
26. Lazar, J., A. Dudley-Sponaugle, and K.-D. Greenidge, Improving web accessibility: a study of webmaster perceptions. *Computers in Human Behavior* 2004. 20(2): p. 269–288.

Open Data Business Models

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Abstract. Opening up governmental and private sectors' data archives creates potential new business opportunities for a range of software companies. Their new service offerings and business models are built on open data. However, research of actual and emerging business models has so far been mostly focused on the technical challenges rather than on software companies. We aim to address this research gap by answering the following research question: how do data service providers capture value? Based on empirical work in three small Finnish software companies, our paper describes a business model for open data service providers. We conclude with an analysis of the business model elements and their interplay in the different stages of open data service offering.

Keywords: Open Data, Business Model

1. Introduction

Open data publication is gaining momentum in several countries. Previously unused archival data has been opened up and made available for public and developers' use. In total, hundreds of thousands of governmental databases have been released letting independent developers build useful applications and mash-ups for citizens and business use. Publication encourages also commercial companies to open up their data. Nordic public bodies have jumped in the bandwagon in recent years. Opening up the vast data archives collected by public sector bodies' offers unique opportunities for SME's. Consequently, the topic of open data, especially governmental open data, is at the centre of attention in academic as well as in business circles. Relevant references in the literature to understand change include open data [3, 20], open content [7, 10], and open source [6, 11]. According to Chesbrough and Rosenbloom [4], there are two main processes regarding the business value: first the value should be created and then it should be captured in order to profit from its benefits. However, research on data publishing is currently focused on the technical challenges [3] and value creation (as social, economical, and political good) [8] rather than value capturing.

To realize the potential of data publication companies are struggling to develop new value propositions, revenue models, resource bases, and business relationships. There is a shortage of research regarding the new business models built on open data.

Our research effort aims to address this research gap by answering the research question: *how do data service providers capture value?*

The goal of the study is to explore open data business models for each entity that participates in the process of value creation and value capturing. The theoretical contribution of this paper is the description of business models for open data service providers. We build the framework of this paper by combining two research streams: literature on entity roles in providing data and literature on business models. The framework will answer the question how value is captured by service providers in open data related activities.

Building value capturing business models on top of public good is challenging. The technical, legal, and business challenges all require their solution. For example challenges related to data licensing [14] and software (standard) related issues. Not to mention the technical standards required in, and emerging from, the process [3]. In this paper we try to pay attention to the most of these issues, draw the explanations, and address the solutions in the discussion section.

2. Previous Research

2.1 Software Business and Open Data

Software industry can be divided into primary and secondary software industry. The primary software industry refers to commercial companies that develop, maintain and publish their software [21, 27], while the secondary software industry companies include software as part of their offering. Both these industries are facing challenges because of a push towards service dominant logic [25] and open innovation [26]. Use of strategic software innovations as barriers of entry leans on proprietary development strategies [13] as opposed to more open innovation environment, where companies remain competitive by relying on external assets for example, open source and open data. Certain companies no longer consider software products as a source of competitive advantage or as the main source of their revenue [21]. In many cases company actions imply that releasing the software asset may create more value than keeping it secret [5, 19]. The following sections discuss open data can help different companies create value at the market and what business models can help to describe this process.

Research finds a number of social, economic, and political benefits of opening up the data and making it reusable at the national scale, among them it helps economic growth by providing SMEs the material for developing new services [8, 20]. The better the format of the data that is published – the better the chances are that it will be reused and hence will create value. Here the format refers to how well structured the data is and other characteristic that Tim Berners-Lee - the founder of world wide web, described in his concept of linked open data. He also introduced a five star data rating system that describes five levels of open data [2]. Improving the rating of the data or converting the data into open and re-usable formats requires considerable effort and involves a number of technical challenges [3]. Consequently,

data transformation and publishing process can be divided in a number of phases and, corresponding to these phases, roles.

Based on Latif et al. [10] description of the entities that participate in the process of data transformation from raw data to linked open data we developed our theoretical framework that is presented in Fig. 1. Latif et al. define that participating entities can be both corporate and non-corporate, e.g. persons, enterprises, associations, and research institutes and they can occupy one or more of the following roles:

- *Raw Data Provider* possesses and provides any kind of unstructured data that is not in RDF (Resource Description Framework) format yet.
- *Linked Data Provider or Developer* possesses the expertise to convert the raw data into linked data format and provides any kind of data in a machine-readable Linked Data format to the next stage.
- *Data Application Provider or Application Developer* possesses the expertise to develop applications, visualizations, and mash ups (all kinds of human-readable outputs) on the top of the data and provides them to the end users.

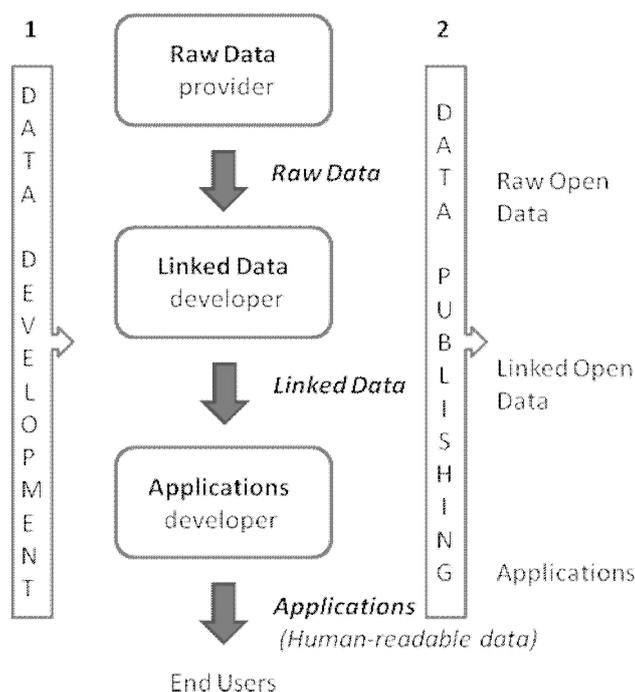


Figure 1. Entities and their roles in the transformation process of raw data into linked data. Stage model of data development, adopted from [10].

In order to apply this stage model of data transformation to our research we need to look into the meaning of data openness. According to the SOMUS project report [23], “open data refers to information that has been made technically and legally available

for reuse". Consequently, any kind of the data (from raw to linked data) can be considered open data if it is published and assigned a relevant license. The ease of the data reuse is dependent on its degree of transformation. Thus, the reuse of the raw open data requires more effort and skill than of the linked open data.

2.2 Business Models

Many sources claim that open data creates new business opportunities and has a potential to fuel up economic growth [8, 20]. We explore and describe business models that are applicable for the open data market to help SMEs develop new services and enable a scalable economic impact. Hence, the present research is focused on socio-technical challenge of building new service models for SME's.

A number of papers have been written on business models of software industry [11, 21] including models of digital [1], and online [12, 17] businesses. We took Rajala's work [21] as a basis for our research on open data business models. His framework combined several streams of research on business models in software industry. Presented in a compact and comprehensive way this framework was a good fit for studying a relatively new and unknown phenomenon of open data business models. Rajala [21] defines business model as "*concise representation of how an interrelated set of elements – the offering [15], resources [18], relationships [15, 16, 24], revenue mode [18], and management mind-set [21] – are addressed to create and capture value in defined markets*".

There are several roles in open data activities that can be performed by one a number of different entities, as it was mentioned earlier, in the stage model of data development (Fig.1). Although all of the phases are aimed at improving overall data reusability the tasks solved in each stage vary and accordingly the value capturing techniques for each player or role would be different. In our study we explore mechanisms for capturing value, that is created along the data development and publishing processes, for each actor in the framework. We plan to research each role separately along the set of business model elements defined by Rajala [21]. This paper is dedicated to the business model from the perspective of linked data developers and application developers (see Fig.1).

3. Methodology and Analysis

As this is a new phenomenon with little existing data, we chose an exploratory approach to study it. For identifying business models we selected case study approach. Our research problem suggested in-depth focus on organizations using a qualitative research approach [9, 22]. We adopted the principles of interpretive case studies [9, 22]. The first stage of the research was interviews with service providers. Table 1 shows the profiles of the interviewees.

Table 1. Interviewees' profiles.

Interview date	Company	Interviewee's position
9.3.2011	FloApps Oy	Project manager / Consultant
11.3.2011	Mysema Oy	Project manager / Developer
16.3.2011	FloApps Oy	CEO / Consultant / Developer
22.3.2011	Hila Open Oy	CEO / Consultant

The first interview was gained using a previous contact and other cases were identified during the interviews. Four semi-structured interviews with three small-sized Finnish companies that offer open data services were conducted at this stage. The interviews took place in March 2011 and were 35 to 45 minutes long. The discussion was centered around the four elements of business model [21]: offering, resources, relationships, and revenue model. The interview guide can be found in Appendix 1.

All the interviews were transcribed and analyzed along the business model elements. Data service providers' roles and activities were analyzed with a help of theoretical framework – entities and their roles in the transformation process of raw data into linked data and applications (Fig.1) that was adopted from previous research. Reoccurring themes were identified in all the sessions and common patterns were matched across different interviews then as quotations they were combined together in the table of the results (See Appendix 2). The table was constructed on the basis of the existing theory (business model elements – the rows) and empirical evidence (reoccurring themes – the columns). Table 3 summarizes results and common patterns that were detected during the analysis.

4. Cases

Majority of open data related projects and initiatives in Finland are focused on converting existing datasets into open format. For example, Helsinki Region Infoshare project at Forum Virium¹. There are also few organizations in Finland who have already released or are willing to release the data and let the developers build services on the top of it. Most of them belong to the government, cultural, and content producing industries. Some examples are HSL's (Helsinki Region Transport organization) contest for using its data to build applications for citizens² and Helsingin Sanomat's (Finnish biggest newspaper) data on parliament elections.

Several companies including Hila Open, FloApps, and Mysema saw the opportunity to commercialize an unfulfilled need of the organizations who would like to open their data and use it more effectively. Then these companies developed the offers to meet this market opportunity. In attempt to understand open data emerging

¹ <http://www.forumvirium.fi/en/project-areas/smart-city/helsinki-region-infoshare>

² <http://hslmobiilikisa.blogspot.com/>

market and describe relevant business models we take a closer look into business of these three data service providers.

Table 3. Findings. Summary.

	Consulting	Conversion / Publishing	Application
Offering	Provide a range of possibilities to a customer how opening their data can bring value inside as well as outside an organization. Identify the needs, the tasks and prepare an offer for the next two steps.	Transforming the client's raw data into data of better format that is easier to share and reuse. Changing data creating patterns in order to improve the quality of the data collected. Help with publishing the data, maintaining the datasets on own servers.	Ensure the reuse of the data. Develop applications on the top of the converted/published data. Attract third parties to reuse of the data and develop applications, visualizations.
Resources	Networking, learning, updating with the latest developments and opportunities available. expertise development,	Learning. For linked open data knowledge of semantic technologies. For publishing, licensing, tools for automatic creation of LOD, servers	Knowing various use cases of converted data and expertise in application development. Marketing of the data available for re-use.
Relationships	Partnering with University for influencing their research focus and accessing the demonstrations of service prototype that can be shown to potential clients.	Partnering with other open data service providers and outsourcing	Agreeing on common standards for all published data in order to make combining of the datasets from different providers easier
Revenue model	Daily price for consulting and necessary research.	Project estimate for the whole dataset conversion and hourly payments for the project implementation	Cutting costs within organization. Creating value for customers and other stakeholders (for example citizens in case if data provider is a municipality).

4.1 FloApps

FloApps is originally web technology and application development company. It is a small enterprise located in Helsinki that consists of 5 employees – mostly developers. The company outsources some activities as interface design and coding work when it is necessary.

FloApps got involved in open data activities in early 2010 by winning in Apps for Democracy Finland contest with their application “Nomen est Omen”³. Since then they have implemented a number of open data and linked open data related projects, such as danceinfo.fi – EU funded project and kulttuurisampo.fi – a cultural project funded by Finnish government. Currently together with Hila Open and Mysema FloApps is involved in Helsinki Regional Infoshare – municipality project of the metropolitan area. Among open data related services FloApps specializes in application development although it also does consultancy and implements data conversion.

Open data related services is the minor source of revenue for FloApps although the management sees a lot of potential in this area and engages into various activities to enhance its employees expertise in this field and promote the service among potential customers.

4.2 Mysema

Mysema is based in Helsinki area it offers technical software development: design, architecture, implementation and consultation services. The company specializes in open source solutions and semantic technologies. Mysema is a small enterprise with 10 employees, consisting mostly of developers.

The company has started to offer open data services in the beginning of 2010. So far open data related services is a minor source of revenue for Mysema – no more than 10% although the interviewee from Mysema is expecting this figure might change rapidly as open data market in Finland grows. Mysema’s main strength in open data related services is transformation of data that includes information analysis and data model definitions (ontologies).

4.3 Hila Open Oy

Hila Open was started by the Finnish open data enthusiast in Jyväskylä. The company offers consultancy for organizations interested in open data and implements Fillari Kanava (Bicycle Channel) project⁴ – crowdsourcing service developed for providing an open communication between bicycle riders and the Helsinki city administration. The company consists of two developers who take care of Fillari Kanava and CEO – the open data expert and enthusiast who provides consultancy services for organizations all around Finland interested in open data.

³ <http://www.nomenest.info/>

⁴ <http://fillarikanava.hel.fi/>

Hila Open employees have been involved in open data projects since 2009 when they helped to organize Apps for Democracy Finland contest. The company provides consultancy for open data projects outside Finland including an ongoing EU funded Epsi Platform (epsipus.net). At the moment, open data related services are almost 100% of Hila Open's revenues.

5. Findings from the Case Companies

Through the course of the interviews we were able to detect a pattern similar to the stage model of data transformation that is shown in Fig. 1. The interviewees identified certain steps or phases in data transformation process. The original framework enriched with empirical findings is presented in Fig. 2.

All the case companies were acting as linked data developers and application developers. Moreover, they also have to provide the consultation services prior the beginning of the actual data conversion as its technical implementation depends a lot on the purposes and goals that a data provider wants to achieve by converting and opening data. Hence, the consultancy is a separate service that interviewed data service providers offer to the market in addition to data conversion and application development.

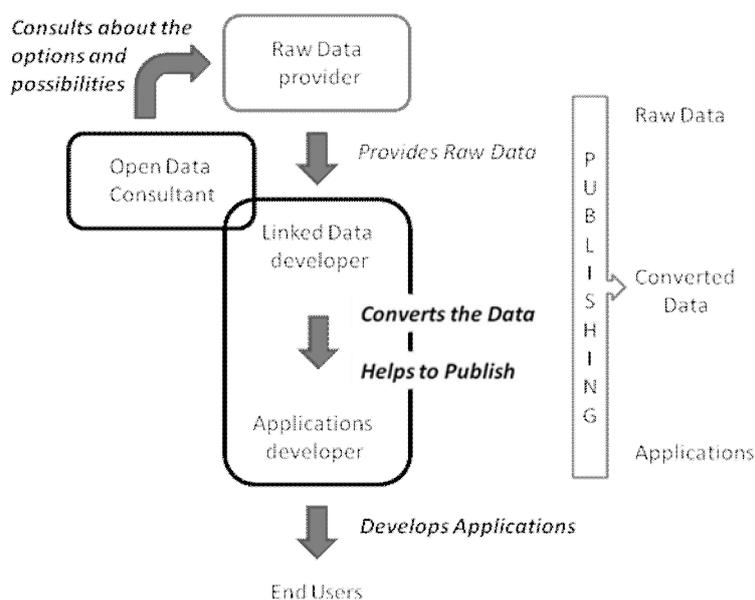


Figure 2. Stage model of data development. Data service provider perspective. Based on empirical findings.

Thus, all the interviewed case companies combine three roles in the stage model of data development: consultant, linked data developer, and application developer

(captured in a bold black frame in Fig.2). The revenues of all the three companies from open data related activities: data conversion, application building and related consultancy as a percentage of total revenues are shown in Table 4.

Table 4. Offerings and revenues of the case companies.

	Hila Open	Mysema	FloApps
Offering	Consulting Conversion Application	Consulting Conversion Application Other	Consulting Conversion Application Other
Revenues	<u>Consulting ~100%</u>	Consulting 1% <u>Conversion 10%</u> Application 1% Other 88%	Consulting 2% Conversion 2% <u>Application 10%</u> Other 86%

Another finding different from the theoretical framework (Fig. 1) was that in reality the second stage – linked data development – is rarely fully implemented due to the high cost of conversion and level of commitment needed to finalize all the requirements of linked data format.

The decision to publish the data is made by data provider as well as the choice of the format the data will be published in (at what stage of development or transformation), and the data licensing. The data service provider informs the client about the available options and what they involve. Then the data provider decides at what stage and in what format it wants to open up its data. When published the data can be placed and maintained at the clients' servers or on the service provider hardware.

The projects that case companies implemented varied in goals and consequently tasks and duration. Each project can be performed by one service provider or divided between two or three partners. For example, a recent project by Finnish metropolitan municipalities – Helsinki Regional Infoshare is performed by three companies. The project aims “to distribute information concerning Helsinki area in an efficient, straightforward way to all interested parties” by opening municipal data in a machine and human readable format. Consequently, the work was divided according to the stages of data transformation or development described earlier: consultation, data conversion, and application building.

The main result of the study is a description of case companies' offering, resources, relationships, and revenue model – elements of business model. The empirical evidence of this finding can be found in Table 2 (See Appendix 2) and the summarized elements of data providers' business model are shown in Table 3 (See section 3).

In this paper we investigated the data service provider's perspective on capturing value. The analysis showed the data service providers capture value through three main activities: consulting, data conversion, and application building. The main customers are the government, municipalities, and other non-profit organizations. Although, some commercial companies were interested in open data services so far the projects did not go through. One of the interviewees explained this situation with

the lack of sufficient open data resources in the business ecosystem to produce expected value and create synergies: *“It doesn’t really help when you are the only one who opens data. But then when the biggest parts of governmental offices start to have it as a habit to open their data then all the integration processes between IT systems of different organizations they come so much easier and cheaper and then the benefits will come.”*

Another problem that most of the interviewees mentioned was the lack of common standard and level in data transformation, which makes it difficult to combine different data sets together and gain expected from this combination benefits: *“someone provides the data and all the hundred companies who utilize the data need to provide the same processing and there are updates. To what level of quality [degree of data transformation] the parties who are publishing the data will set the de facto standard?”* *“The lower the level the more work is needed from the utilization side from the service providers. If the rating of the data is on the 5th level then it is much less work and it is much more tempting and appealing to use it from the software development point of view... But the question is how much is invested from the publisher’s point of view.”* Moreover, even if there is a standard, such as linked open data or 5 star rating for a data that Tim Berners-Lee has defined, not all of the data providers are willing to or have an opportunity to develop the data to the most advanced rating technically. One reason is because usually this development requires an extensive funding and another is because the benefits of doing it are not very clearly defined yet. The cost of the projects is high because the technology is still relatively young and needs extensive learning on the side of the service provider: *“publishing information as linked open data is not really going very much forward unless the tools are easier to use”*. Once the service providers learn to make implementation faster – the services will become cheaper considering hourly based pricing that they [service providers] use at the moment.

One of the interview questions was data licensing. According to interviewees the licensing models are not clearly defined for open data yet. From the interviewees’ experiences, many data providers are not aware of existing licensing solutions and do not pay enough attention to this issue when publishing their data. The most common option currently used is creative commons⁵. However, there are certain limitations of this option. To support open data practices and research data licensing models would need further development.

6. Discussion and Conclusions

The research question that we sought to answer in this paper was: how data service providers capture value? According to our findings, data service providers capture value through the following activities: consulting raw data providers about the possibilities of developing and publishing their data, transforming the data into linked open data, and developing applications on top of the data. Along performing these three activities of data development data service providers also help data providers to

⁵ <http://creativecommons.org/licenses/by/3.0/>

publish the data, which can happen at any stage of data development (Fig.1). During the discussion and verification of our results with interviewed service providers we received a comment that the data development process can include an additional stage – “data filtering” that refers to removing the pieces of data that contain private and other sensitive information from the datasets before publishing. Further research is needed to clear up this issue because the data collected at this phase was not sufficient to cover it.

Many unsolved issues remain in open data research and practice that future studies would need to address. Our focus is on open data business models. We plan to explore open data business model elements from the perspectives of different players who are involved in opening the data and converting it into formats suitable for and encouraging its reuse. Consequently our research contribution is a description of the mechanisms for capturing value by these different players. This particular paper studied the data service providers’ (linked data providers’ and application developers’) business models and their methods of capturing value. The next phase is focused on the same issues from data providers’ perspective. During the following stage we would like to go further and investigate other participants’ and stakeholders’ perspectives in open data related activities.

References

1. Al-Debi, M.M., El-Haddadeh, R., Avison, D. Defining the Business Model in the New World of Digital Business. In Proceedings of the 15th Americas Conference on Information Systems, Toronto, Canada (2008).
2. Berners-Lee, T.: Linked Data Design Issues (July 2006), <http://www.w3.org/DesignIssues/LinkedData.html>
3. Bizer, C., Heath, T., Berners-Lee, T. Linked Data – the Story So Far, to appear in: Heath, T., Hepp, M., and Bizer, C. (eds.). Special Issue on Linked Data, International Journal on Semantic Web and Information Systems, (IJSWIS). <http://linkeddata.org/docs/ijswis-special-issue>.
4. Chesbrough, H., Resenbloom, R.S.: The Role of Business Model in Capturing Value from Innovation: Evidence from Xerox Corporation’s Technology Spin-Off Companies, *Industrial and Corporate Change*, 11(3), 529-555 (2002).
5. Fink, M.. *Business and Economics of Linux and Open Source*. Prentice Hall, New Jersey (2002).
6. Fitzgerald, B.: The Transformation of Open Source Software, *MIS Quarterly*, 30(4), 587-598 (2006).
7. Halb, W., Stocker, A., Mayer, H., Mülner, H., Ademi, I.: Towards a commercial adoption of linked open data for online content providers. In Proceedings of I-SEMANTICS the 6th International Conference on Semantic Systems, Graz, Austria, (2010).
8. Huijboom, N., Van den Broek, T.: Open Data: an International Comparison of Strategies. *European Journal of ePractice*, 12, (March/April 2011), http://www.epractice.eu/files/European%20Journal%20epractice%20Volume%2012_1.pdf

9. Klein, H. K. and Myers, M. D.: A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems, *MIS Quarterly*, 23(1), 67-94 (1999).
10. Latif, A., Saeed, A.U., Hoefler, P., Stocker, A., Wagner, C.: The Linked Data Value Chain: A Light Weight Model for Business Engineers. In *Proceedings of I-SEMANTICS '09 International Conference on Semantic Systems*, 568—575, Graz, Austria (2009).
11. Lindman, J.: *Not Accidental Revolutionaries: Essays on Open Source Software Production and Organizational Change*. Doctoral Dissertation, Aalto University School of Economics, Helsinki, Finland (2011).
12. Lyons, K., Messinger, P.R., Playford, C., Niu, R.H., Stroulia, E. *Business Models in Emerging Online Services*. In *Proceedings of the 15th Americas Conference on Information Systems*, San-Francisco, US (2009).
13. Meyer, P.: *Episodes of collective invention*, working paper 368, US Department of Labor, Bureau of Labor Statistics, Washington, DC (2003)
14. Miller, P., Styles, R. Heath, T.: *Open Data Commons, a License for Open Data*, (22 April 2008), <http://events.linkeddata.org/ldow2008/papers/08-miller-styles-open-data-commons.pdf>
15. Morris, M., Schindehutte, M., Allen, J.: The Entrepreneur's Business Model: Toward a Unified Perspective, *Journal of Business Research*, 58, 726-735 (2006).
16. Osterwalder, A.: *The Business Model Ontology – a Proposition in Design Science Approach*, Academic Dissertation, Universite de Lausanne, Ecole des Hautes Etudes Commerciales (2004).
17. Osterwalder, A., Pigneur, Y. *An e-Business Ontology for Modeling e-Business*. In *Proceedings e-Reality: Constructing the e-Economy*, Bled, Slovenia (2002).
18. Pateli, A., G., Giaglis, G., M., *A Framework for Understanding and Analyzing eBusiness Models*, 16th Bled eCommerce Conference on eTransformation, Bled Slovenia, June 9-11, 2003.
19. Perens, B.: *The emerging economic paradigm of Open Source*. *First Monday* (10) Special issue 2: Open source (2005).
20. Poikola, A., Kola, P., Hintikka, K.: *Julkinen data*. Edita Prima Oy, Helsinki, Finland (2010), <http://www.julkinendata.fi/>.
21. Rajala, R.: *Determinants of Business Model Performance in Software firms*. Doctoral Dissertation, Aalto University School of Economics, Helsinki, Finland (2010).
22. Seaman, C. B.. *Qualitative Methods in Empirical Studies of Software Engineering*. *IEEE Transactions on Software Engineering*, 25 (4), 557-572 (1999).
23. Somus (Social media for citizens and public sector collaboration) project – final report (January 2011), <http://www.vtt.fi/inf/pdf/publications/2011/P755.pdf>.
24. Timmers, P.: *Lessions from eBusiness Models*, *ZfB – Die Zukunft des Electronic Business*, 1, 121-140 (2003).
25. Vargo, S. L., Lush, R. F.. *Evolving a services dominant logic*. *Journal of Marketing*, 68, 1-17 (2004).
26. Von Hippel, E., Von Krogh, G. (2003). *Open Source Software and the 'Private-Collective' Innovation Model: Issues for Organization Science*. *Organization Science*, 14, 2, March-April.

27. Xu, L., Brinkkemper, R. (2007). Concepts of product software. *European Journal of Information Systems*, 16, 531-541.

Appendix 1:

Interview guide for data service providers:

Offering:

1. What kind of Open Data related services does your company offer? Who are the customers? Who are the payers (providers of funding)? Who are the end users?
2. Do you use your clients' archives/your own collected data/third parties' data to develop your applications/services?
3. How is the data licensed?
4. When did you start offering OD related services to the market?

Resources:

5. What resources (tangible/intangible) do you use for creating/developing OD related services? (HR, raw data, anything else?)
6. Where do you get these resources from? For example, data: clients, third parties, online communities – raw data; HR: own employees, outsourcing, communities.

Relationships:

7. Who are your key partners in creating OD related services? (partners: organizations, institutions, persons from whom you get the resources necessary to provide OD services)
8. What are your relationships with these partners? What are you giving and what you are taking (resources) and to/from whom (actors) in order to provide OD services?

Revenue model:

9. How much of the total revenues are OD related services? What is the main source of revenue among OD related services?
10. How the services are priced/any special model?
11. How are the services paid for? (Project payment, hourly basis ect.)
12. Do you have any extra costs related to OD services creation?

Appendix 2:

Table 2. Findings. Empirical evidence.

	Consulting	Conversion / Publishing	Application
Offering	<p>“The first step is consultation... you need to look at what do they need, how do they need it, processes and so forth”.</p> <p>“one part of our work is to provide the ideas and concepts ... tell them there's a possibility, you can go there and we can help with that”</p> <p>“we offer consultancy for those, who would like to know more about opening their data resources, and would like to connect with developer community.”</p>	<p>“The second would be ... either converting the existing data into OD format or make sure that they generate or start to generate that it will become open data.”</p>	<p>“Third step is to apply this open data.”</p> <p>“... I think it's the service providers, they'll develop the services for the consumers, customers.”</p> <p>“it might be surprisingly big that the party who opens the data, they might develop for themselves internal tool because the data will be available from the other departments to use”</p> <p>“In my mind by opening and publishing the data you provide interoperability with other parties and departments also.”</p>
Resources	<p>“mostly I offer my own time and knowledge as consultancy.”</p> <p>“I do this as it is interesting and I try to keep updated in what's going on. Then, I hope I can sell my consultancy and get paid by keeping myself updated.”</p>	<p>“The projects that we have done so far, mostly take databases from the clients themselves...”</p> <p>“there are many data sources that are monopolized for the governmental offices, like weather data for example and statistics of all sorts”.</p> <p>“if some data is gathered and they see that there is value for that... all companies, all organizations are possible providers of data.”</p> <p>“For us it's quite natural since the semantic web technology is very well applicable for LOD. It can be seen as the core of linked data. In that sense we are well positioned from the knowledge and expertise point of view.”</p>	<p>“... we have a lot of quite interesting use cases, which is a very good fit with the technology.”</p>

Relation- ships	<p>“FloApps will do the consultation, Mysema - conversion, and then we do the applications again. But if we are looking at other clients outside of the seminars [that FloApps and Mysema organize together], then we will most likely offer our skills ourselves.”</p> <p>“in different projects we do lots of things together with other people and sometimes we can hire somebody for a short term”</p>	<p>“There is now that project from Eero Hyvonen [Aalto SCI]. He is trying to start up the big project right now and we would participate in that ones it kicks off.”</p> <p>“Very good demonstrations or pilots were made by Eero’s group ... Eero’s team can accelerate the market with their demos.”</p> <p>“if the work [converting] turns out to be much more [than FloApps could do themselves] then we’ll definitely, most likely contact them [Mysema] first. As we know their expertise and we have worked together already.”</p>	<p>“Someone provides the data and all the hundred companies who utilize the data need to provide the same processing and there are updates. To what level of quality the parties who publish the data will [set] the de facto standard, will there be any?”</p> <p>“The lower the level the more work is needed from the utilization side from the service providers. If the quality of the data is on the 5th level then it is much less work and it is much more tempting and appealing to use it from the software developer’s point of view... But the question is how much is invested from the publisher’s point of view.”</p>
Revenue model	<p>“I would say some daily price but what daily price it might differ from project to project.” “Usually it is one payment. The projects are not that big to be divided.”</p>	<p>“we need to understand what we are doing and once we understood then we can define the budget with some variation.”</p> <p>“We try to charge only hourly basis ... but usually you have to have some sort of an estimate to the client.”</p> <p>“We did have an estimate [for one project], but still we went above that estimate and that largely came from the whole thing being a learning experience.”</p> <p>“Partly consciously we were trying to find our own niche which is more added value layer, the visualization layer, we are not that much interested in this hardcore data, which is Mysema much more better at.”</p>	<p>“I think the added value comes from having more clever people look at it. Like in HS case the journalists don’t have the skills, none of them have the skills to use that vaalikone data, which is more than 0,5GB this material is huge, they don’t know how to deal with the data. In their case the added value comes from outsiders being more apt at doing that... There were lots of technical stuff that the journalists were not able to deal with.”</p> <p>“Usually some value would be if there is some hacker creating an application. He makes a great iPhone app and he gets this money.”</p>

Literature review on open-source platforms

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Abstract. This paper aims at reviewing literature contributions addressing the open-source platforms empirical phenomenon. It starts by carefully defining what open-source platforms are, followed by a detailed design of the employed methodological strategy. Unfortunately the literature review is not completed yet, the author seeks for criticism on its proposed open-source platform definition, and more importantly, on the methodological issues guiding this research

Keywords: Open-source, FLOSS, Standards, Platforms, Technology strategy, Literature review

1 Introduction

1.1 The evolution of the open-source term

The open-source phenomenon has been capturing the attention of both researchers and practitioners for more than two decades. Even if new in novelty, the phenomenon keeps itself continuously persistent fomenting intense debate over its theoretical and practical implications. For a better understanding of the phenomenon, it is important to dive into its historical developments that shaped the phenomenon's evolution.

In 1985, Richard Stallman founded the Free Software Foundation promoting a new philosophical idea of freedom in software. The foundation, still very active today, promoted that software could run freely and that correspondent software source code could be studied, changed, copied, published and distributed also freely.

Four years later, the Free Software Foundation introduced the General Public License (GPL), a license type used by software developers to regulate the distribution of free and open-source software (FLOSS). Its adoption supported Stallman's idea of free or open software in an ethics base over business interests.

Almost a decade after, the term open-source was coined in 1998 with the announcement from Netscape in publishing the source code of its popular web browser (Woods and Guliani 2005). However, even if based on the publicly released code, the company continued to sell its product by traditional manners. Netscape circumvented GPL by publishing its browser code in the Netscape Public Licence

(NPL) that allowed Netscape to use community code contributions in their proprietary versions of the program (Mozzila 1998).

In 2001, by looking at the first free operating system knew as GNU/Linux, Raymond (2011) reported a totally new way of developing software by making use of thousands of volunteer developers collaborating over Internet in a distributed “organization” towards a common goal. The researcher argued several points where open-source software development could beat the traditional hierarchical and controlled way of developing software.

By 2006, after many years of steady growth in popularity of open-source Huurinainen et al. (2006) pointed out that the term “Commercial Open-Source Software” was being user by traditional software companies such as Microsoft. This new open-source term pointed to hybrid software products where part of the code is open and part proprietary; this allowed companies to offer their own products under the same license fee based model as before, while getting the benefits of open-source code without having to pay a license fee on that. This was far from the original ethical ideas originated by Stallman, but the growing number of companies that wanted to be associated with open-source software gave even more visibility to the phenomenon.

As previously described, the open-source term evolved over time, moreover it started being used outside the software development context. To advance our communication and understanding, the author following clarifies its own open-source definition that set the boundaries of this literature review.

1.2 The open-source definition

The Free Software Foundation (FSF) maintains a free-software definition aimed at clarifying what must be true about a particular software program for it to be considered free-software (Free Software Foundation, 2011). The definition is based on a set of freedoms expressed by Stallman (1986) that the foundation review from time to time for clarification purposes. The following Table 1 captures the mentioned free-software freedoms, it is important to state that access to source-code is a precondition for both freedom 1 and freedom 3 .

Table 1. The freedoms in free-software definition (source: Free Software Foundation, 2011)

Freedom 0	The freedom to run the program, for any purpose.
Freedom 1	The freedom to study how the program works, and change it to make it do what you wish. Access to the source code is a precondition for this.
Freedom 2	The freedom to redistribute copies so you can help your neighbor.
Freedom 3	The freedom to distribute copies of your modified versions to others. By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

Thanks to the efforts from Free Software Foundation, the definition of what is free-software is well known and rare debate is observed on the issue. However, the

definition of what is open-source software its more abstract and it raised intense debate from its beginning. For the good of the open-source community, the Open Source Initiative (OSI) was founded by Eric Raymond in 1998 to develop and maintain a more commonly agreed open-source definition.

The open-source definition (OSD), based on a social contract from the Debian Linux distribution developers (Debian 1997), is based on a criterion that a software must comply with to comply with for it to be considered open-source software. The OSI organization, as a California-based public benefit organization review and approve licensees as OSD-conformant (Karjalainen 2010). Major organization such as MIT, IBM and Nokia provide software licenses approved by OSI (Open Source Initiative 2011).

The OSD criterion set, freely available at the OSI official Internet address at <http://www.opensource.org/>, is included in the Appendix A of this literature review. The Table 2 briefly lists the criteria, that map until a certain extend the freedoms stated by FSF. According Stigge, (2007) the most important points within open-source and free-software views are the same: while FSF focus on simplicity of the definition, OSI elaborates further on political aspects like the prevention of discrimination of persons, groups or fields of endeavor.

Table 2. The OSI definition criteria of open-source software (source: Open Source Initiative 2011).

Criterion 1	Free redistribution
Criterion 2	Source code
Criterion 3	Derived works
Criterion 4	Integrity of author's source code
Criterion 5	No discrimination against entities
Criterion 6	No discrimination against fields of endeavor
Criterion 7	Distribution of license
Criterion 8	License must not be specific to a product
Criterion 9	License must not restrict other software
Criterion 10	License must be technology-neutral

It is important to refer that the connection between open-source software and standards is very close, as reported by Detrick and West (2003) and Rinaudo et al. (2007). For the OSI organization, a standard by definition is not open enough to be built under an open-source license, however they provide an open standards requirement for open-source software (Open Source Initiative 2011). The Table 3 captures the criteria that an open-standard must meet to not be discriminating against open source developers.

Table 3. The OSI criteria for standards complaint with open-source (source: Open Source Initiative 2011).

Criterion	Explanation
Non intentional secrets (I)	The standard must not withhold any detail necessary for interoperable implementation. As flaws are inevitable, the standard must define a process for fixing flaws identified during implementation and interoperability testing and to incorporate said changes into a revised version or superseding version of the standard to be released under terms that do not violate this criteria.
Availability (II)	The standard must be freely and publicly available (e.g., from a stable web site) under royalty-free terms at reasonable and non-discriminatory cost.
Patents (III)	All patents essential to implementation of the standard must be licensed under royalty-free terms for unrestricted use, or covered by a promise of non-assertion when practiced by open source software.
No agreements (IV)	There must not be any requirement for execution of a license agreement, NDA, grant, click-through, or any other form of paperwork to deploy conforming implementations of the standard.
No incompatible dependencie (V)	Implementation of the standard must require any other technology that fails to meet the criteria of this Requirement.

According to Perens (1999). open-source concerns not only software source code but also the distribution terms of software, as visible in the previous presented FSF and OSI free and open-source software definitions. The author believes that both FSF and OSI definitions address very well the public with both expertise in software development and software license agreements, however the more general public could reveal difficulties in understanding the open-source term.

Addressing it, an in the scope of this literature review, the author tries to provide a more abstract definition based in tree criteria mapping the definition works from FSF and OSI. Those criteria: source-code availability, user-empowerment and standards-compliance are briefly presented in Table 4 that maps each criteria to the original ideas from FSF and OSI.

Table 4. An abstracter open-source definition for a literature review on open-source platforms (source: author).

Criterion	Description	FSF mapping	OSI mapping
Source-code availability	Software source-code is available upon request.	Freedom 1 Freedom 3	Criteria 2 Criteria 4
User-empowerment	Software license empowers user rights and absents user lock-in mechanisms.	Freedom 0 Freedom 2	Criteria 1 Criteria 3 Criteria 5 Criteria 7 Criteria 8
Standards-compliance	The Software privileges the use of standards that enable interoperability.	Freedom 0	Criteria 6 Criteria 9 Criteria 10

For an easier understanding of the proposed tree criteria, the author will here explore the popular open-source software open-office, an office productivity suite freely available on the Internet at <http://www.openoffice.org/> that competes with the popular and expensive Microsoft Office. According Karjalainen (2010) a Finnish large governmental organization obtained considerable benefits with a large-scale migration to this open-source office suite.

In accordance to our first proposed criterion, the availability of software source-code, the open-office project keeps an up-to-date source-code repository available on the Internet at <http://download.openoffice.org/source/index.html>, allowing any interested user to easily browse and downloaded to product source-code. A set of comprehensive open-office development documentation is also provided allowing users to better digest this office suite “blue-print”.

Regarding the user empowerment criterion, this open-source office-suite can be downloaded and modified for free without any associated contractual agreement. Moreover it encourages user participation on the maintenance and future developments of the product. When comparing open-office with its rival Microsoft Office, its salient a higher number of export formats supported by the open-source suite giving the idea Microsoft office-suite is the only one carrying out the information and databases lock-in mechanism as described by Shapiro and Varian (1999).

Finally, regarding the use of standards, the open-office default file format, entitled “OpenDocument” is a standard developed by a technical committee under the OASIS industry consortium, moreover it was approved for release as a ISO and IEC International Standard (International Organization for Standardization 2006). The Microsoft competitor default format is intellectual property of the vendor.

1.3 The growing economic impact of open-source software.

In recent years, the echoes of open-source software development attracted the interest of economic scholars. The economists Josh Lerner and Jean Tirole (2001) made a preliminary exploration of the economics of open-source by assessing the extent to which economics literature on “labor economics” and “industrial organization theory” could explain the open-source phenomenon. The mentioned research brought some answers on what motivate open-source developers, compared the different programming incentives between open-source and proprietary settings and highlighted the favorable organizational and governance characteristics for open-source production.

However, the economists research raised many new research questions related to open-source software on the technological characteristics that are conducive to a smooth open-source software development, on the optimal licensing for open-source software, on the coexistence of open-source and proprietary software and on the transposition of the open-source process to non-software industries. All these research questions were further explored, for instance, Anna Paajanen (2007) developed a multiple case study on the licensing for open-source software while Andrea Bonaccorsi and Cristina Rossi (2003) discussed the coexistence of open-source and proprietary software.

A research with economics-lenses on the influence of open-source software on the software industry business patterns was conducted by Juho Lindman (2004). The author combined existing literature on the history and nature of the open-source phenomenon together with wider discussions on the software industry strategy and its business models. Following a narrative approach on the phenomenon the researcher revealed a change on the competitive environment, a change on customers expectations and centered attention on the importance of competence and platform thinking.

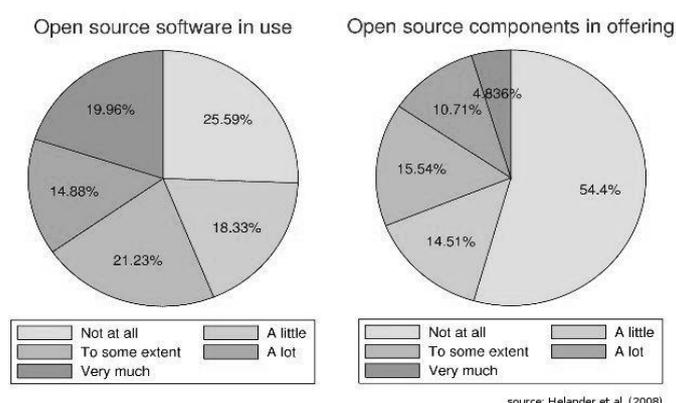
Regarding the changes on the competition environment, the researcher stated that existing proprietary software cannot compete in a long run against open-source, forcing incumbents to fight the open-source initiatives using different tactics such as the use of targeted media marketing tactics, introduction of different lock-ins and copyright lawsuits. The same author identified those customers expectations, linked to the change on the competition environment, need enhancements on the credibility and quality of open-source.

The researcher also discussed that in a society moving towards a knowledge based economy, where markets turn from products to services, different competencies will be needed by open-source developers and the role of software platforms as “market makers” will evolve. This will force the open-source project teams to divest its expertise on software development to other areas related with software and services delivery i.e., software services marketing or software integration capabilities.

Perhaps some of the clearest evidences illustrating the growing economic impact of open-source are the results of a survey on the Finnish open-source software business conducted by Nina Helander, Mikko Rönkkö and Mikko Puhakka (2008) that provides an estimate of the degree of use of open source software in the Finnish software industry, a strong industry that accounted a revenue of 1,52 billion Euro in the 2007 fiscal year. According to the 2008 survey results, 75% of the studied firms

were using open-source software, a enormous increase since only approximately 13% of the firms were using open-source software according an analogous survey in year 2000.

The Fig. 1 captures on what extend Finnish software firms use and offer open-source software, the high usage of open-source software together with the considerable number of open-source components offered to the market by companies reveal a fast increasing of open-source phenomenon withing the Finnish software business. The research author closes now a background introduction to the open-source phenomenon and he now expresses its vision of platforms in the following section.



source: Helander et al. (2008)

Fig. 1: Open-souce use and offering among Finnish software industry

1.4 Computer-based platforms

The platform term is conceptually abstract and widely used across many fields. Within this research, the platform term maps the concept of computer-based platform as in Morris and Ferguson (1993), Bresnahan and Greenstein (1999) and West (2003). As mentioned by West (2003) a platform consists of an architecture of related standards, controlled by one or more sponsoring firms. The architectural standards typically encompass a processor, operating system (OS), associated peripherals, middleware, applications, etc.

Platforms can be seen as systems of technologies that combine core components with complementary products and services habitually made my a variety of firms (complementors). Jointly the platform leader and its complementors form an “ecosystem” for innovation, that increases platform's value and it consequent users adoption (Gawer and Cusumano 2007). For instance, the current leaders of the video games industry, operate by developing the hardware consoles and its peripherals while providing a programmable software platform that allows complementors to develop games on top of their systems. Attracting more game developers to the platform, means more and better games, an increase of value for the final users (video game players).

In recent years, high-tech industries have become platform battlegrounds. Examples include, the digital media players (Apple versus Microsoft and Real), the video game consoles (Sony versus Microsoft and Nintendo), the enterprise software (SAP versus IBM, Oracle and Microsoft), online payment services (PayPal/eBay versus Sony, Microsoft and credit card companies) among many other wars (Gawer and Cusumano 2007).

Based on a case study analysis of the Japanese computer and consumer electronics industries, Hagi (2005) claims that those firms are organized around two-sided platforms with software at their core. The author identifies that within the computer, video-game and PDA industries, the main platforms are currently either pure software platforms (such as the Linux operating systems) or integrated hardware-software platforms (such as the Sony Playstation). The same author claims that the smartphone industry make the difference with two software platforms sitting on top of each other (a layer related to device's operating system and other is related with network operators services). The Fig. 2 captures Hagi's two sided platforms with several hardware and software layers.

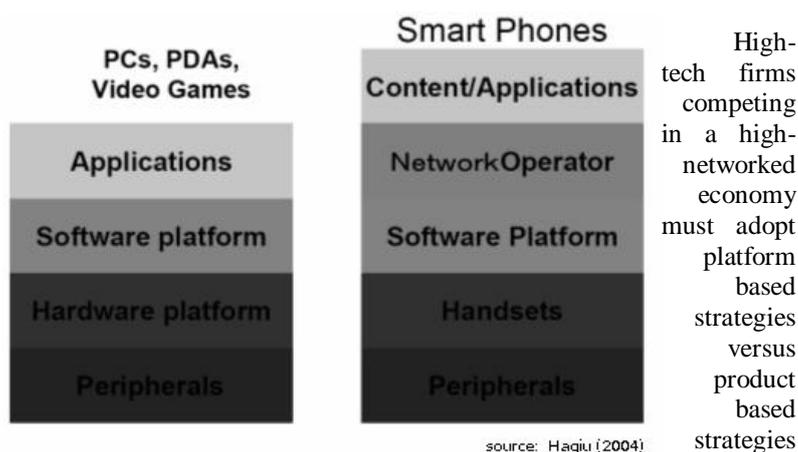


Fig. 2: Platform layers in PCs, PDAs, Video games and Smartphone

of satisfying by themselves an exceedingly and complex consumer demand. Hagi (2004), in a column dedicated to the software platforms in Japan's high-tech computer based industries, illustrates the fact that providing all the products demanded by consumers is neither necessary nor sufficient for achieving success.

The author remarks that an "all in house" strategy is not economically visible in most of the cases and expressly recommend firms to focus efforts on the highest value-added components of the platform, making it attractive to all market participants, and let the market to supply the needed complementary products. The previously cited column refers the failure of the telecommunications third-generation platform Vizzavi, a joint venture between Vodafone and Vivendi, that relied on exclusively on in-house content provided by Vivendi Universal.

Gawer and Cusumano (2007), in a strategy article pointed to firms pursuing a platform leadership, highlight the key economic role of platforms as “engines of innovations”. The strategy researchers claims that there is a shift from a vision narrowly limited to products or services with functional uses, to a new one fuelled by continuous innovation brought by third-parties.

Within this research, the author addresses literature on open-source computer-based platforms; meaning that computer-based platforms that are both built on top of open-source components and provided with a set of open-source components are investigated. The Maemo open-source platforms sponsored by the mobile devices manufacturer Nokia available on the Internet at <http://www.maemo.org> is an example of such platform: Most of architectural components were integrated from the open-source community and most of the packages delivered by the platform are released by open-source manners.

This research aggregates and exposes literature that combines knowledge on both open-source and computer based platforms. Following, the author provides more details on the goals, methodology and design considerations that guided this literature review.

2 Research Methodology and Design

2.1 Research goals and methodological base

Primarily, by conducting this structured literature review the author aims to provide an aggregated vision of what is well known within the academia regarding open-source platforms. Secondly, he benefited personally from this literature review: first by increasing his breadth of knowledge on the research topic; secondly by identifying seminal works on the area; and finally by identifying other authors sharing the same research interests. All important contributions that will outline authors doctoral research.

This structured literature review took in consideration methodological issues provided by vom Brocke et al (2009), Kitchenham et al., (2009), Okoli and Schabram (2010), Järvinen (2008) and Webster and Watson (2002). Maximum transparency and rigor in documenting the literature review process, use of a systematic and future reproducible procedure were some of the base-pillars of this literature review on open-source platforms.

The literature review was performed between the second of November 2010 and the first of April 2011 under the scope of author's doctoral studies in information systems science in Turku schools of Economics. The author had previously reviewed literature on the topic, however by unstructured manners and not taking in account the scientific rigor of different sources. This literature review aims at favoring relevance and rigor by only considering rigorous peer-reviewed sources.

2.2 Design and research basis

The author followed from very close the literature review design from von Brock and Theresa (2011). The author carefully defined a research basis that guided how the literature was collected. As in von Brock and Theresa (2011), the author made use of Emerald, EBSCO and ProQuest ABI/Inform databases of general journals and conferences; plus the use of Google books index on published books; and finally the use of the eLibrary system from the Association of Information Systems (AIS) as a database indexing more specific journals and conferences within Information Systems field.

The author decided to complement von Brock and Theresa (2011) research basis by including the Doria.fi and Dissertation.se databases that index academic dissertations by Nordic intuitions. The author strongly believes on the quality of such publications, and made use as well of the Volter database that index books withing a large Finnish libraries network. The Table 5 summaries database sources from where the literature was collected. All databases were reached using the Turku University Internet proxy zproxy.utu.fi:2048/ even if accessed remotely.

Table 5. Database sources used for conducting the literature review (source:author).

Source	Type	Website http://
Emerald	General journals and conferences	emeraldinsight.com
EBSCO	General journals and conferences	web.ebscohost.com
ProQuest ABI/ Inform	General journals and conferences	search.proquest.com
Google book	Published books.	books.google.com
AIS eLibrary	Information Systems journals and conferences	aisel.aisnet.org
Doria	Nordic academic dissertations	doria.fi
Dissertation	Nordic academic dissertations	dissertation.se
Volter database	Published books.	volter.linneanet.fi

As previously mentioned this research aims to assess existing literature that combines knowledge on both open-source and computer-based platforms. Previous author knowledge on the open-source and computer-based platforms, reinforced with author discussions within its academic circle influenced the choice the terms used to search for literature addressing open-source platforms.

Addressing the open-source term, the keywords “open source”, “open-source”, “OSS”, “FLOSS” and “libre” were used within the search procedure. Moreover, for capturing relevant literature within computer-based platforms the keywords “platform”, “platforms”, “platform-based”, “eco system”, “eco systems”, “eco-system” and “eco-systems” were employed.

The decision of using several keywords benefited on the output of relevant research captured after the literature search process, however it increased the complexity during the search process: The high number of keywords forced the author to re-execute the same query several times just by changing keywords referring to the same terms. With five keywords for open-source and seven keywords for computer-based platform, the author was required to run 35 different queries within each specific database.

The author dropped captured publications that after an careful content analysis did not seem relevant to the Information Systems field . The Fig. 3 provides an overview of the research scope on open-source computer-based platforms within the Information systems field. Several captured publication been discarded by not fitting with this literature review adopted definition of open-source and platforms.

The author limited its search to peer-reviewed publications, several published books and journal articles were discarded by not clearly demonstrating any evidence of passing by a peer-reviewed process. The author also limited its search to research expressed in the English-language, however he keeps to option of expanding the search to other languages in future research.

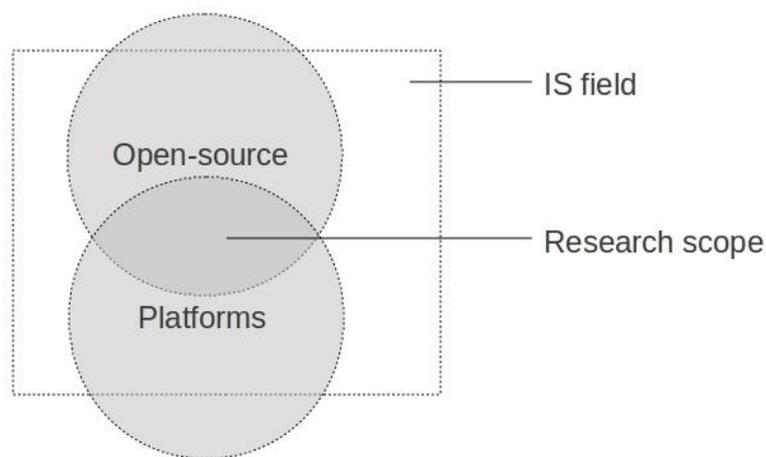


Fig. 3: The literature review scope (source: author).

Our research basis (α) was defined by searching, within the mentioned source databases, for publication items with keywords capturing open-source and platforms on their titles. An initial set of 15 publications was defined as our starting point research basis. From the 15 publications were books, two conference proceedings and the remaining serial journals.

After an extensive analysis of the research basis, the author decided to extend the research (β) by searching for publication items with keywords capturing open-source on their titles and with keywords capturing platforms on the abstract. An amount of 360 new publication items were captured with this first research extension. For future research, the author considers the possibility of extending the research to include other publications with platforms on the title and open-source on the abstract.

The Table 6 gives an overview on how the captured research publications were retrieved by each of the eight source databases. A considerable number of collisions, publications indexed more by different databases, was encountered. Books and dissertation databases were not considered in our research extension because books databases do not support queries addressing a possible book abstract.

Table 6. Number of captured research publications per database source (source:author).

	EME	EBS	PQA	GOB	AIS	DOR	DIS	VOL
α (title CONTAINS (open-source AND platforms))	0	3	5	6	1	0	0	0
β ((title CONTAINS open-source) AND (abstract CONTAINS platforms))	1	24	318	QNS	2	QNS	0	QNS
Total captured items per database source	1	27	323	6	3	0	0	0

2.3 Extraction and categorization of literature

In order to provide both a quantitative and qualitative overview of relevant research of open-source platforms within the Informations Systems field, the author extracted and categorized literature according its description and content. To keep the process simpler, the author conducted first a simpler categorization of the literature without looking at its content, focusing later on extracting and categorizing each publication by reviewing its content.

Within Table 7 describes the information extracted and categorized by using meta-descriptions of each captured paper. Not all non-content information was available within the used sources databases, requiring visits to the different publishers Internet resources. For each captured paper, a citation analysis was made using both <http://scholar.google.com> and <http://www.isiknowledge.com> web resources. An example on how Loebbecke and Angehrn (2003) non-content information was extracted and categorized, is provided on the third column.

The author decided to keep track of each captured research paper price, if applicable: both the payment amount charged by the publisher to download the paper and the yearly subscription rate for a non US-based academic organization. The first was mostly obtained by using the <http://b-on.pt/> Internet resource, but the second required an extensive to each paper publisher Internet site.

Table 7. Non-content extraction and categorization of each captured publication (source: author).

Information	Description	Example
Found item	Captured publication identifier with authors name and year.	Loebbecke and Angehrn 2003
Internet link	Internet link pointing to the captured publication.	http://aisel.aisnet.org/ecis2003/89/
DOI	Digital Object Identifier if available.	-
Authors	Authors names.	[Claudia Loebbecke;Albert Angehrn]
Year	Publication publishing year.	2003
Date	Publication publishing detailed date.	-
Organization	Organization hosting the captured research authors.	[University of Cologne;INSEAD]
Country	Country hosting author's organization.	[Germany;France]
Title	Captured publication title.	Open Source Platforms Under Co-competition
Subtitle	Capture publication subtitle.	A Comparative Analysis of SourceForge and 'CodeX' (Xerox) ...
Journal?	Captured publication on a journal ?	0
Conference?	Captured publication on a conference ?	ECIS
Book ?	Captured publication on a book ?	0
Nordic these?	Captured publication is a academic these produced within the Nordics ?	0
Found 1st db	Database where the publication was firstly found, from Table 5 .	AIS
Citations 1st db	How many works cite the captured publication according to the database where its was firstly found?	NA
Citations GS	How many works cite the captured publication according to google scholar ?	3
Citations ISI	How many works cite the captured publication according to ISI WoN ?	NA
Price individual	Price of the captured publication item for individual non-affiliated readers.	0
Price year sub	Price the publication serial yearly subscription for a non-USA organization.	0
Download page	Internet link from where the publication was downloaded by the author.	http://www.informatik.unitrier.de/~ley/db/conf/ecis/ecis2003.html
Team description	Do we have single author or an unknown, within-in-organization, continental or inter-continental collaboration of author?	Continental collaboration

In order to provide a qualitative overview of the literature review, the author performed a demanding analysis of the each captured paper content, identifying key information such as research question, methodology, theoretical implications among others. The Table 8 describe information extracted and categorized by analysis each paper. An example for Loebbecke and Angehrn (2003) is also provided.

Table 8. Content extraction and categorization of each captured publication (source: author).

Information	Description	Example
Found item	Captured publication identifier with authors name and year.	Loebbecke and Angehrn 2003
Content available	Was it possible to access to the content using UTU library resources ?	Yes
Research question	What are the captured publication research question ?	[What are the motivations for individuals and organizations to participate in open-source projects; What mechanisms of leaderships, governance and decision making are implemented?;How is the collaboration dimension managed by the different members?; How is the competition dimension managed by the different members?]
Research trigger	Who is the main sponsor/financier of the capture research ?	[Host;EU funded 'eFactors' and 'Knowlaboration']
Research summary	Within a single text line, summarize the captured research content.	This paper examines two open-source repositories/platforms from a 'Co-opetitive Learning and Knowledge Exchange Networks' (CoLKENS) point of view.
Theoretical research implications	What are the contributions of the captured research to the body of theoretical knowledge?	Detail co-opetition strategies from SourceForge and CodeX
Practitioners implications	What practitioners benefit from this research?	Detail co-opetition strategies from SourceForge and CodeX
Future research	What future research actions could or should be taking in the future according to the captured research?	[More on how open-source platforms evaluate and manage competition?; What collaboration tools and mechanisms?;Development of a research framework for weighing off the advantages of collaboration against the potential downside of competition]
Methodology	Within a single text line, detail the methodology employed within the captured research.	Inductive case study approach with cross-case analysis of two different cases

Qualitative versus quantitative	Should the paper be classified as qualitative, qualitative or mixed ?	Qualitative
Theoretical relevance	What is the perceived theoretical relevance of the captured research ? Null, low, medium or high.	Low
Empirical relevance	What is the perceived empirical relevance of the captured research ? Null, low, medium or high.	Medium
Related industry verticals	What empirical industry vertical are mostly impacted by the captured research.	Any hosting software development activities.
Related platforms	What “real-world” computer-based platforms are addressed by the captured research ?	[SourceForge;CodeX (Xerox)]
Related items	Does this captured publication relates with other found items within this research ?	None

Analysis of open-source platforms research key contributions

Unfortunately the literature review is not completed yet. From 360 articles collected, 121 articles were digested, extracted and categorized. The author looks for feedback on the methodological issues that are guiding this literature review.

4 Contributions

The author aims to contribute academia with new definition of open-source software based on tree simpler criteria and an aggregated overview of academic literature on open-source platforms.

References

1. Bonaccorsi, A. & Rossi, C., 2004. Altruistic individuals, selfish firms? The structure of motivation in Open Source software. *First Monday*, 9(1).
2. Bresnahan, T.F. & Greenstein, S., 1999. Technological Competition and the Structure of the Computer Industry. *The Journal of Industrial Economics*, 47(1), 1-40.
3. vom Brocke, J. et al., 2009. Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. In *17th European Conference On Information Systems*. Verona, pp. 2206–2217.
4. von Brocke, J. & Theresa, S., 2011. Culture in Business Process Management: A Literature Review. *Business Process Management Journal*, 17(2). Available at: [Accessed March 12, 2011].
5. Debian, 1997. Debian Social Contract (version 1.1). Available at: http://www.debian.org/social_contract#guidelines [Accessed March 29, 2011].
6. Dedrick, J. & West, J., 2003. Why firms adopt open source platforms: a grounded theory of innovation and standards. In *Proceedings of the MISQ Special Issue Workshop: Standard Making: A Critical Research Frontier for Information Systems*. Seattle. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.5.2634&rep=rep1&type=pdf>.
7. Ferguson, C.H. & Morris, C.R., 1993. *Computer Wars: How the West Can Win in a Post-IBM World*, NY, USA: Times Books New York.
8. Free Software Foundation (FSF), 2011. The Free Software Definition (version 1.92). Available at: <http://www.gnu.org/philosophy/free-sw.html> [Accessed March 29, 2011].
9. Gawer, A. & Cusumano, G., 2008. How Companies Become Platform Leaders -. *MIT Sloan Management Review*, 49(1), 28-36.
10. Hagi, A., 2005. A General Perspective on Multi-Sided Software Platforms and the Japanese Computer and Consumer Electronics Industries. *Keizai Sangyo Journal - Research & Review*. Available at: <http://www.rieti.go.jp/en/papers/research-review/023.html> [Accessed April 1, 2011].
11. Hagi, A., 2004. Japan's High-Technology Computer-Based Industries: Software Platforms Anyone? *Columns FY*, (149). Available at: http://www.rieti.go.jp/en/columns/a01_0149.html [Accessed April 1, 2011].
12. Huurinainen, J. et al., 2006. *Motives, Circumstances and Driving Forces for Open Innovation: Using Open Source to run profitable business*, Lappeenranta University of Technology, Department of Industrial Engineering and Management. Available at: http://kouvola.lut.fi/file/lid1271/files/attachment/ResearchReport_174-20071106.pdf.
13. International Organization for Standardization (ISO), ISO/IEC 26300:2006 - Open Document Format for Office Applications (OpenDocument) v1.0. Available at: http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=43485 [Accessed April 1, 2011].
14. Karjalainen, M., 2010. *Large-scale migration to an open source office suite: An innovation adoption study in Finland*. Academic dissertation. Tampereen yliopisto. Available at: <http://acta.uta.fi/english/teos.php?id=11357>.
15. Kitchenham, B. et al., 2009. Systematic literature reviews in software engineering - A systematic literature review. *Information and Software Technology*, 51(1), 7-15.

16. Lerner, J. & Tirole, J., 2005. The Economics of Technology Sharing: Open Source and Beyond. *Journal of Economic Perspectives*, 19(2), 99–120.
17. Lindman, J., 2004. *Effects of open-source software on the business patterns of software industry*. Master's Thesis in Information Systems Science. Helsinki School of Economics. Available at: <http://pascal.case.unibz.it/retrieve/2316/lindman.pdf>.
18. Loebbecke, C. & Angehrn, A., 2003. Open Source Platforms Under Co-opetition: A Comparative Analysis of SourceForge and 'CodeX' (Xerox) as Two 'Co-opetitive Learning and Knowledge Exchange Networks. In *ECIS 2003 Proceedings*. ECIS. Available at: <http://aisel.aisnet.org/ecis2003/89/> [Accessed March 13, 2011].
19. Mozilla, 1998. Netscape Public License (version 1.0). Available at: <http://www.mozilla.org/MPL/NPL-1.0.html> [Accessed March 29, 2011].
20. Okoli, C. & Schabram, K., 2010. A Guide to Conducting a Systematic Literature Review of Information Systems Research. *Sprouts: Working Papers on Information Systems*, 10(26). Available at: <http://sprouts.aisnet.org/10-26> [Accessed February 19, 2011].
21. Open Source Initiative (OSI), 2011a. Licenses approved by OSI. Available at: <http://www.opensource.org/licenses/alphabetical> [Accessed March 29, 2011].
22. Open Source Initiative (OSI), 2011b. Open Standards Requirement for Software. Available at: <http://opensource.org/osr> [Accessed March 29, 2011].
23. Open Source Initiative (OSI), 2011c. The open-source definition (version 1.9). Available at: <http://www.opensource.org/docs/osd> [Accessed March 29, 2011].
24. Paajanen, A., 2007. *Open source software license decisions*. Master Thesis in Information Systems Science. Helsinki School of Economics. Available at: http://www.itea-cosi.org/modules/docmanager/get_file.php?curent_file=10&curent_dir=2.
25. Perens, B., 1999. The Open Source Definition. In *Open Sources: Voices from the Open Source Revolution*. O'Reilly Media, Inc., p. 280.
26. Pertti Järvinen, 2008. *On developing and evaluating of literature review*, Tampere: University of Tampere. Available at: www.cs.uta.fi/reports/dsarja/D-2008-10.pdf.
27. Raymond, E.S., 2001. *The Cathedral and the Bazaar: Musings on Linux and Open Source by an Accidental Revolutionary*, O'Reilly & Associates, Inc.
28. Rinaudo, F., Agosto, E. & Ardissonne, P., 2007. Gis and web-gis, commercial and open source platforms: general rules for cultural heritage documentation. In *Proceedings of the XXI International CIPA Symposium*. CIPA 2007. Athens.
29. Shapiro, C. & Varian, H.R., 1999. *Information rules*, Harvard Business School Press Boston, Mass.
30. Stallman, R., 1986. What is the Free Software Foundation? *GNU's Bulletin*, 1(1). Available at: <http://www.gnu.org/bulletins/bull1.txt> [Accessed March 29, 2011].
31. Stigge, R., 2007. 24 Common Misconceptions about Open Source Software. *ECE News*, 09(07). Available at: <http://www.rolandstigge.de/track/>.
32. Webster, J. & Watson, R., 2002. Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly*, 26, 13-23.
33. West, J., 2003. How open is open enough? Melding proprietary and open source platform strategies. *Research Policy*, 32(7), 1259.
34. Woods, D. & Guliani, G., 2005. *Open Source for the Enterprise Managing Risks Reaping Rewards*, O'Reilly Media, Inc.

Appendix A: The OSI definition criteria of open-source software

Criteria	Criteria description
Free redistribution	The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.
Source code	The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.
Derived works	The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.
Integrity of author's source code	The license may restrict source-code from being distributed in modified form only if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.
No discrimination against entities	The license must not discriminate against any person or group of persons.
No discrimination against fields of endeavor	The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research
Distribution of license	The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.
License must not be specific to a product	The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.
License must not restrict other software	The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.
License must be tech neutral	No provision of the license may be predicated on any individual technology or style of interface.

Between the Citizens and the Web Pages is the Classification

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Abstract. The call centre of a large public agency is studied. The call centre advisors exhibit different competences to be able to answer a citizen satisfactorily. The considerations and evaluations of the call centre advisors will influence how they help the caller. Many aspects of a particular call can not be represented in the category system used for registering the call. Improving the web pages is one of the uses of the log data. Relevant information for targeting the web pages can not get registered in the categories of the log. The concept of erasure from [1] is used to discuss the findings.

Keywords: information systems, classification, call centre, competences, erasure

1 Introduction

Call centres are often described as "the new sweat shops" where "the "tyranny of the assembly line" is but a Sunday school picnic compared with the control that management can exercise in computer telephony" [2], or as characterized by "technological determinism" to be challenged [3]. The author's empirical work in the call centre of a large public agency gives a different impression of a friendly place where the employees are encouraged to develop their competence and give high quality answers on the phone. In between the admittedly strict frames for their work they have the opportunity to employ competence and act on the behalf of the citizens towards the rest of the agency. In this paper I will present and discuss how the understanding and actions of the call centre advisor goes beyond what can be recorded in the log. What is not recorded can be of importance in reducing traffic load to the call centre by presenting the answers on the agency web pages.

Data is represented in the call log along some chosen categories, and can be studied as such based on the concepts of Bowker and Star in their seminal book *Sorting Things Out* [1]. They studied large scale classification schemes with wide ranging consequences for people's lives. A classification scheme is always a compromise between many needs and rationales that makes up the background or represent the needs for that particular classification.

The concept of *erasure* is defined in [1] as “the ongoing destruction of selective traces in the present” (p. 257). Information that do not get represented in a particular classification will be lost for future reference and use, it will be erased.

The Agency Call Centre, abbreviated here as ACC, answers the phone for all general questions to the agency. The aim of the ACC is to help the callers help themselves. The employees answering the phone are seen as advisors to the public within the agency’s domain. I use the term call centre advisor or merely advisor in this paper¹. The advisors’ instructions are to help people handle their own tasks, by for instance directing them to the electronic self services on the agency’s web pages if possible.

The employees at the call centre is dedicated to answer incoming calls organised in different lines. When calling the agency phone number the caller hears an automatic message that presents the options. If a caller has one or more questions that belongs to more than one of these lines, he or she will be transferred to a second line after receiving an answer at the first line of choice. The employees are dedicated to the lines that coincide with their field of competence.

The call centre advisors register each call in a database according to a local classification scheme. Based on this data statistics about which questions people ask are made. This is among other things used to influence how the web pages of the agency should be targeted to the current needs of the public. For example when many people call about how to hand in the tax return form, this service is listed as “popular services” on the web pages.

2 Method

I have undertaken an interpretive case study of the use of the log system at the agency call centre [4]. Main methods have been field work and document studies. Field work at the call centre has consisted of listening in on telephone calls from the citizens, participant observation and interviews. In addition I was participating in an internal work shop about channel strategies where I gave a presentation of my project. The documents I have access to are yearly reports from the agency call centre, state budget text about the agency, as well as some internal plans and steering documents.

The listening in have taken place from April 2010 and is still ongoing. Each session takes about 2 hours, and I have done 8 interviews with advisors and managers and ca 11 sessions with listening in with various advisors. The interviews was done as open as the semi structure allowed, and each took around 1,5-2 hours.

When listening in I sit together with the call centre advisor at his or her desk in the office landscape. We both use headsets with earphones and a microphone, but only the advisor is allowed to talk. I can hear what the advisor and caller say, and can see the computer screen and what the advisor is doing during and after the call. I take notes when listening in.

¹ In the literature the terms *call centre worker* or *call centre operator* are used. The Norwegian word ‘veileder’ used for their job indicates competence and helpfulness, so I prefer the term *call centre advisor* as it better conveys the connotations of the Norwegian term.

As a background to observe and interpret what is going on inside a government agency I draw upon 10 years of experience from working within the government sector. I find the notion of “headnotes” useful to describe experiences, impressions, encounters and evaluations that are continuously present in our memory [5].

I began the field work with listening in on some occasions before I started to interview the call centre advisors. After having interviewed around six people I did the interviews of managers. In this way I wanted to get an understanding of the organisation and the work going on there from the perspective of the non-management positions. This is in line with the world view of the Scandinavian tradition, where all voices of the organisation shall be heard as far as possible [6]. A sensitivity towards silenced or dominating voices is part of the research approach. In my view the management and superstructure get to express the official view of the organisation in strategies and steering documents. I expect to get a richer and more unofficial picture of the organisation and its tasks from the shop floor employees .

3 The Agency Call Centre

The agency can only be reached by phone through the telephone number to the ACC, which is presented on the agency’s web pages as the number to the local agency office.

The ACC is organised as a separate unit within the agency. The ACC has employees located at numerous national offices. All offices answer all telephones, regardless of their geographical origin, and a caller has no knowledge of where the person on the other end of the line is located. The call centre advisor can also direct the question by email to a case handler if he or she considers that the question needs case handling.

The ACC is a relatively new unit within the agency. The tasks the ACC is doing now were previously distributed within the offices of the agency. When the ACC in the last reorganization was established very few applied for a job there, and among the first employees many were placed there who did not want to work there. The management has worked towards making the ACC a place where people want to work, and now they have many applicants for vacant positions. Answering the phone has been seen as low status work within the organisation, and the management is working to change this view of the ACC within the agency. The advisors get training and have allotted some time to spend updating their competence within their domain. This situation differs from the impression one get of call centre employees in [3].

The ACC advisors need at least to have competence in rules and regulations within their public domain, use competence of their ICT systems needed to do their job and competence in how to handle a caller. What the advisor needs to do is wholly based on the question asked, although many of the tasks are the same for a wide range of questions. For most questions the advisor will ask for the National Identity Number, but this is not done for impersonal questions like “Where do I get the PIN-codes to log on to your site?”. So the call centre advisor will need to act according to the question, or decide on a procedure to answer the question for each single call [7]. Although there are great similarities and standard procedures may be described, there

still exist questions that can not be solved in a standardised way, or even solved at all at the call centre.

The employees of ACC only talk on the telephone with the citizens. The agency considers the telephone service an expensive channel to use to reach the citizens. The management wants more questions being answered by the citizens themselves with the help of the web pages. The advisors are encouraged to direct the callers to the electronic self services on the agency's web pages. Although the advisors have write access to do changes in one of the databases of the agency, their instructions are not to do so if they consider the caller to be able to request it themselves electronically. However, there are some possible ways the advisors can help a caller asking to change his or her personal information. If the advisor considers that this caller sounds able to handle it themselves, they direct the caller through the pages on the website. The advisors know this by heart and can navigate the caller through the web pages without seeing them herself. If the caller does not have access to the Internet or for some reasons the advisor considers that this caller might benefit from some more help, for instance if he or she has already tried the electronic service without success, she can print out the paper form requesting the change and send it to the caller to fill in and return. In some relatively rare cases the advisor may consider that a caller will need even more help with filling in the form, and writes the new figures directly into the database.

Letting the advisors having write access to this database has been a matter of discussion within the agency. This possibility has recently been closed and opened again. The issue is that the advisors are expected to help people help themselves, not doing services for them. In addition it can be difficult to hear exactly what the caller says on the phone, so errors might occur when the advisor enters the data. On the other hand, the advisors want some degree of autonomy in their work and be able to assess the situation and the caller and decide by themselves which level of service will be the best for any given caller.

The advisors at the ACC employ a range of IT-programs and systems in their work to help a caller. They can look up some databases, but they only have write access to one database. They can look up letter correspondence between the citizen and the agency, and they can look up address information in the Population Register. Most regular questions they can answer without looking up the actual rules and regulations in question. However, if they need to look something up their sources for this is the external web pages for the agency, which everybody can use, the intranet within the agency, sometimes they have posted at their desk a letter with some specific information that is of special relevance at the moment, or they use a publicly available handbook in electronic or paper version. A call centre advisor can also send the question to second line support if he or she cannot answer it herself, or optionally direct it to a case handler at some other unit in the agency. Then she will write a short note of what the call is about in the log system.

4 The log

The routines say that all phone calls should be registered in the log database, to document and register the kinds of questions the callers ask. A log entry typically consists of (available) personal information about the caller, a classification of the question asked, and optionally a free text description of the question and what the call centre advisor did to help. The information registered in the log system is of various kinds, and consists of data fields, formal category choices and natural language. Statistics extracted from the log is used to profile links to the most used services on the agency home page. The advisors consider these pages and the electronic self services as not good enough. If people get lost or the self services doesn't work properly, the advisors will get to know it.

In addition to influencing the content of the web pages the log registration serves numerous other purposes.

- **Reporting:** The total amount of incoming calls is of interest to the ACC to document the use of the service.
- **Resource planning:** The kinds of calls is documented and make the basis for planning the personnel resources needed to the expected load on the different telephone queues.
- **Journal for an individual:** If a caller can be seen from the log to have made many calls about similar questions recently, the advisor can try to explain things carefully and patiently in the hope that this might help the caller to understand things better and be more able to help him or herself in the future. The advisor might also check up among the case handlers in other units of the agency if needed.
- **Journal for an individual, control aspects:** Some callers are said to shop among the advisors for replies that they like. They can call once, and get a reply they don't like. If they call once more, the advisor can see that they received a phone recently from a person with this national identity number, and hopefully be able to see that the caller asked the same question previously. This requires that the previous call is registered and described in free text in the log.
- **Communication with second line support:** Logging of the question serves as a background for second line support or a case handler that receives the question.
- **Future experience database:** The log of questions is planned to be the start of an experience database, where a advisor can look up what her colleagues

answered on a particular question. This is not used today, as the data is not registered sufficiently to be of any use in this context.

In the following paragraphs I will present some examples that illustrate how questions get classified and logged, and show how important information for improving the web pages gets lost.

5 Classification in the log system

The ACC has made the log system as an agency in house software development based on the framework BMC Remedy IT Service Management Suite². The same framework is also used within the agency to register IT service requests, and they have in-house knowledge of it.

The classification of the question is done in four levels of drop down lists. The first level has the same category choices as the lines of telephone queue. The three next levels offer a finer classification. The categories have caught my attention as I am curious how they can capture the richness and variation of the calls for the various purposes mentioned above.

A telephone call can only be classified once, even if the call in question consists of many questions (*While I have you on the line I might as well ask ...*). If the caller asks about more than one issue, the advisor will have to decide which of the possible categories to choose.³ Figure 1 shows the categories of the top 10 popular questions one week.

² http://en.wikipedia.org/wiki/AR_System_User

³ If a call is represented in more than one category, other quantitative measurements of the advisors' performance will break down.

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1. Selvangivelse/Skatteoppgjør - Generelle spørsmål om selvangivelsen (alle tema som ikke har egen kategori i loggen)
2. Faglig – Bolig – Ligningsverdi, salg, utleie
3. Selvangivelse/Skatteoppgjør – Utsettelse
4. Faglig – Særfradrag – Sykdomsutgifter
5. Attester/Utskrift – Reprint av PSA
6. Faglig – Klassefastsettelse
7. Faglig – Fradrag – Reiseutgifter hjem/arbeid
8. Faglig – Utland – Regelverk og lignende
9. EL Tjenster – AltInn – Guiding
10. Skattekort – Endring

Figure 1: Classification of the top ten popular questions one week in April 2010 (Source: yearly report from the ACC)

There is no standardised way of choosing a category when registering a call. An easy way out is to choose “general questions – others” for the two most specific category choices, as is often done. If an advisor does remember that somewhere in the menu of categories there is one corresponding to the current call, he or she has no way of choosing this one. They have only 40 seconds until the next call comes in, and there is not enough time to look through all menus. They often pick some general category they know. In the following I will give some examples of questions and how they are classified in the log system.

Example 1. A calls in and is answered by advisor B. A says that she asked for changes in the tax deduction card almost two months ago. She had used the electronic self service on the web and wondered why no card has arrived in the mail. B looks up in the database and can see no trace of any changes being made. B have no access to logs of A's transaction with the electronic service, so he seems to believe her when she claims to have used the self service. If she had not told him that she already tried the self service, he would have directed her to the web. Now he wants to repair for her failure with the self service so instead of telling her to try again he fills in her new income figures directly into the database. He gives her a little lecture on the phone about tax deduction and the different types of tax deduction cards.

He then proceeds to print out the new card. This will be printed out at the directorate so that they can assure the quality of it before it is mailed to the caller. B can read on the intranet that this service is on schedule otherwise he would have helped A to try the electronic self service once more. He can only tell her what to do,

and he has no information about what is happening in the IT systems back office from the web pages.

B classifies the call in the log as «Tax deduction card – Change⁴» and added a free text comment about the change from «table card» to «percent card».

Hence, some information will be erased. The log will not show that A supposedly had tried the electronic service previously with no result and that B actually changed the figures in the database⁵ and printed out a new card. There is no category available for classifying calls that come because of alleged errors in the electronic services.

Example 2. C, a social worker in a municipality calls in to advisor D. The tax payer E is C's client, and he is sitting in her office at the time of the call. He has experienced an increase in tax deduction from his welfare allowance. He receives too little money now to sustain himself. E will need pin codes to use the electronic self service, and the social worker says that he doesn't know these. D makes no attempt to tell C and E how to get the pin codes or how to navigate through the self service pages. She enters the figures given by C directly into the database, and tells her that the tax deduction card will arrive in the mail to the social worker, and in addition the new card will be sent electronically to the Labour and Welfare Service (NAV) . While the call lasts we hear nothing from E, only C is talking. After the call D tells me that NAV is often behind schedule in updating the yearly tax deduction cards for the welfare clients, so this happens because the card is considered missing and the tax deduction is set to the default value which is 50%.

The category system has no way of classifying that D decided to change the figures, E's condition, that the social worker C was calling, and that E was considered to be in a condition where he could not be expected to handle this himself. The web pages was not an issue, which is an important reminder.

Example 3. A foreigner F speaking another language calls to advisor G. He has applied for a tax deduction card for 2011 but has not received any. He asks if something is wrong, and says that he showed up in person at the counter, as all foreigners must do this year to get the new tax deduction cards. G looks up the electronic archive to see the correspondence but cannot find that a request for a tax deduction card is registered. G explains a little of the rules and regulations concerning the tax agreement between the two countries. G cannot issue a tax deduction card because the caller is not listed in the tax census. Some new requirements are issued recently and G finds out that the caller has got his application form returned in the mail because he had not filled in all the information needed in the form. G tells F to fill in the missing information and send in the form once more. After the call G tells me that he thought that the case handler receiving the incomplete form should have called and told F to provide the missing info, instead of merely returning the form.

The call was about many themes, for instance new regulations for foreigners, the population register, the non-resident personal identification number, or the tax deduction card. G thinks it is most meaningful to classify it as «Employee – Tax deduction card – RF – LF RF1209». RF is the abbreviation used for forms and

⁴ The translation of the categories here is my own.

⁵ This can be traced in the record in the database.

RF1209 is 'Application for a tax deduction card for foreign citizens', the particular form used in this case. He also adds some free text to say that F had received the form in return because of missing information, and explains to me that this text is mostly for their own use, in case F calls once more about the same case.

In this case the categorisation does not express that the caller had already visited a counter, filled in an incomplete form, and received a reply which he did not understand how to follow up.

Example 4. I am listening in with H on the telephone line for business tax. A caller with a newly established personal business is asking whether he will need to register his company before he can pay advance tax for the business. The advisor explains that he does not need to pay advance tax before he makes a profit from the business. He categorises the call as «self-employed persons – advance tax – others – others». The two last categories are residual categories, they are present mostly to make it four levels and to exclude the other category choices on the same level.

The question asked was a relatively simple question from a newly established self-employed person. The categorization used can not distinguish between a simple question from someone inexperienced in this area, or a more complicated question concerning advance tax. H says that he could have made other category choices, but that he does as he is used to do, and then he adds that «all [the advisors] interpret differently» and hence classifies differently. Some advisors habitually write a little free text note in the log, some does not.

Example 5. I am told that the instruction to the advisors is that everybody shall log every call, even the missed ones. Most advisors follow up on this, but they explain to me that the ones most easy to forget to log are the extremely simple ones to answer, as they result in a very short telephone call. Among these extremely simple calls is someone asking for how one goes about to get a new tax deduction card, and how one hands in the tax return form. Many advisors have been reluctant to log such simple calls.

This might indicate that the statistics about what kinds of questions that are asked might be weaker in the case of the extremely simple cases. The simple questions risk being erased from the log. However, they might be of importance as indications as to what kind of information to provide on the web pages.

6 Analysis

A classification will always be in a dialectic relation to its intended use. The classification will support some uses and inhibit others, while at the same time be subject to change based on needs coming from actual use. The advisors are instructed to direct the callers to the web pages if possible. However the advisors considers the web pages lacking when it comes to ease of navigation and use of the electronic self services.

The questions can be seen as belonging to one of three groups related to how easy it will be for the agency to avoid the call in the first hand by publishing information on their web pages that can give the answer.

- **Simple, static information.** Some questions are very simple. An answer must be located on the web page so that most citizens can find it easily.
- **Some questions indicate errors.** Errors can stem from both the caller and the agency, and they might be easy or complicated to solve. Some of the simple and perhaps regular error situations can be presented at the web pages together with how to solve them. However, in a democracy there must be a place to call when errors occur. The agency can not expect to get rid of all telephone calls.
- **Some questions concern a complicated case, perhaps with some sensitive personal information involved.** Details may make a difference as to what the reply will be. Such cases might at the best of times be described very broadly on the agency web pages, and the agency can never expect to get rid of such questions on the phone. In a democracy there must be a place to call in such cases.

The ACC has been told that they must change and develop the categories used, but an important question will be change by whom and for what purpose? Can all the needs of the log classification be served with one category system?

6 Discussion

The study gives rise to reflections of various kinds. I have showed how the call centre advisor assesses and evaluates how to handle a particular call and targets the information given to her interpretation of the experience of the caller. The advisors learn which rules and regulations the citizens find complicated, which self services are hard to use, information that is hard to find on the agency web, formulations in letters from the agency that are hard to understand and they get direct experience in how the callers understand the advisors' explanations. The advisors get a wider understanding about the questions asked than they can express within the categories used for registering the call. Quite often some residual category like "general question – other" is used for registering the question.

Some information that can not be expressed in the categories can be written in free-text, but will in this case be unavailable for statistics and other processing. Hence it will not survive the ephemeral character of the call and will be unavailable for some future uses. It is an important difference between what is expressed as a choice among given categories and what is expressed in free-text. Statistics, processing and searches can be made from the former. Free-text searches are more unreliable as a source for statistics and processing.

Some degree of erasure is unavoidable with all category systems, so the interesting question is twofold, that the information that actually gets registered serves a useful purpose⁶ for the organisation, and that what gets erased is not too important for the agency's goals. As it is now only the call centre advisors have any knowledge of what gets erased.

I conclude with a list of some issues that arise when the theory of classification is used in this practical setting.

Precision versus arbitrariness. There might be many dimensions to a question that will be of importance in how the question is answered and logged. Many calls can be interpreted and classified in different ways, and this indicates that erasure is not necessarily due to erroneous classification by the advisors.

With more fine-grained categories it will be possible to describe a question more precise. The statistics may look more precise with fine-grained categories, but the advisor's choice of which category to use in any given case can be more arbitrary if there are many to choose from. It is therefore important to resist a temptation to increase the level of detail within the classification system. There will always be a trade off between granulation and ease of use of classification systems, and there will always be residual categories. An important question is whether the residual categories hides useful or marginal information, and how to find out [8].

What can the agency do? I have showed that the categories in use today miss out much information that can be used to improve the web pages. The categories can be developed to capture this purpose.

Instead of increasing the level of detail the challenge will be to develop a category system without allowing more arbitrariness. This can be solved with a relatively small set of categories targeted for the most important use of the information which is classified. Details that cannot be logged will have to be conveyed by other means if needed. The agency can use the advisors' knowledge more directly.

If the questions were classified as "easy", "error" or "complicated" as described above the log could be used more immediately for updating the web pages. The easy questions will be a particularly natural candidate for directing the traffic onto the web pages. The answer is based on static information that should be easy to find on the web pages instead of calling the ACC.

The agency will also need to work to develop a more conscious use of the categories among the advisors (who registers the data) and other parts of the agency (who use the data).

Status and competence. The low status previously ascribed to the call work at ACC might be based on beliefs that the advisors are merely doing a simple answering job. I find that the advisors need to use many competences to do their job satisfactorily. Of special interest is that they will need to interpret what the caller is asking about, or in

⁶ I intentionally avoid the term "intended purpose". There are many examples of technology where the marginal or unexpected purpose is dominating, for example the World Wide Web or SMS.

some occasions, what the underlying problem is that the caller might experience and describe the way he or she does. The underlying problem might (as everybody who has done software debugging knows) very well show up somewhere else than where the error occurs.

This finding is similar to the description in [9] of how the managers underestimated the competence needed for the document mark-up work done by litigation support. They were seen as doing mindless document coding and risked being substituted by machines or outsourced, whereas the researchers found that the indexing needed to be based on competence to be useful.

Erasure and its consequences. The advisors seem not to worry that certain aspects of their work and knowledge are rendered invisible in the log, in contrast to the nurses developing a classification system for nursing interventions described in [1]. Erasure is not seen to pose a threat to the advisors. They seem a little indifferent to the categories, and many have objected to logging all calls. Is this because nursing is a profession with its own education and certification, whereas being an advisor does not have a similar status? Will a stronger ownership of their logged data and a recognition of other people's use of that same data bring about more engagement and ownership of the categories for the advisors?

The concept "erasure". The word is a noun that describes an activity, that destruction or erasing is happening. Does the definition of erasure as [1] "the ongoing destruction of selective traces in the present" presuppose that the "traces in the present" is actually present? The knowledge that do not get registered in the log is not formulated so as to be present outside of the mind of the advisor, or in talk among themselves. How can something be destroyed if it is not there in the first place?

The concept was coined by Bowker and Star in their description of how the classification system for nursing interventions was developed. The nursing knowledge was there already. The nurses developing the classification knew very well that some nurse activities could not be described at the risk of being erased from the medical records. The advisors have not so far taken ownership of the categories, and they do not seem to put much importance in the information being erased.

The same goes for the concept "silenced" as discussed in [8], which indicate that there is a need or a push to express what is silenced. As I read it the word "silencing" indicates that something is suppressed when it is silenced. I do not think the advisors and the managers of the ACC will think that this applies. It is neither a push to express nor a pull for the nonregistered information. Is it a need for a new concept to describe information omitted in a category system without presupposing that the information is already there? Perhaps "ellipsis" do not carry such connotations.

However, being able to express what is silenced is described as liberating. Could this be the case for the advisors? By studying the log production and use of the ACC looking for silenced knowledge will we find something else, that we otherwise will not see? Could categories with more room for representing the advisors' knowledge be a means also to raise the status of their work?

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References

1. Bowker, G.C. and S.L. Star, *Sorting Things Out: Classification and Its Consequences*, 1999, Cambridge, Massachussets: Massachussets Institute of Technology.
2. Fernie, S. and D. Metcalf, *(Not) Hanging on the Telephone: Payment Systems in the New Sweatshops*, 1998, London: London School of Economics and Political Science, Centre for Economic Performance.
3. Nyberg, D., *Computers, Customer Service Operatives and Cyborgs: Intra-actions in Call Centres*. *Organization Studies*, 2009. **30**(11): p. 1181-1199.
4. Stake, R.E., *Qualitative Case Studies*, in *The Sage Handbook of Qualitative Research*, N.L. Denzin, Y., Editor, 2005, Sage Publications. p. s. 443-466.
5. Finken, S., *Methods as technologies for producing knowledge, Ph. D thesis*, 2005, Computer Science Department, Roskilde University.
6. Bjerknes, G. and T. Bratteteig, *User Participation and Democracy: A Discussion of Scandinavian Research on System Development*. *Scandinavian Journal of Information Systems*, 1995. **7**(1): p. 73-98.
7. Suchmann, L. and E. Wynn, *Procedures and problems in the office Office: Technology and People*, 1984(2): p. 133-154.
8. Star, S.L. and G.C. Bowker, *Enacting silence: Residual categories as a challenge for ethics, information systems, and communication*. *Ethics and Inf. Technol.*, 2007. **9**(4): p. 273-280.
9. Blomberg, J., L. Suchmann, and R.H. Trigg, *Reflections on a Work-Oriented Design Project*. *Human-Computer Interaction*, 1996. **11**: p. 237-265.

Defining Master Data Management: A literature review on an emerging phenomena

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Abstract. Data quality issues have become a problem due to the increasing amounts of redundant data in multiple information systems that exist in organizations. Master data management (MDM) has been offered as a solution for maintaining consistent definitions of master data and to enable its sharing between several information systems.

The concept MDM is current fuzzy, and lacking a concise definition. Hence, the first goal of this paper is to conduct a literature survey to find out how master data management is defined. It seems that MDM is seen as a technical concept.

Master data is the organizations' core data being closely connected with its processes and functions. In addition to technical approaches to MDM, it is also seen as a set of methods for managing all the aspects concerning master data. This emphasises that the support for business needs. To develop MDM, collaboration between the business and IT people is required.

Key words: Master data, master data management

Introduction

The data has accumulated over the years in organizations. [4]. Although technology is able to store data, the amount has exceeded the organizations' ability to manage it [4]. This is because the complexity of managing data increases when data volumes increase [26]. This is a common situation in organizations today and the problems multiply when acquisitions and mergers are done [7].

It does not facilitate the problem that the data is usually also divided in organization's various information systems. A large organization has usually multiple information systems that hold the same data, for example customer information. This is because information systems containing the data have been developed in silos [11]. The problems with data quality and reliability have emerged. Problems with data quality cause additional costs for organizations and also problems with the use of data [14]. Costs are due, for example, to data errors whose inconsistencies lead to mistakes [24]. This results inefficient processes with higher costs for corrections and manual labour [13]. However, the costs are not the only problem, but e.g. unsatisfied customers and frustrated users are also suffering with incorrect data. Yet the organizational data is a critical resource that supports business processes and decision making. Data is processed in variety of different and complex ways to generate information that serves as input to organizational decision making.

Master data management (MDM) has been recognised as a concept that can help the organizations with these kinds of data quality problems. MDM focuses on managing the organization's most important data, referred also as master data, in a centralized manner. It is believed that this results that the organization's data would consequently be always coherent and timely.

Currently the term MDM seems to be somehow overused, loaded with multiple meanings [23]. In general, MDM is typically defined and understood as a technical concept. MDM is usually mentioned in the context of databases, and associated with terms like data governance, data quality, data management and data consolidation.

Yet there is no unified or generally agreed definition for MDM. This motivates our study to review its different connotations and definitions through a literature survey. It allows the researcher to analyze and evaluate literature within a domain to draw conclusions about object in scope [28]. The goal of this paper is to draw a picture of how the term MDM is appears in the literature.

Following research questions have been identified:

- How has the previous research described master data management and what different aspects have been linked to the concept?
- Is studies on master data management merely focusing on an IT-function or do the studies take a broader, organization level scope?

The study consists of a time period from 2004 to 2011. Literature review was conducted by reviewing recent articles and books written on MDM. The time limit

has been set with the fact that the term does not seem to occur in literature before this. In addition to variety of meanings, it seems that there is a scarce amount of research on MDM so far [22]. This indicates that more research is needed as the topic is apparently of most significant in practice.

To find out what kinds of studies on MDM have been published, a literature survey was conducted. The survey was conducted by searching multiple keywords, such as 'Master data management,' 'MDM,' 'master data,' etc. from numerous databases including EBSCO Host, Emerald journals, IEEE/IEE Electronic Library, SpringerLink, and ScienceDirect.

Master Data

First of all, it is important to specify the difference between data, information and knowledge. This helps to understand the foundation of MDM. Data is basically for example characters, figures or numbers. According to Wilson [27] data is all that is outside of human mind that can be manipulated and consist of facts. Data on its own carries no meaning. In order for data to become information, it must be interpreted and take on a meaning. Terms data and information are used interchangeably. In this study the term "data" is used to describe unprocessed data. Information consists of data with meaning while knowledge takes the step further and associates information to a certain context so that, e.g. it can be beneficially used there.

Master data is usually connected to organization's basic or core data. This kind of data is connected to organizations business processes and functions being essential for the organization. The problem persists how to identify what data is master data. Master data can be defined as the data that has been cleansed, rationalized, and integrated into an enterprise-wide "system of record" [3]. The identification can be done by assessing the data against criteria. By using these criteria, organization can define its master data. With these features master data can be distinguished, from example, transaction data, reference data and metadata.

Master data can be distinguished from other data types with some features. Typical features are presented in table 1.

Table 1 Features for distinguishing master data

Feature	Description
Stability	Master data does not change often [19], [21].
Complexity	Master data tend to exist in more than one business area within the organization, so the same customer may show up in a sales system as well as a

	billing system [12].
Reuse	Master data is usually reused, which is also one of the reasons why managing this kind of data is important [3].
High value for the organization	Master data is very important for the organization as a key business data [12].
Life cycle	If the life cycle of data involves multiple ways to generate, read, update or remove data, it most likely is master data [21].
Independence	Master data can exist without other objects. For example customer exists without other objects [19] [6].
Behaviour	Master data is closely related to transactions and often occurs in the context of them [21] [24].

Basically any business data can be master data [3]. Common examples of master data are customers, employees, vendors, suppliers, parts, products, locations, contact mechanisms, profiles, accounting items, contracts and policies [12]. When defining master data, customer data is a typically mentioned as an example. This kind of data is considered important in an organization. Therefore it is easy to claim it as an important data type. However, the customer data in the organization can be stored in many different information systems. This means that the same data has many versions and appears in different formats. This is the core problem but also the main idea for the need of master data management.

Usually the customers' addresses are stored in more than one information system. Thus if the customer notified that their address has changed, it is possible that only one of those numerous instances of the address is updated. As a result, the systems will contain incorrect address for that customer. [8].

What is Master Data Management?

Master data management focuses only on a small number of core data that is set as the organization's master data [23]. The organization usually expects that this kind of data is managed in a centralized manner. MDM approaches this by focusing on business processes, data quality and the integration of information systems [22].

In the old days there was no need for studying MDM because all the applications and related data sets were housed in a single computer [12]. Because of the rapid increase in the amount of data, the organizations ability to manage it has steeply declined [4]. The data is stored in multiple information systems and databases. Large organizations typically have multiple information systems that hold the same data, because data has been developed and evolved in silos over the past decades [11].

As seen in Table 1, the literature presents many different definitions for MDM. Loshin [12] describes MDM as an aggregator for best data management practices:

“MDM is a collection of best data management practices that orchestrate key stakeholders, participants, and business clients in incorporating the business application, information management methods, and data management tools to implement the policies, services and infrastructure to support the capture, integration, and subsequent shared use of accurate, timely, consistent and complete master data.”

The key word there is to “orchestrate”. The word defines the core essence for the term MDM as an organizer. MDM is consequently about ensuring that the most important business assets are accurate and timely for the use of the organization. Smith and McKeen [23] thus see MDM as a process and emphasize that it is not a technical issue:

“Master data management is an application independent-process which describes, owns and manages core business entities. It ensures the consistency and accuracy of these data by providing a single set of guidelines for their management and thereby creates a common view of key company data, which may or may not be held in a common data source.”

While this definition approaches MDM as a guideline that describes, manages and owns core data, Snow [24] concentrates on to business information aspect:

“Master data includes the business objects, definitions, classifications, and terminology that, in sum, constitute business information; as well as format specifications for transactional data. MDM makes it possible to define and link master data, including those definitions, references, rules, and metadata. It seeks to establish and maintain a high level of data consistency and reliability.”

This definition links master data and transactional data. Yet Snow’s definition focuses more on the nature of data than how it is used or managed. The main difference between Snow’s definition and the first two is that Snow emphasizes the data definition in MDM but lacks, for example, a data governance aspect.

All of these definitions share a common feature that they all see MDM as set of methods and not as a technical term. They do not comment on how the data should be maintained, managed or administrated in information systems. MDM just refers to the tools and workflows for life-cycle governance of master data [10]. MDM seeks to consolidate data into a single version of truth by defining and maintaining consistent definitions of master data and enable sharing across organization’s multiple information systems, but it is not bound on a specific application [15]. It is obvious that all the definitions link MDM to business processes.

The Purpose of Master Data Management

Task of MDM is to support organization's functions by providing access to consistent views of uniquely identifiable master data entities across the operational application infrastructure [12]. It is a method that one can use to target incomplete, inaccurate and fragmented data that is stored in various data stores in an organization [20].

Technically speaking information sharing between information systems is straightforward. It is relatively simple matter to electronically connect information systems together using a network and then to transfer data between them. Difficulties come after this when the receiving information system cannot interpret the data or interpretation is wrong. [8]. Some data conflicts can be solved by integrating information systems and eliminating data redundancy. This is rarely adequate, especially in large and complex organizations [1]. MDM provides organizations ability to integrate, analyse and exploit the value of their key data assets, regardless of where that information is stored [25]. Master data management governs the methods, tools, information, and services for this [12].

Perspectives on MDM: Technical vs. Organizational

Master data management requires a partnership of business and IT staff. Business people are responsible for managing the master data and IT staff for supporting business efforts across the organization [24] [7]. According the study by Otto and Reichert [19], MDM is seen as both an organizational and technical topic. MDM organization is seen as a support unit for business.

It can be seen as an IT issue to integrate master data, but it is important to realize MDM is a cross-functional and process-oriented discipline, which requires acceptance and wide organizational support [5]. MDM cannot be seen as a merely information systems related. It concerns operations on a strategic, an organizational, and on an information systems level [19]. It is important to emphasize that MDM is not technology driven. Information systems play a big role in MDM but managing data is a business issue [8] [23] [25]. Also, for example, Andriole [2] emphasizes that MDM is strategic, not just operational issue.

According to Lucas [14], data quality problems are usually considered as IT problem, because data stewardship roles have not been accomplished. Data governance is setting the policies and procedures that support the build and maintenance of the master data, as well as some of the more detailed tasks involved in the MDM rollout [17]. Dreibelbis et al. [6] see data governance as a part of MDM and describe it as a process of changing organization's behavior:

"Data governance is a political process of changing organizational behavior to enhance and protect data as a strategic enterprise asset [6]."

Data governance provides a process and structure for managing information as a resource [16], [29]. This requires breaking down the stovepipes separating data across business units and creating collaboration between business and IT functions. Data governance is needed to address both organizational and technical perspectives, and this way demanding leadership, authority, control and allocation of resources. [14] It defines the responsibilities and tasks for different roles. McKnight [17] notes that data governance is the head of MDM because that is where the brainpower is applied. Some of the usual data governance roles are described in table 2.

Table 2. Data governance roles

Role	Description
Data governance council	Guides and oversees data governance activities [12] [6]
Data owners	Usually business process owners who have the authority to set policies and make business rules for the data. [9]
Data stewards	The most important duty of a data steward is to continuously evaluate and improve the processes that contribute to data quality [14]. Instead of managing data within the narrow focus of their own business unit, they must ensure that their data is managed from an enterprise perspective so that it can be used and shared by all business units [18]. Data Stewards should also come from the business area, not from IT [18] [23].
Data administrators	Tasks include establishing and enforcing data modelling principles, formal standards for data definitions, data naming standards, data domain standards, and metadata standards. [18]

Discussion and conclusions

Although research literature on MDM is scarce, it is apparent that the concept of MDM is defined in multiple ways. The purpose of this study was to contemplate the different definitions and to see how they link to each other.

The master data forms a basis for understanding the nature of MDM. The master data is defined as an organization's core data that forms the basis for business processes [13]. Identified characteristics of master data are stability, complexity, reusability, high value for organization, versatile life cycle, independence and close linkage to transactions. Master data should be managed as a strategic business asset.

All definitions share a common feature that the MDM concept is seen as a set of methods and guidelines for managing master data and not as a technical term. MDM ensures a coherent view of the organization's core data. This enables the business processes to have timely and high-quality data for the whole organization. MDM is part technology, part governance, and part philosophy [2]. These perspectives are not evident in the literature and their definitions on MDM.

As MDM is both a technical and an organizational issue, it is important to understand the relationship between technologies and organizational units. This emphasises the support for business needs, necessitating collaboration between those corresponding units. Both of these aspects have been taken into account in data governance, which is clearly a critical element in MDM. Again, the research on the topic is scarce.

These findings point out several issues. First, the MDM as a research topic is emerging. Currently there are several industry-focused seminars where MDM is discussed. Yet, as the literature review shows, there are only a few studies. Second, those few studies addressing MDM seem to share technical approach. This means that there is a need for further studies on MDM as an organizational, managerial, operational, strategic, or process-oriented phenomenon. These issues underline our contributions as showing the need for further studies, and for commonly shared, possible universal definition of MDM. Both research and practice of the area would benefit these results.

There are several possibilities for further research. How have organizations perceived master data management from a strategic point of view? Are the benefit realized and how are they achieved in actuality? As stated earlier, there is only a limited amount of prior research and very little practical research on the subject at the moment.

References

- [1] Andreaescu, A., Mircea, M.: Combining Actual Trends in Software Systems for Business Management. In: International conference on computer systems and technologies (CompSysTech'08). v.9-1--v.9.6 (2008)
- [2] Andriole, S. J.: Technology Due Diligence: Best Practices for Chief Information Officers, Venture Capitalists, and Technology Vendors. Indiana University Press, Bloomington (2008)
- [3] Berson, A., Dubov, L.: Master data management and customer data integration for a global enterprise. McGraw-Hill, New York (2007)
- [4] Davenport, T.: Competing on analytics: The New science of Winning. Harvard business school Press, Boston (2007)
- [5] Dayton, M.: Strategic MDM: The Foundation of Enterprise Performance Management. Cutter IT journal. Vol. 20 (9), 13--17 (2007)

- [6] Dreibelbis, A., Hechler, E., Milman, I., Oberhofer, M., van Run, P., D. Wolfson.: Enterprise Master Data Management: An SOA Approach to Managing Core Information. IBM Press, Boston (2008)
- [7] Dresner, H.: Performance Management Revolution: Business Results Through Insight and Action. John Wiley & Sons, New Jersey (2008)
- [8] Gordon, K.: Principles of data management. Facilitating information sharing. BCS, Swindon (2007)
- [9] Joshi, A.: MDM Governance: A Unified Team Approach. Cutter IT journal. Vol. 20 (9), 30--35 (2007)
- [10] Kobiulus, J.: Master data management: Bridging SOA to the datacentre. Business communications review, Feb 2007, 50--53 (2007)
- [11] Lee, Y., Pipino, L., Funk, J., Wang R.: Journey to data quality. The MIT Press, Cambridge (2006)
- [12] Loshin, D.: Master data management. Morgan Kaufman, Burlington (2009)
- [13] Loser, C., Legner, C. & D. Gizanis.: Master Data Management for Collaborative Service Processes. In: Proceedings of the International Conference on Service Systems and Service Management. Beijing (2004)
- [14] Lucas, A.: Corporate Quality Management. Iberian Conference on Information Systems and Technologies, 524--548 (2010)
- [15] Maedche, A.: An ERP-centric Master Data Management Approach. In: AMCIS 2010 Proceedings. Paper 384. (2010)
- [16] McGilvray, D.: Data Governance: A Necessity in an Integrated Information World. DM Review, December 2006, 1--3 (2006)
- [17] McKnight, W.: Master Data Management and the Elephant. Information Management Magazine, Nov/Dec 2009 (2009)
- [18] Moss, L. T.: Critical Success Factors for Master Data Management. Cutter IT journal. Vol. 20 (9), 7--12 (2007)
- [19] Otto, B., Reichert, A. Organizing master data management: findings from an expert survey. In: 2010 ACM Symposium on Applied Computing (2010)
- [20] Poolet, M.: Master Data Management. A Method for reconciling disparate data sources. SQL Server magazine. January 2007 (2007)
- [21] Samaranyake, P.: Enhanced Data Models for Master and Transactional Data in ERP Systems – Unitary Structuring approach. International Multiconference of Engineers & Computer Scientists (IMECS) 2008, 1607--1614.(2008)

- [22] Silvola, R., Jaaskelainen O., Kropsu-Vehkaperä, H., Haapasalo, H.: Managing One Master Data – Challenges and Preconditions. *Industrial Management & Data Systems* Volume: 111 (1), 146--162 (2011)
- [23] Smith, H.A., McKeen, J.D. Developments in Practice XXX: Master Data Management: Salvation Or Snake Oil? *Communications of the Association for Information Systems*, 23 (4). 63--72 (2008)
- [24] Snow, C. Embrace the Role and Value of Master Data. *Manufacturing business technology*, Vol. 26 (2), 38--40 (2008)
- [25] Tuck, S. 2008. Is MDM the route to the Holy Grail? *Journal of Database Marketing & Customer Strategy Management* Vol. 15 (4), 218--220 (2008)
- [26] Watts, S., Shankaranarayanan, G. & Even, A.: Data Quality assessment in context: A cognitive perspective. *Decision support systems* 48 (2009), 202--211 (2009)
- [27] Wilson, T. D.: The Nonsense of 'Knowledge Management'. *Information Research*, 8 (1) paper no.144. (2002)
- [28] Petter, S., DeLone, W., McLean, E.: Measuring information systems success: models, dimensions, measures, and interrelationships *European Journal of Information Systems* (2008) 17, 236--263
- [29] Clevén, A., Wortmann, F.: Uncovering Four Strategies to approach master data management. In: *Proceeding of the 43rd Hawaii International Conference on System Sciences* (2010)

Innovative Car Renting Kiosk Services: Toward New Kinds of Online User Experiences

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Abstract. A kiosk system is typically an interactive terminal, which allows a user to perform some task or data transaction. A new type of kiosk uses a remote video connection for online services with a customer servant. Field studies on this type of service kiosks are scarce and we do not know yet how well they meet the needs of the intended users. Our goal is to represent the user experiences gathered by the field study with the human-supported kiosk prototype built for the car renting service concept of Avis. The study shows that users received the service positively, and the kiosk system with the video connection offers many advantages over the traditional kiosk systems. Further studies within the entire service process are needed, especially with the role of service personnel that shaped vital part of the user experiences used to think about mostly as technology oriented.

Keywords: kiosk system, online service, user experience, field study

1 Introduction

Creating efficient services has become important in both public and private domains. For instance, the Ministry of Finance in Finland is working for new ways of offering citizens more efficient services. One strategy is to develop remote services, which can offer many advantages, such as that several locations can be serviced from one service provider and personal services offered in cases when customer servants actually cannot be present. Computer-supported kiosk systems are one possible way of offering remote services. However, instead of implementing just completely computer-operated self-services, we should also consider other type of solutions, such as where the interaction between service kiosks and customers is remotely supported by real people, offered as a real-time service. One promising solution is that service providers' personnel work via the Internet and support their customers' interaction with service kiosk systems. However, thus far this kind of service concept is less

researched in field circumstances and also the design interest has focused chiefly on the completely computer-supported interaction and self-service kiosks.

A kiosk is a device, which usually consists of software and hardware including some sort of input and output equipment, by which the user can perform predefined operations. Kiosks can be used for information, advertising, entertainment, selling, or other varied types of short-time service needs [1], [2], [3], [4]. For example, Redbox (www.redbox.com) offers a service in the United States where the user can reserve a rental digital video disc and then pick it up at a suitable time from a self-service kiosk. Other type of kiosk service is provided by Avis (www.avis.com), who offers car renting services globally in many countries. It has developed a new type of service kiosk based on a remote service concept that is very flexible as personalizable according to each customer. In the current kiosks, users typically have to choose from predefined dialog options. The idea behind the new type of kiosk is that the customer is able to communicate directly with a service representative through a video connection and the Internet. This kiosk concept enables companies to offer much more versatile customer services than by the traditional, completely computer-supported kiosks. For example, they can modify the services with humans more easily and faster as customer servants can change their way of working according to each individual customer or whenever needed. Furthermore, they can offer related extra services within their service alliance providers.

The customer service model, however, requires some nontraditional solutions. Users should be able to communicate with remote service personnel as if they were actually present at the location. In addition, customers want to identify the person servicing them, service providers need to reliably identify their customers as well as protect their personal information and service interaction from outsiders. This makes security crucial and that traditional authentication methods may not be suitable. Furthermore, the usability of the kiosk systems is different when the two-way, online interaction happens between the systems and the humans at present. When finished the kiosk system should be usable, secure and acceptable to the intended users and support the wished user experience including the activity and role of customer servants.

The goal of this paper is to provide the user experiences gathered by the field study [5], [6] with a new type of kiosk prototype built for the new service concept of the car renting service Avis. The previous research into the service concept is scarce and also these types of kiosks have been less researched [4], especially by qualitative field studies and from the viewpoint of user experiences. However, kiosk user interfaces have been tested and found that there are certain commonalities between the service kiosk and traditional kiosk interfaces [1], [2], [3], [4]. Moreover, when studying systems on the field, empirical setting should response not only to research goals but also to produce ideas for systems design [5]. Thus, persons involved in the study should equate to varied characters of intended kiosk users (including new, elderly, disabled users, etc.) and service personnel. The study situation should be comfortable to the people involved so that customer servants and service users can complete the service process easily, without too many errors. How fast they proceed may not be so important with these types of kiosks but for understanding the service situation, people's opinions should be obtained [4] and user experiences catered.

Generally, user experience (UX) refers to any experience that the user undergoes while interacting with a product under certain conditions [7]. Then again, UX goes beyond traditional usability aspects of measuring quality of immediate use situations. Discontinuity, indirectness and intertwined aspects of human experiences make their study challenging. However how people feel about using some product can be studied qualitatively, for example by field studies with appropriate empirical, ethnographic or participative methods [5], [6]. In this case direct observations and interviews in situ were applied as studying what kind of user experience the customer service kiosk prototype of Avis offered and how people received the Avis's new service concept. By these questions, the study joins discussions of Human-Computer Interaction (HCI) and Security related human-centered Information and Communication Technology (ICT) based services with the concept of User Experience.

In the next chapters main features of interactive kiosk services are introduced (chap. 2); the field study with the kiosk prototype of Avis is described (chap. 3), analyzed and discussed (chap. 4) for the future research and design needs (chap. 5).

2 Interactive Kiosk Services

Holfelder and Hehmann define a kiosk system as “a computer-based information system, located in public areas, with which, through an intuitive user interface, from mostly anonymous users, predominantly while standing and for a relatively short time, information can be recalled or transactions can be triggered” [2]. In some cases, kiosks are not necessarily even considered being separated physical machines but instead can be seen as interfaces to services that can be used over the Internet [8].

Typically, interactive kiosk services are used to provide public access to digital information and e-transactions [9], including banking, sales, advertising, entertainment, and other type of purposes which have to be offered with the needed privacy and security. Thus, different types of kiosks have different capabilities based on what is needed to perform the required functions. The kiosks that are used to dispense simple items such as stamps or cards do not usually have high requirements for information presentation or transaction support and can function independently. On the other hand, automatic teller machine (ATM) types of kiosks [10] implemented to allow users perform certain limited transactions usually have high support for the required transactions but do not need high information dissemination capabilities. These are important for instance in tourist information kiosks which do not need transactional support but then again the frequently changing information has its own requirements [10]. Such as, the user can offer information about some shopping preferences and the kiosk can then make recommendations based on the given [9].

Interactive kiosk services are quite complicated technological systems that require high information dissemination and transactional capabilities but what the users utilize should be usable and effective tools and the service free from defects. Thus, kiosks may have different implementations based on the type of interaction media (text, graphical, audio and video elements) the kiosk supports and the degree of distribution of data needed in the service situation (local data, online or remote data) [2]. Especially transactional kiosks often use distributed data management. For

example, ATMs have to contact the bank to receive information about the amount of money the user has, and then deduct that sum based on how much was withdrawn.

All in all, kiosks systems are typically highly automated, technology-mediated interactive services so that the user and the service provider do not meet face-to-face. These kinds of kiosks can be called as computer-operated service systems [2], which are often considered the most effective way of offering online or offline services. However, authors have also reported about usability, user experience and security problems in the contexts of automation [9], interactive product based, or mobile services [7], [12], [13], [14], [15], [16]. One way of improve the service is the online support by real humans.

2.1 Online Kiosks Supported by Real Humans

Typically various kinds of input and output devices are used for kiosks' user interfaces. Buttons and touch-screens are common interaction elements to make simple functions given by menus. If the interaction requires more complicated input for example to complete transactions, keyboard, mouse or related devices may be used. Kiosks may be incorporated with a video that enables an audiovisual input, a microphone for vocal input, and card and document readers to get credit card or other related information feeds. Output is usually presented on graphical interfaces, by sounds or by printed documents.

Today kiosk systems are not entirely computer-operated but the interaction between the kiosk and the users can also be supported by real humans. New types of service kiosks may be partly human-operated but the role of humans supporting the service is less taken into account when considering the properties of kiosk services [4]. In a computer-operated kiosk, the user interacts only with computer components. In a human-operated kiosk, user can interact with another human who is supporting the service and operating the kiosk from a remote location. These kiosks apply computer interface technologies but are complemented by online Internet and video connections, which enable the user to see and talk to a customer servant.

As compared to completely computer-operated kiosk systems, human operated kiosks can be used to perform tasks that are not yet available by computer-operated kiosks. One example is the authentication of a person based on online mediated face-to-face identification with an identity document checking. The other example is that by the human-operated kiosks a variety of online expert service can be provided more reliably and securely. In the future, this might include, among others, remote healthcare advice to locations where human staffing is impractical or centralized information services where a few customer servants can help users or customers at various locations in a very large building or inside organizations.

Kiosks offering expert or information services apply partly basic information kiosk features [1] but enable a more dynamic two-way information flow when humans are online. A typical user using a kiosk does not interact with it for very long, usually from a few seconds to a few minutes but that can change depending on the type of kiosk in question [2]. Kiosks serve a large number of different users who generally are not known beforehand, have diverse features and customer change is rapid [2].

These issues can make the design of kiosk user interfaces a real challenge also because the user does not want to nor has the time to learn how to use the interface.

2.2 The Situated Human Driven Interaction

In her seminal work, Suchman [11] has shown the most challenging aspect of human-computer interaction design is the situated action grounding the experiences humans go through as using the technology available in situ. This is still the actual topic as the many usability studies have been shown and as we need alternatives for the growing, diverse population of users we should serve by kiosk systems, too.

According to Kules et al. [3] the challenge with designing human-operated kiosk interfaces is that most design guidelines are meant for traditional, completely computer-supported interactive self-service kiosks. These, however can be partly applied to the computer-supported interaction parts: a kiosk should capture the human interest and make people approach it [3]; it should appear as usable and secure and invite the user to interaction [4] by clearly indicating how to start; login or authentication should be as late as possible so that the user is not chased away before using the kiosk [3] and instructions should be presented in subtle ways and be available as offline forms too [4].

Generally, many common principles of good product and interaction design apply to the human-operated kiosk as well (e.g., [3], [4], [13], [17]) including privacy and security needs and information security. According to Maguire, also in cases that no private information is handled, many users prefer to use service kiosks without bystanders [4]. A kiosk should not be located in the middle of passing people and any private information should be concealed [4]. Interaction elements, loud voices or issues that may catch outsider attention at the service kiosk location should be avoided. However, all the elements of the interactive and physical user interface of the kiosk systems used should support the user as a customer of the remote service provider [4]. Moreover, the kiosk should be immediately made ready for the next customer, waiting time should be short and the previous user's personal data closed [3]. In practice this requires both the high level security and usability standards and the privacy protection of the persons in situ.

Usability of security is a concept, which is used to combine security and usability in the context of human-computer interaction and information processing systems. According to Whitten and Tygar [15] the security of an information processing system can be seen as usable when:

1. The person is reliably made aware of security tasks that they need to perform.
2. The person is able to figure out how to perform those tasks successfully.
3. The person does not make any dangerous errors.
4. The person is sufficiently comfortable with the user interface.

This definition includes the traditional attributes of usability [1], [2], [3], [4]. Such as the easiness of learning how to use the system at present; the immediate identification of the user interface elements with their obvious use purposes; the system is efficient to use for the purposes designed; use errors would be minimal and the occurred ones manageable by the user, and the user satisfaction, which all contribute to the wished, good user experiences. However, the challenge of design is that these attributes are

still poorly understood in the context of the human-supported but computer technology based, real-time, two-way, user interaction. The related field studies are scarce and most design guidelines given to the kiosk systems by the Human-Computer Interaction, Usability Engineering or Security fields principally maintain the traditional design approach of how to produce the fully automated kiosk services.

The following field study aims to provide the firsthand user experiences about the service kiosk concept where usability, user experience and security issues intertwine and therefore approached including the human-supported online interaction in situ.

3 Field Study with the Service Kiosk Prototype of Avis

The field study based on the user experience study on a human-supported, online car renting service kiosk prototype developed for Avis (Fig. 1) by the third author.



Fig. 1. The service kiosk prototype of Avis for car renting

The solution resembles a video banking kiosk described by Paradi and Ghazarian-Rock [18] in that one customer servant can manage several customer locations from one service location. The authors have shown that the arrangement can be cost-

efficient, especially when there are several smaller locations where services are needed sometimes but it might not be viable to station personnel there permanently. Thus, the prototype supports an online, two-way face-to-face communication between real people and flexible service processes adaptable to customers' needs immediately. All this makes it as a perfect focus for personalized user experience studies.

The purpose of the prototype (Fig. 1) was to demonstrate how this kind of service kiosk fits Avis's new remote service concept of car renting. The kiosk was implemented for online face-to-face communication between the customer and the customer servant by video, audio, and document camera feeds. Functions enable to verify customers' identity (a customer shows a driver's license by a document camera), to produce a signed rental agreement by a printer, and to open a key locker (a digital display and a keyboard). Payment options are billing or credit cards.

The field study was organized in cooperation with Avis at the Kemi airport, Finland and the first author as an actual field worker. The methods applied were observation of use situations and thematic interviewing in situ [5]. This arrangement enables also the field worker's learning from the practice studied [6] and is seen as useful in capturing user experiences and usability issues for research, design and product development [7], [19], [5].

In this case the field study set-up was different from customary usability testing: the prototype was working; the focus was on firsthand user experiences about the kiosk concept; the use and the service were not predefined beforehand, and kiosk users did not have other support available than that of given by the Avis's people online, and they could follow standards of their service work. Thus, customers and customer servants could act in the ways they saw as best in the actual situation. The service process could vary depending on the interacting people and their individual ways of acting together and their preparations done beforehand. In the situations observed, a variety of services included more prearranged cases (the customer inputted the given pin code and took the keys from the locker) and ad hoc and multi-phased, complex rental processes. The customers booked and rented cars by the kiosk and asked about what ever additional information and the customer servants offered insurance or other related services. However, the standard car renting service of Avis included certain steps such as that a car rental agreement was always signed before a customer could actually get the keys of the car rented.

The study was done in three parts during the fall 2009. The physical setting at the airport was kept as similar as possible in all the study situations. In all, two customer servants (male, female) of Avis and nine car renting customers (Appendix 1) participated in the study. They shaped a representative, convenient, and natural sample [5] of car renters based on availability at the study dates and by agreement to participate in the research: seven men and two women of varying ages, new and accustomed car renters with varying rental habits and going to somewhere in a hurry, as a motivation to rent a car [14]. The renting processes took three to ten minutes and the service languages changed according to the customers (Finnish, Swedish, and English). The renting situations were video recorded for research and the customers were interviewed about their user experiences [5]. The thematic, semi-structured research interviews lasted ten to thirty minutes and were conducted in English or Finnish. The recorded data were transcribed and analyzed by applying the interpretative, multi-phased qualitative content analysis [20].

4 Analysis of the User Experiences

The users received the service concept quite positively and generally user experiences about the usage of the kiosk can be interpreted as responding to their actual needs. The usefulness, comprised of utility and usability, the security, and the aesthetics of the product were identified as product properties that affected the user experiences of the participants. Other identified factors were the physical context, the location and the time of usage, the social context with the online presence of the customer servant, and the branch context with the company's reputation, and certain properties of the users including prior experience, expectations, emotions, familiarity of ICT, and trust.

Many of the observations about the user experiences are compatible to earlier user experience studies or experiences reported in the context of, usability, product design or security (e.g., [7], [12], [13], [3], [16]). On the other hand, in many places the findings went beyond the customary ICT, HCI or Security and Usability Engineering aspects used to think about only as the technology or system use oriented attributes. The most impressive observations analyzed for this paper related to the online presence of the customer servants that could create the circumstances for the new kinds of user experiences categorized as follows:

1. People were able to act as “normally” with the technology;
2. The online view embodied the face-to-face interaction;
3. The immediate improvement of usability and security.

4.1 People Act as “Normally” with the Technology

The direct expressions of how a person felt when using the product, such as “it felt natural”, “it felt uncomfortable” or “it felt difficult” can go a long way into clarifying what kind of experience the user had while using the product. Most participants deemed that the renting process, overall, was very easy and clear and if there were any problems they were solved with the customer servant. Two of the participants commented that first usage of the kiosk felt weird and was different from anything they were used to. Nevertheless, later they commented that it started to feel quite natural as talking with another human being. Some mentioned that they imagined the usage being harder and were rather surprised how easy it was. This prejudice was at least partly based on their previous experiences with other computer systems. Then again, the difference between what was felt during the usage situation, how people felt about the usage afterwards and as discussing about it with others, is the property of experiences and the factor which make their study quite challenging [7], [12].

The experiences about the usage situations were varied. The renting processes took from around three minutes up to over ten minutes. The longer processes were partly due to the customer servants' inexperience as they had not received actual training into customer services of this sort. Still, all of the participants were able to complete their tasks eventually and many deemed that the renting process was similar to customary face to face services. Therefore, the kiosk concept seems useful and we can interpret the observations that users' diverse ways of acting as “normally” can be supported by the customer servant's online presence.

The online presence of real humans, such as the customer servants in this case, may also influence positively their attitudes toward ICT based services [3], [13]. Some of the participants specifically mentioned that being able to talk with another human being made them feel more confident with the technology in use, because it gave them the feeling that everything was going “OK”. To most users, it seemed beneficial that they were able to ask any questions at all if they were unsure or met difficulties. Particularly the feeling of immediate easiness of use [3] ensued from the practice where users could enjoy the service comfortably as only a few acts of use were needed. Users described the experiences as “good”, “nice” and “pleasant”.

However, this type of customer service through a video connection differs from conventional customer service methods, such as services via phone and personally at some location. The participants deemed the online presence of the customer servant useful as it supports them to achieve their actual goals as customers of the service and familiarize the new technology so that they could act as “normally”. Especially the customer servant’s ability to explain also all the ICT related things to the customers was considered very useful. Then again, this demands the management of the social, appearance and service skills and to manage also the user’s ICT setup technologically, instructionally and collaboratively in the service situation at hand [11].

4.2 An Online View Embodies the Face-to-face Interaction

Especially, the online video connection is a very important attribute that contributed to the user experiences of the customers in the service situations. When improving the service concept, the design team should consider how this online service situation differs from the services implemented, for example, for phone connections and face-to-face situations in offices. In this case, some customers could wonder the odd angles of view on the kiosk system’s screen and the customer servants had to keep on mind which direction to watch so that the mediated view would be natural for the customer.

Experiences about the customer’s online view show that it may be important to see when the customer servant is typing or doing some other task with the system in use, and how people can keep their eye contact naturally. In the study situations, unfocused views seemed disturbing the service and the customer servant often appeared to be looking down while typing which made his or her face seem somewhat awkward. A rearrangement of cameras seems thus vital and some sorts of dynamic zooms and shared or adaptable screen technologies capable of keeping the screen informative all the time, for both parties.

Then again, the online service that resembles a private face-to-face situation in many respects may be deemed uncomfortable when implemented as a technology-mediated service. In this case, one participant mentioned about such feelings although otherwise deemed the service satisfying. The feelings related to the expected normal face-to-face communication, engaged conversation and action when the customer servant worked quietly and the customer could not see that by the screen or hear the normal sounds of work. Also some other participants expressed some signs of restlessness with the kind of situation. Thus it is important to make the situational action visible [11], [21], for the interacting partners. In this case, the customer

servants realized this fact quite soon and could take it into account in their later service situations and by sharing their knowledge about ICT with the customers [22].

4.3 Immediate Improvement of Usability and Security

For the customers, how to make physical action visible and capture the other person's interest by the video connection was a vital learning experience. Actually, they needed to understand that the large screen (Fig.1) in front of the face was the audiovisual output medium that mediated the customer servant's figure and action and the video camera and the covered document camera in the middle of the kiosk device were the audiovisual input media for their communication. Thus, it is apparent that this type of ICT communication was unfamiliar to most customers and caused some usability problems. For instance, two customers tried to show car keys or credit cards to the customer servant by holding them in front of the screen and did not notice the cameras or the card reader device. Actually, the customer servants had to inform most users about these input-output features of ICT and several times [22].

On the other hand, one customer also informed the customer servant about the airport location where the kiosk was. This is vital information to the customer but not for the customer servant who knew where the kiosk and the customer were. Conversely, this shows that the person's mental model of how this kind of online service is organized might originate from his or her earlier service experiences with other type of ICT, and when one has had to specify the exact location and personal data to the customer servant in order to rent a car. Also when the customer servants noticed that their customers had difficulties with the online input-output devices of the kiosk, they could easily change their ways of action according to the customers' situation and acts and inform them, in subtle ways, about how to protect the sensitive issues and take care of security during the online service situations.

Based the experiences we can infer that the customer servants could compensate diverse kinds of usability and security problems immediately [13], [3], [15] in the situation at hand [11] by giving extremely clear instructions of how the kiosk system operated and how the personal data could be given. These user experiences show also that improvement of the usability and security of the ICT used necessitated the customer servants to articulate about the technological features of the service kiosk [23] and to share their expertise on ICT with their customers by the online service situation [22]. The kinds of issues have been tried to solve by means of ICT or HCI design for the fully computer-operated kiosks. However, with this kind of kiosk, which is partly human-operated and partly computer-operated and because audiovisual feeds demanded the coordination work of customer servants, the customary user interface and security design guidelines proved impractical [4].

All in all, the overall user experience can be interpreted as positive based on that the required actions were easy to complete, how the participants felt the usage and expressed their opinions. The issues caused negative effects, such as the placement of audiovisual devices or service personnel's lacking training, can be improved as needed. These might be partly due to the innovative kiosk and the online service concept that are not yet generally known. In any case, the personalized service concept with the human-supported online kiosk is appropriate for the service purpose

of Avis. More focused research going beyond the firsthand experiences and extension of the study toward the entire service process are however required to achieve the deeper understanding about this service concept.

5 Concluding Remarks

User experiences gathered in the context of human-supported online service kiosks are scarce and we do not know yet how well they meet the needs of the intended users. The goal of this work was to provide the firsthand user experiences gathered by the field study with the prototype build for the remote service concept of Avis.

Based on the field study, we can conclude that user experiences with the Avis's customer service concept were mostly positive. In a kiosk service situation, the personal, two-way, online communication offers many advantages over the traditional, fully computer-supported kiosk systems: people can act as "normally" with the technology; the kiosk enable the face-to-face and the joy of to be serviced feelings and the immediate improvement of usability and security by human actors.

Furthermore, the online presence of real humans seems to influence positively on people's attitudes toward ICT based services. This may be important for the society's service infrastructure and we thus suggest that the kiosk system with the service concept may offer a lot of potential to combine different services and offer them in places where other types of services would be impractical.

Further research going beyond the firsthand experiences is required to achieve the deeper understanding about this entire service concept. Especially, the role of service personnel that shaped the vital part of the overall user experience in this case should be approached in detail, including possible alliance services, and how this type of human- and computer-supported cooperation could be conceptualized for other purposes. Accordingly we have to learn to think about these kinds of kiosk systems through a much wider perspective than from the current computer oriented Human-Computer Interaction and Security approaches.

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References

1. Borchers, J., Deussen, O., Knörzer, C.: Getting It Across: Layout Issues for Kiosk Systems, Newsletter ACM SIGCHI Bulletin 27, 4, 68--74 (1995)
2. Holfelder, W., Hehmann, D.: A Networked Multimedia Retrieval Management System for Distributed Kiosk Applications. In: the International Conference on Multimedia Computing and Systems, pp. 342--351 (1994)
3. Kules, B., Kang, H., Plaisant, C., Rose, A., Shneiderman, B.: Immediate Usability: Kiosk Design Principles from the CHI 2001 Photo Library. Technical Report CS-TR-4293, University of Maryland (2003)

4. Maguire, M.C.: A Review of User-Interface Design Guidelines for Public Information Kiosk Systems. *International Journal of Human-Computer Studies* 50, 3, 263—286 (1999)
5. Blomberg, J., Giacomi, J., Mosher, A., Swenton-Wall, P.: Ethnographic field methods and their relation to design, in Schuler, D., Namioka, A. (Eds) *Participatory Design: Principles and Practices*. Lawrence Erlbaum, Hillsdale, pp. 123--155 (1993)
6. Whyte, W., Whyte, K.: *Learning from the field: A guide from experience*. Beverly Hills, CA, SAGE (1984)
7. Arhippainen, L., Tähti, M.: Empirical Evaluation of User Experience in Two Adaptive Mobile Application Prototypes. In: the 2nd International Conference on Mobile and Ubiquitous Multimedia, ACM New York, pp. 27-34 (2003)
8. Yeung, C., Tung, P-F., Yen, J.: A Multi-Agent Based Tourism Kiosk on Internet. In: the 31th Hawaii International Conference on System Sciences, Volume 4, pp. 452--461 (1998)
9. Rowley, J., Slack, F.: Kiosks in Retailing: the Quiet Revolution. *International Journal of Retail & Distribution Management* 21, 6, 329—339 (2003)
10. Tung, L.L., Tan, J.H.: A Model for the Classification of Information Kiosks in Singapore. *International Journal of Information Management* 18, 4, 255--264 (1998)
11. Suchman, L.: *Plans and Situated Action: The Problem of Human-Machine Communication*. Cambridge University Press, New York (1987)
12. Arhippainen, L.: *Studying User Experience: Issues and Problems of Mobile Services*. Oulu University Press, Oulu, Finland (2009)
13. Jokela, T.: When Good Things Happen to Bad Products: Where Are the Benefits of Usability in the Consumer Appliance Market? *ACM Interactions* 11, 6, 28—35 (2004)
14. Chang, H.-L., Yang, C.-H.: Do Airline Self-Service Check-in Kiosks Meet the Needs of Passengers? *Tourism Management* 29, 5, 980--993 (2008)
15. Whitten, A., Tygar, J. D.: Why Johnny Can't Encrypt A Usability Evaluation of PGP 5.0. In: the 8th USENIX Security Symposium, pp. 169--184 (1999)
16. Yee, K.-P.: Aligning Security and Usability. *Security & Privacy* 2, 5, 48--55 (2004)
17. Hewett, Baecker, Card, Carey, Gasen, Mante, et al.: *ACM SIGCHI Curricula for Human-Computer Interaction*, Chapter 2 (2009), <http://old.sigchi.org/cdg/cdg2.html>
18. Paradi, J.C., Ghazarian-Rock, A.: A Framework to Evaluate Video Banking Kiosks. *Omega, the International Journal of Management Science* 26, 4, 523--539 (1997)
19. Buchenau, M., Suri, J. F.: Experience Prototyping. In: the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, ACM New York, pp. 434--440 (2000)
20. Tesch, R.: *Qualitative Research: Analysis Types & Software Tools*, Falmer Press, Hampshire (1990)
21. Nardi, B., Engeström, Y.: A Web on the Wind: the Structure of Invisible Work. *Journal of Computer Supported Cooperative Work (CSCW)* 8, 8, 1--8 (1999)
22. Ackerman, M., Pipek, V., Wulf, W. (Eds): *Sharing expertise*. MIT Press, Cambridge, MA (2003)
23. Schmidt, K., Bannon, L.: Taking CSCW seriously, Supporting articulation work. *Computer Supported Cooperative Work* 1, 7--40 (1992)

Appendix: Participants of the Field Study

Age	Gender	Car rental habits	Usage of kiosk systems	Customer servant
44	Male	Rents quite often, does not own a car	Only uses of ATMs	Male
29	Female	Rents 5-10 times per a year	Uses of Internet banks	Female
60	Female	Rents very rarely	Uses ATMs weekly	Male
40	Male	Rents very rarely	Very rarely, once a year	Male
38	Male	Rents weekly	Not much	Male
not given	Male	Rents abroad and for longer distances	When needed, service by personnel if available	Male
52	Male	First time renting	ATM, uses of Internet services	Female
not given	Male	Rents very rarely	ATM, uses of Internet services	Female
44	Male	1-2 times per a year	Only when necessary	Female

The Beginner's Guide to ICT Context – A Theoretical Contribution Aimed for the Atypical Developer and Team

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Summary. Many recent ICT development projects involve atypical developer teams and practitioners that are domain experts, but not experienced in information systems development. While domain experts usually participate in development projects, we find that many of them take a more active or even driving role in recent projects. This can pose a problem, since the common systems development methodologies are complicated and require training. They are also not designed for the level that these atypical teams and non-expert practitioners can benefit from. In this paper we formulate a framework based on personal experience of several ICT development projects and a theoretical foundation in information systems development research. The framework is designed to be suitable and accessible by non-expert and to be able to serve as a platform for collaboration and communication. The framework divides the development process into four stages and four areas of concern. It also introduces a number of concepts, such as focus, scalability and equilibrium. A project scales from stage to stage, each focusing on a different area of concern.

Key words: information systems development, practice-oriented approach, process model, socio-technical system

1 Introduction

Computers are ubiquitous in today's organizations. It was noticed early on by Hirschheim et al. [14] who pointed out that computer-based systems have moved from supporting back office (such as payroll) to enter into all functions in respect to the entire organization. However, in the beginning the core work revolved on the actual development of computer-based systems while other aspects, such as user interaction or how they fit into the organization were not always considered. The computer-based systems were programmed rather than designed, and the development was technology focused and carried out by experts. These experts often followed systematic practices, to help deal with the complexity, but such practices were invented when needed and closely related to the technology at hand. Programming practices and techniques that worked well were re-used, and adapted as needed, basically forming sets of guidelines. But, with each team

or even person using their own practice, it was difficult to communicating it to others. In order to improve the situation, a great deal of research efforts was put into reasoning about and describing the development process. This led to many important discoveries, such as the distinction between logical and physical design, organizational development, risk analysis, stakeholder inclusion, etc. It also resulted in the formulation of life-cycle models that describe the systems development, for example, the Systems Development Life Cycle (SDLC) [27].

A life-cycle model describe the development of an information system as a set of stages, to plan, manage, control, and evaluate the same [1]. The stages of the SDLC can be described as:

- feasibility study,
- system investigation,
- systems analysis,
- systems design,
- implementation, and
- review and maintenance.

A life-cycle view is favored by expert developers but as the context where ICT and IS development takes place is becoming increasingly diverse so are the developers background and skill set. The most difficult thing to fathom is the overall context and realizing the fit that need to be made. These “novices” have the deciding power but do they have the means to understand the possible implications that need to be considered. Professionals from other fields and even consumers have a voice in the development process nowadays. How can we help manage IS development/ICT transformation when the playing field have changed so considerably? When the “novice” has the lead how can the complexity, that we in the IS profession are aware of, be communicated in a model suitable for them? How to summarize, simplify and provide a intuitive language to guide them?

In order to improve the development practice, there is a need to *understand* the problem domain and reason about it. A useful aid in understanding is to create conceptual models and in turn frameworks that capture phenomena in reality [25]. Describing reality and making theoretical contributions is always done with a certain degree of abstraction but with the user of it in mind.

The aim of this paper is to investigate and improve the development practice of initiatives in the field of information systems. We begin by discussing how computer-based systems are developed. The main purpose of this discussion is to establish the terminology used within this paper and why it was chosen. The paper continues with an overview into information systems development and the notion of socio-technical system and the different perspectives it entail. This presentation is not intended to provide a complete picture of information systems development nor its history. We continue with a discussion of the ongoing effort to establish theories within this field. This discussion is intended to show how the field moves from a technological focus to addressing more the work activities and the social context as important considerations (when developing information systems).

This paper presents a framework that is formulated and presented in a way that is suitable for the inexperienced developer and team. By providing a simplified although holistic development model we communicate sound development thinking for ICT entry, use and transformation in the organizations of today.

2 Development of Computer-Based Systems

New methodologies were formulated as an attempt to describe information systems development practices. A *information systems development methodology*, according to Hirschheim et al. [14], can be described as a collection of methods and tools that help the system developers in their efforts. A method is a way to perform a particular activity during the development. A method often involves the use of one or more tools. Avison and Fitzgerald [1] remark that an information systems methodology also includes a conceptualization of a life-cycle.

However, an information systems development methodology is more than a collection of methods. It is based on a *philosophical view*, and includes beliefs and values. These guide both the overall development practices and what is considered a good solution. A philosophy might be that an information system that is, for example, the easiest to implement, cheapest to run, or liked by the stakeholders is preferable and regarded a good solution [1].

There exist a large number of different information systems development methodologies, and they differ in the collection of methods and tools or in terms of the philosophical views. Two different methodologies might share methods and tools but differ in their philosophical view. This makes certain methodologies more suitable for some problems, people, or organizations than others.

One example of an information systems development methodology is the Rational Unified Process (RUP) [16]. RUP uses the Unified Modeling Language (UML), which is a tool, to describe use-cases, which is a method. One belief of RUP is that the development practices should be iterative and incremental.

Hence, a methodology provides a step-by-step description of how a system should be developed, using the stages of the life-cycle, and the methods, and tools included. Although, a large number of stages, methods, and tools might make a methodology a blunt instrument to use in some cases, or difficult to master according to Avison et al. [2]. Avison and Fitzgerald [1] state that a framework is similar to a methodology but less restricted and rather than enforcing a strict step-by-step order it leaves room to choose what best suit the situations, people, or organizations. A framework can provide the overarching structure of the development practices and be a platform for work and communication.

3 Information Systems Development

The introduction of methodologies advanced the development practice within the field of information systems greatly. However, there were still issues with the end products (e.g. the information systems) produced. Many of the information

systems were technically sophisticated, but lacking in terms of connecting to the social work environment. The development methodologies often regarded information systems as solely computer-based systems and their introduction as a technological activity.

Smithson and Hirschheim [26] state that the introduction of an information system normally has social, organizational, and human implications and is never just a technological activity. The information system represents more than just computers and software. The users and the organizations they are part of both affect and are affected by the information system, putting focus on issues such as usability, policy, ethics, and so forth. They further state that there are few common or widespread organizational interventions so poorly understood and surrounded by such exaggerated expectations as the introduction of ICT.

Hence the approach to regard information system in terms of a socio-technical system was established, acknowledging it as a system that involves complex interactions between people, machines, and the work environment, according to Emery and Trist [13]. Another example, also building on the socio-technical school of thinking acknowledges these as two separate systems, the social and the technical, respectively, and focuses explicitly on the interactions between them [9]. Badham et al. [4] state that there are five key features of a socio-technical system:

- the system has interdependent parts,
- the system adapts to and pursues goals in external environments,
- the system has an internal environment comprising separate but interdependent technical and social sub-systems,
- the goals of the system can be achieved by multiple means, and
- the system performance relies on the joint optimization of the technical and social sub-systems.

Socio-Technical Systems Design (STSD) approaches take the people, machines, and context into consideration when developing systems. There are several such approaches that often exist on a more abstract level than the methodologies. One such example is the ten principles provided by Cherns [11]. The principles are formulated on a level relating to social and organizational aspects. While these principles point out important issues, they provide little (practical) guidance for a developer. These are more to be seen as a checklist. For example, one principle is labeled “Incompleteness”, since redesign is continuous and is the function of self-regulating teams, emphasizing that work group design is never complete.

There are, however, some approaches to STSD that can be considered as systems development methodologies. One such example is ETHICS [22] where the social and technical systems are designed in parallel to allow them to intertwine and to help optimize their interaction. Another key aspect of ETHICS is active end-user participation in the design. Another example is the Soft Systems Methodology (SSM) [10], which was developed as a move from thinking about systems in “hard” engineering terms. SSM does not divide a system into technical and social (sub-)systems but rather view the system as being composed

of logically linked activities. A key feature of SSM is the focus to develop an understanding of a problematic situation. In this sense, SSM is essentially an analytical approach.

While there is a general consensus that an information system should be considered within its social context, and that the problem addressed by STSD is important, the approaches have failed to make a significant impact on how systems are developed (e.g. Mumford [23]). A problem that makes the adoption of STSD more difficult is the term socio-technical system. The term was coined by researchers at the Travistock Institute with a specific meaning. It is also often closely linked to the ETHICS methodology. However, many researchers in different fields, often using their own interpretation, have adopted the term. A socio-technical system often refers to the social and the technical system (as the name imply), while the interaction between these are disregarded.

Another source of problems with STSD seems to be that compared to the technical, the social appears more complex and difficult to make sense of, hence less explored and understood. For example, several technical characteristics, such as response time or failure rate, can be defined and measured for an IT artifact, while ergonomics and usability are perceived more challenging to measure. Majchrzak and Borys [21] claim that the existing socio-technical systems theories are not specific enough to allow for empirical testing. Further, it can be difficult to define criteria to measure the social elements of the system. Land [18] discusses how to, for example, measure job satisfaction, but also point out the fact that the success is measured by various stakeholders and they have different viewpoints and value systems. In a sense, the technical element measures can be considered objective, while the social are more subjective often leading to difficulties comparing and making choices.

There is also a concern to find the right abstraction level. The information systems development methodologies established life-cycle models as well as methods to model and reason about the information system. From this viewpoint, it might be tempting to divide a socio-technical system into a social and a technical part, and then continue to decompose these two separately. This in turn might result in a different emphasis on the two parts, and focus often falls on the technical. Another concern regarding the abstraction level was raised by Hollnagel [15] who points to an over-emphasis of the context of a socio-technical system (e.g. the organization) at the expense of the individual.

In a sense, the complexity of the social dimensions in this respect and the difficulty to find reasonable abstraction levels to handle these, attributed to the identity crisis noticeable in information systems research according to Benbasat and Zmud [6] and Orlikowski and Iacono [24]. For example, Orlikowski and Iacono [24] argue, based on a review of articles published in information systems research between 1990 and 1999, that a significant number of these either focus on the context, some capability of the computer-based system, or a specific variable assigned to the implementation or use of the technology. In many cases the computer-based system is implicit in the research, e.g. the IT artifact is assumed to work in the background. Orlikowski and Iacono [24] conclude that

“we will need to stop taking IT artifacts for granted and begin to take them seriously enough to theorize about them”(p. 131), and propose five premises as a basis for further theorizing. In short, they argue that:

- IT artifacts are always value based, since they are designed and used by people with different interests, values, and assumptions.
- IT artifacts are always embedded in a historical and cultural context.
- IT artifacts are usually made up of several components, and generic terms such as the Internet and “the Technology” should generally be avoided.
- IT artifacts are not fixed and independent, but co-evolve with the work practice in which they are embedded.
- IT artifacts are subject to changes in technology.

Benbasat and Zmud [6] also point to the need to theorize about the IT artifact, and propose what should be included and excluded for the field of information systems research. They state that it is necessary to understand the role of the IT artifact in a social context, and which aspects of both the IT artifact and the social context that should be left for other fields to investigate. They assume that the IT artifact exists within a social context and they focus on three core information system properties: the IT artifact, its use, and its impact. This is in line with the socio-technical system view that the technology has social effects. This correlate with Lee and Baskerville [20], who state that an information system is emerging, in a broad sense, from the interaction between people, practices, and technology.

4 An Extended Socio-Technical Model

This paper discusses how information systems development moved from a technical focus to include social dimensions in an attempt to provide theoretical contributions that better captures how the IT artifact is perceived and used. Information systems development acknowledged the socio-technical nature of an information system early on and tries to understand how (computer-based) systems are seen in relation to users.

Even if information systems development research still struggles to describe the interaction between people, practices, and technology, there are some established development methodologies that represent a sound approach to development practices. This sound approach has lead to information systems that are sustainable, meaning present and persistent in every day life of people and constituting the backbone of organizations. While a number of theoretical contributions to handle the socio-technical nature of information systems exist, information systems development still struggles to produce information systems that perfectly match the target. There is a lack of conceptual modeling and in turn frameworks adjusted to the interplay between researchers and practitioners (concerning the development practice).

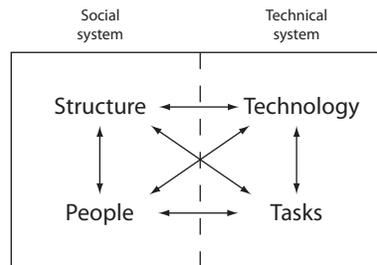


Fig. 1. A Socio-Technical System.

A great deal of effort has been put into understanding how IT artifacts are developed and introduced into organizations. There is a wide range of both research results and practical considerations involved.

Information systems development often starts as a technology-oriented activity and in a later stage recognized to have both a technology and social dimensions. There are both social aspects, such as users and organizations, as well as technology, such as computers, involved in the process. There are many research results indicating how to deal with socio-technical systems. However, information systems demand special consideration in terms of the work tasks. Consider the representation of a socio-technical system depicted in Figure 1. Technology and Tasks are considered as part of the technical system, while People and Structure are considered Social. If a information systems initiative would be described using this model, the task would include the goals, and the technology would include the work process. The user would, together with all the other stakeholders, be placed in People, while the rest of the organization would be the Structure.

According to Bostrom and Heinen [9], a socio-technical system consists of the two dimensions, social and technical, which are divided into *People* and *Structure*, and *Technology* and *Tasks*, respectively. Figure 1 depicts this view of a socio-technical system. Addressing information systems using this view, the goal would belong to the Tasks, the work practice would be considered Technology, and all stakeholders would be considered People.

The socio-technical system view depicted in Figure 1 does not contradict the view that work tasks are personal and individual, but it does not promote it either. The division into work practices as technology, the goal as task, and the user as one of the stakeholders gives a fragmented view of the work. In order to deal with this, an extended view is suggested that places work into a personal system and puts the same emphasis on it as the social and technical.

The new extended view (cf. Figure 2) introduces a personal system that contains the Tasks. In this view, Tasks is synonymous with the overall work process. The Technology contains all the technology, such as computers and software that support the work tasks. The classification of People has been changed to not include the user, but instead refer to other people he or she interacts with, such as work colleagues and supervisors.

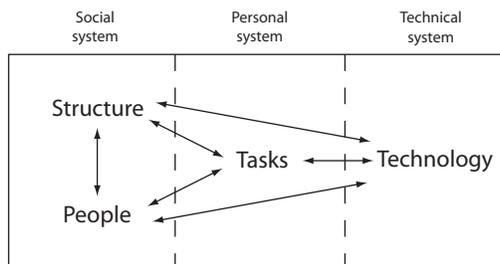


Fig. 2. An Extended Socio-Technical System for User Oriented Information Systems Development.

5 The Concepts Explained

The previous section introduced an extended socio-technical system for information systems. However, the main change is that the work, i.e. the tasks, has moved from a technical perspective to a personal one, focusing on the individual nature of work. This means that People, Structure, and Technology are unaffected, and hence, models and methods developed for socio-technical systems are still applicable, at least to concerns that fall within these. This section focuses on concepts found in information systems development methodologies.

An important part of an information systems development methodology is the life-cycle model. In their ideal form, life-cycle models can be regarded as sequential or iterative. There are many variations, but in essence the idea is to either progress through a specified number of stages or to repeat a specified number of stages until the end goal is reached.

When observing the development of information systems initiatives, it was found to be highly iterative, but with well defined progressions in terms of various steps. Based on observations, four major stages can be identified namely Idea, Trial, Project, and Release. Any information systems initiative should progress through these. Each stage represents a specific activity and specific goals. For example, the Trial stage revolves around testing the prototypes in a controlled environment with limited groups. A stage can contain several iterative development cycles and a large number of actual trials. When a stage is considered finished, e.g. the results are satisfactory, the stage is over. It is generally difficult to go back and repeat a previous stage, so progress from one stage to another should only happen once it is “completed”.

A sequential life-cycle makes late changes very expensive. When summarizing lessons learned from Multiview, Avison et al. [2], state that the sequential life-cycle is inappropriate for describing the development practice. They also found that an iterative life-cycle can be difficult to use since it lacks a well-defined progression. In order to support an iterative life-cycle as well, each stage can be thought of as containing a number of iterations. The life-cycle is iterative inside each stage, but sequential over the four stages specified.

The extended socio-technical system for information systems consists of three systems, the social, the personal and the technical. These three systems exist in each of the four stages of the information systems life-cycle. To incorporate them and make the visible, each stage is divided into four *Areas of concern*. The additional area is created by dividing the social system into Social (People) and Organization (Structure). The other two areas are Technology (Technology) and Work (Tasks). Technology is the hardware and software used, Work includes the practice and goals, while Social includes how users use and interact using the technology. Organization represents the organizational concerns, for example laws and regulations, and policies. The name *areas of concern* is inspired by Checkland [10] and how he reasons about a problem situation.

The areas of concern can be considered as views. Each area of concern deals with a specific aspect of information systems and can be linked to a specific group of stakeholders. Since the four areas of concern represents different views on the same IT artifact, they are interlinked. A change to one of the areas will affect the others. By discussing how any decision will affect the four areas of concern, there is a built-in analysis of how a decision affects stakeholders and what possible risks it might create.

The areas of concern support the iterative development practices within a stage. Changes will propagate between the areas, and result in new changes that will propagate in turn. However, as discussed previously, there is no defined progression, and the propagating changes may make it more complex. In order to deal with this, mediation between the areas of concern is needed. The concept of *focus* is introduced in order to provide mediation and reduce complexity. This is inspired by Avison and Wood-Harper [3] reasoning about mediation using the metaphor of a camera. Using focus it is possible to see all four areas at the same time, but only by sacrificing the level of resolution. So, it is possible to focus on and examine one particular area in great detail, but at the expense of losing some of the greater context, which is depicted by Figure 3, where the Social area of concern is in focus.

The use of focus in relation to the areas of concern provides a sequential progression. Each area of concern is focused on in turn, and the main development objectives revolve around that area. Changes to one area will still affect the others and need to be managed, however, by only focusing on one area — one potential source of change — a sequential progression is maintained and complexity is reduced.

In order to deal with the interlinked areas of concern and the propagating effects that a suggested change will have, the notion of *equilibrium* is introduced. This is similar to Leavitt's model for organizational change [19] where the term equilibrium is used to signify that the opposing forces of a change are in a steady state, e.g. the effects of the change have been compensated for. The term is used in a similar manner here, where it signifies that a change has propagated to all related areas of concern and that each area has been adjusted to deal with the change. A system that is not in equilibrium will contain risks not assessed that might result in a failure to obtain any or all of the benefits of the IT artifact at

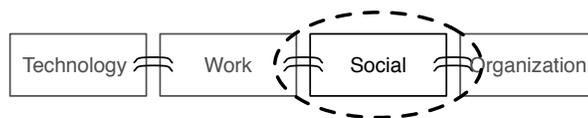


Fig. 3. Focus on the Social Area of Concern.

a later stage. Since there might be risks not considered in a stage that is not in equilibrium, it is not possible to progress to the next stage before equilibrium is reached.

The steps and exploratory development used by information systems initiatives contain a growth process. They transition through several stages, starting from a few users with mock-up prototypes to larger groups with real hardware and software. The users early on might be members of the development team while the users later on will be closer to the target audience. In essence, each change to either of these variables changes the scope. The growth process, or rather the ability to scale up is an important part of the exploratory development used in information systems initiatives.

In the field of Computer Science the term scalability is considered a quality of, for example, a network or a system. If an information system is not scalable, it cannot handle an increase of factors. The understanding of scalability is often vague or subjective, but a number of research efforts to define this notion have been carried out. Laitinen et al. [17], in addition to Weinstock and Goodenough [28], give a good overview of the underlying concepts and problems of scalability in information systems development. Bondi [8], in relation to an information system, judges how scalable it is when the information system needs to accommodate to changes, for example a higher demand in terms of more users or hardware.

Scalability can be considered as the initiative's ability to grow. This growth, in respect to all the four areas of concern should be able to handle the different types and groups of users and organizations with everything that this entails. There will always be a point at which scalability stops making sense, e.g. the largest rational organization it can scale to or a "market" that can be "controlled". Using this description, scalability can be defined as the ability to reach a state that matches the pre-set requirements at a development stage. The more stages at which it reaches these, the more scalable the initiative is. In this respect, saying that a information systems initiative is scaled to the Project stage simply means that the initiative reached a state in accordance with the specified variables at the Idea, Trial, and Project stages. The components were in unison with each other at each stage.

The term sustainability is defined by Eckersley [12] as the *ability to continue an activity or maintain a certain condition indefinitely*. Black [7], in connotation to communities and societies, says that sustainability is being increasingly seen as involving three interrelated dimensions: the economic, the social, and the ecological. When applied to systems in a general sense it relies on Beer [5], who

states that a viable system in order to survive needs to be organized in a way to meet the demands of an ever-changing environment. The Darwinian saying *survival of the fittest*, from his theory of natural selection comes to mind, and a living system needs to be able to maintain a separate existence over time.

The end product (e.g. the information system) of a development initiative needs to be stand-alone in relation to its creators and sustain an existence by itself in the intended setting. A sustainable information systems initiative would be one that reaches the last stage, e.g. the Release stage, and is incorporated into the targeted environment. The goal is a information systems initiative that survives on its own merits and adapts to changes in the environment. By combining the definitions of scalability and sustainability, sustainability is the same as “maximum” scalability. The key concepts are summarized in Table 1.

Stages	The development of an ICT initiative goes through a number of Stages. This process that can be summarized using the following four stages: Idea, Trial, Project, and Release.
Areas of Concern	Each stage deals with a number of concerns or requirements that deal with different aspects of the ICT initiative. There exist an interplay of technical, pedagogical, people-related, and bureaucratically considerations and these are called, in short, the following areas of concern: Technology, Work (tasks), Social, and Organization.
Focus	Focus is a way of reducing complexity. Each stage deals with the areas of concern, but it was found that certain areas are more prominent during certain stages. By applying focus on particular areas, these provide the primary concerns to investigate.
Equilibrium	The concept of Equilibrium is the measure of when the inner development process has reached a “final” state. When all the concerns within a stage, both those within areas in focus and those indirectly affected by the focused areas are in balance, equilibrium has been achieved.
Scalability	Scalability indicates how well the initiative is able to grow. When an initiative reaches equilibrium at one stage and is able to refine or add to the considerations within the areas of concern that should be dealt with in the next stage, it can then transition from one stage to the next. Scalability is the measure of how many such transitions the initiative can accomplish.
Sustainability	Sustainability is the measure of how well the result fits the intended setting. An initiative that has reached a stage with realistic and “final” concerns and reached equilibrium at this stage is considered sustainable.

Table 1. The Key Concepts Summarized.

6 Bringing Forward a Theoretical Framework

In order to support the various groups of researchers and practitioners in information systems, the framework was created with a focus on philosophy, while not focusing so much on the actual tools, methods, and models. There are simply too many such tools, methods, and models to include, and given the diversity it is hard to recommend some before others. Researchers and practitioners are, however, free to specialize the *use* of the framework to suit their exact needs by providing their own models, methods, and tools.

The framework consists of a life-cycle that divides an initiative into four stages: Idea, Trial, Project, and Release. Each stage is divided into four Areas of concern: Technology, Work, Social, and Organization. The four areas are linked together and depend on each other. A change to one will affect the others. In order to reason about these propagating changes, the concept of Equilibrium is used to reason about the state of a stage. If a stage is in equilibrium, all changes have propagated and the effects of this propagation have been dealt with (or at least considered). Equilibrium is reached for a stage when there is no longer a need for reaction and adjustment.

The concept of Scalability discusses how to evolve from one stage to the next in the life-cycle with the focus on what will change and how to deal with those changes. A large part of scalability is to limit the scope of the change, to minimize the ripple effects. Scalability means the ability to extend the results from the previous stage and combine them with knowledge of the areas of concern of the next stage. The concept of Sustainability is a means to reason about both an individual stage and the entire initiative. A stage is sustainable if it adheres to the pre-set specification and is in equilibrium. An initiative is sustainable, if the Release stage is sustainable.

In order to reduce the complexity introduced by the areas of concern and the propagating changes, the concept of Focus is used. During each stage of the evolution, one (or at most a few) area of concern is in focus. The area in focus represents the area where the development is currently the most active, and where the direct changes will occur. The other areas are only changed through propagated effects of a change to the area in focus. Focus thus provides a means to reduce complexity and a way to introduce a sequential workflow to the framework depicted by the arrow in Figure 4 and the relation to other concepts brought forward.

By bringing forth a framework, which presents a mix of sequential and an iterative life-cycle, that describes the development from conception to implementation (Idea to Release), the researchers and practitioners are free to use the models, methods, and tools that they are familiar with. The major role of the framework is to guide the development practices not to tie down the models, methods, and tools, which follows while the framework is in use. Hence, the framework is there to be a work and communication platform and provide a theoretical take on information systems development.

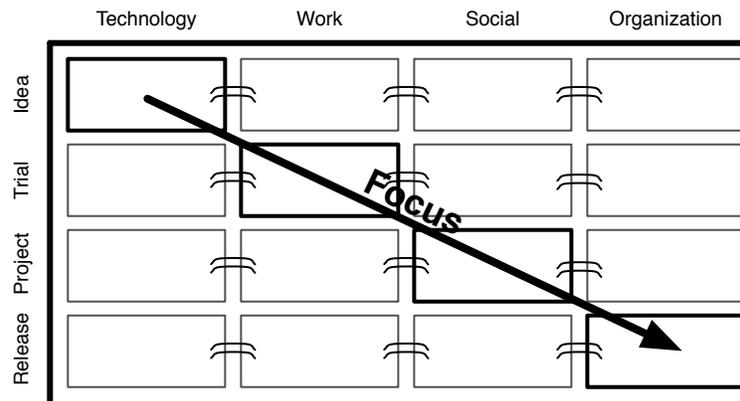


Fig. 4. The Life-Cycle and the Areas of Concern.

7 Conclusions

In this paper, we show how a current development situation, where development and design teams include atypical and non-expert developers, can be strengthened by knowledge from the field of information systems development. We introduce a framework aimed at guiding these through the process, using novel concepts such as Focus.

Theoretical contributions, such as the extended socio-technical system can help create a sound foundation for further exploration of context. In combination with our framework, the theoretical contributions can help provide non-expert practitioners with tools and understanding to aid them and expedite the entry, transformation and development of ICT in modern organizations. It is important that theoretical results are presented in a way that is both suitable and accessible to practitioners in order for them to be used. Our framework can help improve communication and collaboration in development practice.

The framework is designed from experienced gained from a number of development projects, but it has never been used in its current form. The next step is to show the framework to atypical developers and gain feedback both from discussion and from observing it in practice. The framework as influenced by a study of the development of technology-enhanced learning systems, and we intend to perform a study where we use the framework to develop such systems. A typical team includes learners, developers, teachers, and other stakeholders, i.e. an atypical team. We plan to offer such teams the framework and a short introduction to how it will be used. We will then observe how it is used in practice and what problems they experience. When the projects are finished, we intend to assess the quality of the outcome and compare it to similar projects. We also intend to conduct surveys and interviews with the teams. This should help form a first opinion on how well the framework works in practice.

References

- [1] Avison, D. and Fitzgerald, G. [2006], *Information Systems Development: Methodologies, Techniques and Tools*, 4th edn, McGraw-Hill Higher Education.
- [2] Avison, D., Wood-Harper, A., Vidgen, R. and Wood, J. [1998], ‘A further exploration into information systems development: the evolution of multi-view2’, *Information Technology & People* **11**(2), 124–139.
- [3] Avison, D. and Wood-Harper, T. [2003], Bringing social and organisational issues into information systems development: the story of multiview, *in* ‘Socio-technical and human cognition elements of information systems’, IGI Publishing, Hershey, PA, USA, pp. 5–21.
- [4] Badham, R., Clegg, C. and Wall, T. [2001], Sociotechnical theory, *in* W. Karwowski, ed., ‘International Encyclopedia of Ergonomics and Human Factors’, Taylor & Francis, New York, NY, USA.
- [5] Beer, S. [1984], ‘The viable system model: Its provenance, development, methodology and pathology’, *The Journal of the Operational Research Society* **35**(1), 7–25.
- [6] Benbasat, I. and Zmud, R. W. [2003], ‘The identity crisis within the IS discipline: Defining and communicating the discipline’s core properties’, *MIS Quarterly* **27**(2), 183–194.
- [7] Black, A. W. [2004], The quest for sustainable, healthy communities, *in* ‘Effective Sustainability Education: What Works? Why? Where Next? Linking Research and Practice’.
- [8] Bondi, A. B. [2000], Characteristics of scalability and their impact on performance, *in* ‘WOSP’00: Proceedings of the 2nd International Workshop on Software and Performance’, ACM, New York, NY, USA, pp. 195–203.
- [9] Bostrom, R. P. and Heinen, J. S. [1977], ‘MIS problems and failures: a socio-technical perspective. Part I: The causes’, *MIS Quarterly* **1**(3), 17–32.
- [10] Checkland, P. [1999], *Soft Systems Methodology: a 30-year retrospective*, Wiley, Chichester, UK.
- [11] Cherns, A. [1987], ‘Principles of socio-technical design revisited’, *Human Relations* **40**(3), 153–162.
- [12] Eckersley, R. [1998], *Measuring Progress: Is Life Getting Better?*, CSIRO Publishing.
- [13] Emery, F. E. and Trist, E. [1960], Socio-technical systems, *in* C. W. Churchman and M. Verhulst, eds, ‘Management Sciences Models and Techniques’, Pergamon Press, pp. 83–97.
- [14] Hirschheim, R., Klein, H. K. and Lyytinen, K. [1995], *Information systems development and data modeling: conceptual and philosophical foundations*, Cambridge University Press, New York, NY, USA.
- [15] Hollnagel, E. [1998], *The cognitive reliability and error analysis method*, Elsevier, Oxford, UK.
- [16] Kruchten, P. [2000], *The Rational Unified Process: An Introduction*, Addison Wesley, MA, USA.

- [17] Laitinen, M., Fayad, M. E. and Ward, R. P. [2000], 'Thinking objectively: The problem with scalability', *Communications of the ACM* **43**(9), 105–107.
- [18] Land, F. [2000], Evaluation in a socio-technical context, *in* R. Baskerville, J. Stage and J. DeGross, eds, 'Organisational and social perspectives on information technology', Kluwer Academic Publishers, pp. 115–126.
- [19] Leavitt, H. J. [1965], Applied organizational change in industry: Structural, technological and humanistic approaches, *in* J. G. March, ed., 'Handbook of Organizations', Rand McNally, Chicago, IL, USA, pp. 1144–1170.
- [20] Lee, A. S. and Baskerville, R. L. [2003], 'Generalizing generalizability in information systems research', *Information Systems Research* **14**(3), 221–243.
- [21] Majchrzak, A. and Borys, B. [2001], 'Generating testable socio-technical systems theory', *Journal of Engineering and Technology Management* **18**(3–4), 219–240.
- [22] Mumford, E. [1983], *Designing Human Systems — The Ethics Method*. Retrieved 15th April 2011.
URL: <http://www.enid.u-net.com/C1book1.htm>
- [23] Mumford, E. [2006], 'The story of socio-technical design: reflections on its successes, failures and potential', *Information Systems Journal* **16**(4), 317–342.
- [24] Orlikowski, W. J. and Iacono, S. [2001], 'Research commentary: Desperately seeking the "IT" in IT research — a call to theorizing the IT artifact', *Information Systems Research* **12**(2), 121–134.
- [25] Robinson, S. [2006], Issues in conceptual modeling for simulation: Setting a research agenda, *in* 'Proceedings of the 2006 OR Society 3rd Simulation Workshop'. Retrieved 10th April 2011.
URL: <http://arthur.cs.vt.edu/conceptual-modelling/>
- [26] Smithson, S. and Hirschheim, R. A. [1998], 'Analysing information systems evaluation: Another look at an old problem', *European Journal of Information Systems* **7**(3), 158–174.
- [27] Sommerville, I. [2006], *Software Engineering*, Pearson, CA, USA.
- [28] Weinstock, C. B. and Goodenough, J. B. [2006], On system scalability, Technical Report CMU/SEI-2006-TN-012, Software Engineering Institute, CMU.



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Using Componentization as a Means to Standardize Software Development Process: Change from Organizational Redundancy to Process Effectivity

1. Introduction, what we do not know and why does it matter

Software development and its processes are widely discussed areas (e. g. van Solingen 2009; Rico 2004; Zahran 1998, Introna & Whitley 1997). There are arguments for and against the use of standardized methods and their efficiency. Before that can really be assessed, the objectives have to be clarified. There might be quite divergent ends that are trying be reached when a company chooses whether or not to use a certain system or methodology in its software development work. In the end they both, whether or not use a certain methodology, and all aim at the same goal: they are trying to make the software producing process better and more effective. Regarding the methodologies, there are statistics that showed over a decade ago that there are more than one thousand branded methods (Jayaratna 1994). If the goal of these all is more or less the same, how different can the methods be in order to achieve that same goal?

Taken to the environment of traditional production, components and their use is common practice since decades ago. Using read-made components from a subcontractor is often seen as a way to cut down the costs. Component based thinking is also acknowledged to be a good base to start producing effectively mass customized tangible goods required by the customers. (Womack & Jones 1996) The same applies in the case in software business too (Li et al. 2006). One way to make the modifications to the software development process is to unify the actual ways the software is developed. Traditionally, the software development process, the work itself, has been to code everything from the scratch, to start with a clean slate. This means a lot of redundancy and unnecessary work (Schuh 2004). There are many factors and variables in the equation of making software. Some companies justify and rationalize the use methods by saying that with them there is discipline brought into the production process (Fitzgerald 1998). There are certain approved procedures to accomplish. When the amount of work hours in software development is considered, it seems that significant amounts of labour and money are to be saved when these matters are addressed in a right way. Only to find the right way may prove to be a task nigh impossible.

The research problem is condensed to a few research questions: what is said about the use of methodologies in software development? Is there a way to study the phenomenon and if so, is it able to increase understanding of the phenomenon? What are the methods for improving the software development process like? Do the improvement methods really work?

One of the questions behind this study is how to standardize effectively the systems development processes. The last one of the research questions determines the use of qualitative methods, i.e. “what one wants to learn determines how one should go about learning it” (Trauth 2001 4). The reason for choosing a qualitative approach was based on the need for more understanding of the phenomenon. As the empirical research plays a major role in this study, a rich and versatile data is pursued by conducting a qualitative research. This requires interpretative approach to the data gathered. An interpretative approach assumes that the answers people give to questions are creations and associations of their own constructs and perceptions of their interaction with their environment (Chua 1986 according to Trauth 2001). This statement puts the data into

its context. It is intuitively easy to believe that certain solutions are workable only in their certain surroundings. Contingency theory (Fiedler 1964) is based on these assumptions and acts as a starting point to study this phenomenon, however the original theory is focused more on individual leadership and needs thus to be adapted to this day and age as well as to the context in which it is studied. It may be assumed that organizations are open organizations that may be influenced by outside factors, thus they need to be managed with care and in balance with their surroundings and happenings therein (Morgan 1986). There is no one best solution for all occasions, but rather that all occasions demand their own and more or less tailored solutions. Morgan (1986) adds that one of managements priorities should be finding nicely fitting solutions rather than wasting their time in trying to find best overall answers.

The essence of this study is to learn more of the relationship between the theoretical models and practice regarding information systems development (ISD) and software process improvement (SPI). However, this paper does not aim to bind these two together, separate them from one another or enter this particular relationship of these two areas any further but rather leaves it for future research. This paper presents and tests a framework that might be used for modeling these developments. The model's functionality is compared with the findings of the case study. Conclusions are drawn and fitted into overall picture.

In the next chapter the reader will find answer to the question what we do know, as the theoretical rationale is opened up. Third chapter will enlighten more of the whole phenomenon and how it may be observed through the lens of a chosen model. Chapter four entails the case description and the research settings. In chapter five the results of the case study are presented and discussion in chapter six binds the results together with the theory.

2. Theoretical backgrounds

In chapter one there are arguments that argue why standardized, branded methods should be used in software development work. One main argument is to claim that the systems work is so complex by nature that it is advisable to use a methodology to divide it further into more overseeable and controllable subsegments and parts, i.e. steps to be taken (Olerup 1991). This means in practice that breaking the work down to smaller parts makes it easier to accomplish, a thought intuitively quite plausible and easy to believe. Yet another angle at this particular point is the function of methods in dividing the projects, and tasks, into economically manageable units. These divided units may include possibilities for specialization and division of work and workforce and they in turn are a base for various rewarding and remuneration systems. Also the angle of learning new skills may be seen to go with these premises. These are things that need to be addressed further down the line. Also an argument for the use of methods is that of giving on one side the management tools to monitor and oversee the happenings in the actual software production. (Ahituv, Adass & Neumann 1984, Avison & Fitzgerald 1995; Floyd 1987; Friedman 1989 according to Fitzgerald 1998) The nature of systems-related work is sometimes quite independent and it might be even difficult for the management to comprehend. The multifaceted tasks and nature of software work include too many features for any one man to understand. This means that tools like methodologies are needed and welcomed by the managerial staff. On the other side, for the actual workers who are in the middle of it all, the use of methods might give a certain feel of professionalism (Fitzgerald et al. 2002) as all the other functions in their corporation have their frameworks and guidelines, such as corporate governance or bookkeeping practices. The through the use of methodology acquired professionalism is also quite relevant in building the professional identity of and for the software developers. Two unmentioned major reasons that claim that certain methods just have to be used, are confusingly and painstakingly clear. The methodologies or methods might have to be used because the organization is striving for to get the ISO-certification and it is required for the certification that

a method is used in the process. The other given reason is that whether there is a third party involved in the process, such as official authorities and financiers, they sometimes may necessitate the use of a certain methodology. (Downs et al. 1992; Holloway 1989) Despite the latter two are dating back some time they still apply and leave little room, or will, for discussions.

Contrary to the previously presented, there are also numerous articles against the use of methodologies (see e. g. Introna & Whitley 1997; Fitzgerald 1998). A quite a human argument is that while using a methodology one focuses on fulfilling the demands listed by it and stops the thinking process thus losing the focus for the actual goal (DeGrace & Stahl 1990 according to Fitzgerald 1998). This corresponds quite nicely to the proverb and a rule of thumb of one getting what one measures. Another quite plausible sounding argument is the one claiming that when a methodology is applied, the contextual premises are easily forgotten and the solution is seen as omnipotent for every occasion (Chikofsky 1989; Avison et al. 1988; Curtis et al. 1988 according to Fitzgerald 1998). This approach bears risks, as the case specific context might sometimes be seen as a determinant for the needed solution. So, not all solutions are designed for all purposes. Also the more human related factors such as innovation, intuition and creativity are not perceived or they are even totally left out from and by most methodologies (Iivari et al. 2010). One criticized feature in software development is that the organizations tend not to learn (Päivärinta et al. 2010). This feature might be enhanced by the use of methodologies if the learning is not duly noted within the respective specifications. Quite logically the shortened period of lead times (Mujtaba et al. 2010) has lead to the point where the settings are also needed to be for more short term oriented, including the features that are included in the system development methodologies.

3. The model or the lens for observing the phenomenon

In this paper a model is used as a lens through which the phenomenon of software development process is observed and studied. This model simplifies the process and clarifies the objectives of software development process. According to this model there are objectives on a more general level that are recognized to be worth striving for (Päivärinta et al 2010, c. f. Figure 1 below). These objectives are a sort of given guidelines that fulfill also economical as well as technological desires that may exist within one's own organization. These general objectives have certain procedures and steps that are required to be taken in order to achieve the desired outcome. The objectives may include such, for any business enterprise worthy goals as productivity and profitability to name but a few. As for example when productivity is concerned, redundancy is certainly something that is to be avoided. To do something knowingly more than once, or over and over again, is obsolete in contemporary business. It does not matter whether it is about software industry or industry of more traditional nature. This procedure is on general level as mentioned. However, in order to be useful it has to be brought to more case specific, pragmatic level. Thus the context, in which the phenomenon under study is taking place, plays a significant role. There are contextual factors such as organizational structure, the people, the division and allocation of resources that all are within the equation to form the specific outcome. In this case specific context there are particular goals that the organizational management has decided to be the ones that their organization wants to achieve. These goals were for example reduced through-put time, better cost structure and more and improved intraorganizational communication. These goals set the need for specific procedures to fulfill the needs of the organizational goal setting. Let us take the intraorganizational communication as an example; managerial meetings on regular bases as well as team leader meetings serve to cater for this purpose. However, on a general level the procedures may be left at *enhanced internal communications* when on local level it is going to be specified what is actually meant by this. The change from P(l) to P' means that sometimes the original planned procedures evolve into something refined or even completely new procedural action as the time goes by and experiences are gathered.

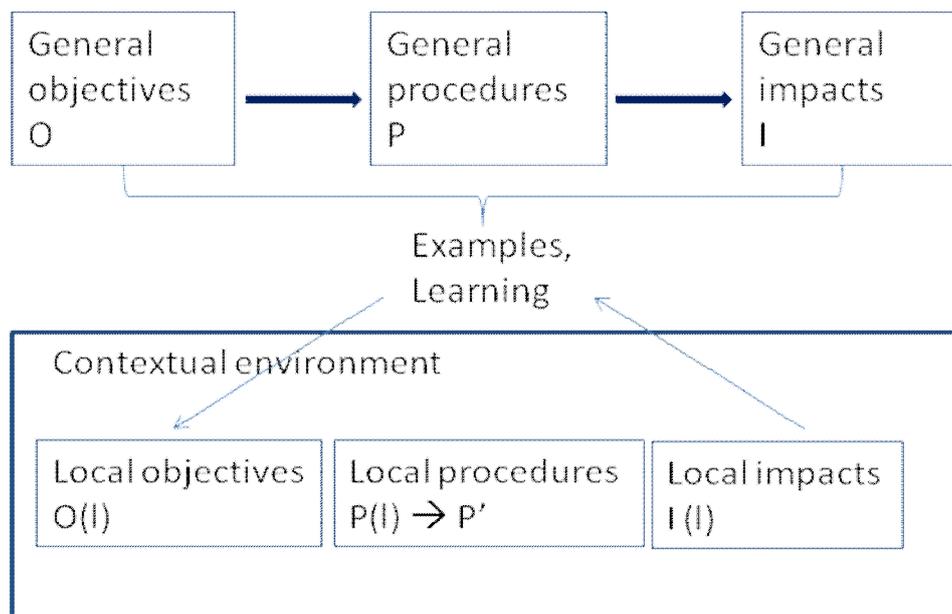


Figure 1. The Process Improvement Model (Päivärinta et al. 2010)

After having implemented local procedures in their original or altered form the result present themselves on local scale. Those are the outcomes on that particular environment formed by the particular, local procedures. The results wouldn't necessary be the same in another setting, even within the same industry, let alone in completely another branch. The interface between the two levels is formed by learning. The very phenomenon that is said not to be there (Päivärinta et al. 2010; Fitzgerald 1998). The interpretation of this statement is that the organizations tend to start everything over with the clean slate as mentioned, instead of having learned from past projects and their experiences. Seen from the other side, it may be observed to mean examples taken from theoretical approaches into practice, i.e. one reads and learns and then applies the learned into a real life case. The learning may also be interpreted to the work that academics do to form new or improved theories based on cases we study. When certain measures are taken, their results studied and their implications formed one may see how all that responds to the theoretical model that has set the action in motion in the first place. In case alterations are needed, they are made. Learning happens on theoretical level. Aforementioned deficiency in learning was meant to be the one in companies and in their software development work, i. e. how actively, and well, the organizations debrief their teams after each project to learn from their possible mistakes and successes. This is something in which the methods may assist the companies. The learning should be written down in the procedures. These are focal matters in this phenomenon and they certainly deserve more attention in the future.

4. Presentation of the case and the used methods

The case company is a high-tech company, a large software company operating in business-to-business market. The case organisation provides large and complex ICT systems and solutions for its organisational customers. The company has grown rapidly in the last years, mostly through acquisitions and mergers. The acquisitions have made the company become quite dispersed. Typically the companies that have been bought have remained working as separate teams, even in company-like manner, inside the mother company. Also

the mother company's original operation is based on working in separate teams. The teams differ in many ways. They have different organisational backgrounds, different technologies and tools in use, different products and customers and also very different compositions. Each of these teams is responsible for their own software development, production and sales. There is also often physical distance between different teams. The organization is geographically quite dispersed as the operation involved in this study takes place on eight sites. These distances make it difficult to know what others in the organisation are doing. Even the team leaders do not mostly know what the others on an equal hierarchical level in the organisation are working on. Due to this, the teams are making the software often, if not always, from scratch. This leads to a situation that the teams do overlapping programming and software development work. This overlap in the software development process causes extra costs for the company.

The toughening competitive situation of and in the external environment is giving the company pressure to search for newer and more efficient ways of working in its software development and production. The aim is to root out redundancies, increase productivity and improve the level of innovativeness in order to create better and more effective solutions for customers. To get to that point better utilisation of the knowledge inside the organisation is needed. Thus, improvements in the knowledge flows and closer collaboration between teams and individuals throughout the organisation are necessities. The organisation tries to tackle the aforementioned problems by switching to decentralised component based software engineering. By this strategic decision the organisation aims to use existing knowledge more effectively. With this they aim to release more resources to the development of new innovative ideas. Component based software engineering (CBSE) means that in addition to doing their day-to-day tasks as before the teams must try to identify potential components, i.e. products, subparts or features that could also be used in other teams and environments. After being approved as a component the component should be entered into the component repository called a library to be available for the others in the organisation. As a method for data gathering interviews were an obvious solution. In the case study, altogether 44 interviews were carried out, see Table 1 below.

Table 1. Summary of the interview data

Interviewees	Architects	Management	Team leaders	Code writers	Other	Total
Site A (He)		1+1	2		1	5
Site B (Ta)	3	0+1	2+2	1	1	10
Site C (Tu)			4	3+1		8
Site D (Po)		1	1+1			3
Site E (La)	1+1	0+1	1	3+1	2	10
Site F (Lra)	1		1			2
Site G (Ri)	1+1		1		1	4
Site H (Va)			2			2
Total	8	5	17	9	5	44

The interviews took place on various hierarchical levels of both of the organizations in order to get the most reliable picture of the situation and happenings regarding the organizational change. The interviewees were

assured their anonymity to further strengthen the reliability of the answers. In addition, in the case two internal workshops of the organization were observed and documented. Both of these observed workshops were related with the organizations change process at hand. Also internal documents of the organization were collected to complement the interview and the observation data.

In the case company the operation is geographically dispersed onto multiple sites. The 44 interviews were conducted on various sites. First group to be interviewed was what the organization named an architect team. These were the change agents, a group of individual professionals responsible for making the change happen. They were the ones to think of the standardization process as a whole and to think of the methods by which this harmonization could and would be made happen. Members of this team were also operative on different sites from one another. The team leaders were IS professionals with extensive experience in the trade. Their participation in the actual software development varied, but often they were in the middle of it like any other member of their team. After the first group the interviews were agreed upon and arranged on various hierarchical levels and sites according to the schedules of individual interviewees. The first round interviews were carried out in the beginning of the organizational change, the second round interviews were follow-up interviews carried out after the busiest change period was over.

5. The results; based on the study

According the data, the interviewees in the case organization are in unison of the basic objectives: they all agreed that some measures are to be taken in order to improve the productivity and competitiveness in their case organization and also in their line of business in which the competitive situation is hard. They also shared the unanimous opinion that the present state of operation was not optimal. The interviewees acknowledge that there is overlapping and redundant work done all around the organization that has grown through numerous acquisitions and mergers. Partly the situation is due to the historical facts of merged technologies, products and teams and partly due to the dispersed nature of the operation based on multiple locations. However, in this study the geographical distance and its effects are not studied any further.

The management in the case organization made a strategic decision to concentrate the efforts of improving the operation to software development process in which the teams were introduced a new production philosophy: componentization. Componentization, also known as component-based-software-engineering (CBSE), is recognized as a way to increase the effectiveness of software development in several technically oriented studies (see e.g. Meyers & Oberndorf 2001). CBSE decreases the amount of overlapping work as basic features may be put into practise by using readymade components instead of having to do all by oneself. Componentization means that as the teams are developing software, they are supposed to monitor whether various parts of their output could be used as components also elsewhere within different teams and products. The components and their repository, the component library, are defined by the architect team. The architect team set the guidelines as to what is a component and how they are to be built while offering advice and consultancy to the teams.

There are two major ways to organize the actual componentization: decentralized and centralized component based production. The centralized component based production means that the component creation and component use are separated from one another: component creators and their users are not the same people (Frakes & Kang 2005; Jacobson, et al. 1997). There is often a dedicated professional unit responsible for the creation and production of components. In the decentralized way of componentization anyone can be a component creator or user. Also a compromise of the two is possible (Jacobson, et al. 1997). The effective use of resources and intraorganizational communication concerning developing and using reusable software

is an important factor in enabling the componentization in any chosen model (Sherif et al. 2006). In this paper the componentization nor the details how the change was implemented, are not covered any further.

The actual results concern the fact how the componentization was realized in the case organization. In here lie the most divergent opinions. The management declared that henceforth only one specific programming language was to be used. In the case organization there was a team assembled to introduce and to help to implement the actual change in all the teams. This architect team was also supposed to promote the new way of doing software development as well as to define the concept of component and storage facility of the components in the case organization. The architect team itself declared that they have done their part, perhaps sometimes ungrateful task of informing the teams about the change. According to them they had arranged meetings and they had informed all the personnel on various occasions about the new way of developing software. They had set up web page in the company intranet with information about the renewal. However the personnel to whom this information was targeted for did not share their opinion. There were answers according to which the message was not too clear and also the frequency of these informative meetings and briefings was not sufficient. This contradiction may have been caused by the fact that there were not enough extra resources allocated to the change project. The teams were kept busy in maintaining their level of production with the ongoing customer projects. They had to concentrate on multiple things at the same time.

The most unsuccessful action was that of unifying the used programming language. The teams that were already using that particular language in their software development were more satisfied with this decision. However, the teams which were not familiar with this new standard, although they were promised support in form of training and even manpower, did not exactly welcome this move. Some teams acknowledged the possible need for change, modernization, but still the actual change was a bit much for them. Also the training needed and promised to implement this change was felt quite laborious to schedule as there were no major extra resources allocated to these teams and the teams still had to keep up with their preordered software development work.

The conclusions may be summarized on two levels, practical and theoretical. On the practical side such framework may give a model to follow up on and that there are methodologies worth applying if implemented correctly; suitable under the circumstances and fitting to the context. There so many methodologies that it implies that perhaps some are modifications to various contexts. There is no reason, why things could not be done again in similar way in a certain company. That is to say that the use of a methodology has generally no value as such, only as a means to an end. If there is a methodology found in the literature that suits the case, according to the experiments observed in this company, it may be implemented. Sometimes it is necessary to concede an unsuitable solution for a certain purpose. If need be, the methodology may be modified to fit the needs and the outcome can still be functional.

The study gives pragmatic understanding and confirmation to state that the local procedures result in local outcomes and that they may be changed if need be. The conclusions on theoretical level conform to those on practical level. It may be stated that such a theoretical model will ease the search for a suitable solution. It also contributes to the understanding of the phenomenon by clarifying the causalities involved in this.

6. Discussion

In theory there are numerous possibilities to be found to manage one's operation. There is also a number of ways to improve and enhance them. It is quite clear that the methodologies and methods are there in abundance, there are surely some suitable solutions for almost every need. However, one should pay

attention in what measures are to be chosen to be put into practice, because not all measures are suitable for all occasions. Also, the same applies to how these measures are presented and implemented for and in an organization. The model used in this paper presents a plausible way to model the process of information system development. Software process improvement falls at least partly under this same model. The model also helps to form a picture of the proceedings in the case organization of how the standardizing process really went. The decisions made by the management in their context are in real life the factors that form the base on which the choice of methodology and/or methods. This context is always a brew of the products, technology used to build them, organization, with its members, ways of working and artifacts, but also its environment as well.

In the case organization there was a clear consensus among the interviewed persons on various hierarchical levels that something should, and could, be done. There were little to be done with the environment so it became obvious that they needed to look into their own operation. The competitive situation would not ease up, so the productivity came in to focus. The consensus reached also the fact of what should have been done; software development process could be improved. Then the question became how the process should be improved. The answer was found to be standardizing the software production process into component based software development and engineering. Basically the operation was to be standardized and harmonized; all the teams should work in similar ways with the same programming language to build components for other teams to use in addition to that of their own and also to use components made by others in their own work. Intuitively this sounds fine.

However, there were factors along the way to make things harder. A quite human phenomenon of resistance to change for one: the teams were not pleased by the fact that they would have to give up their learned practices. There were also voices uttering doubts about the made decisions, for example the shift to unification of the programming language. Although in their answers there was still acknowledgement to this direction. The resistance to change may be more than just a negative phenomenon. It may start discussions and point out flaws in the plan.

The informative communications about the renewed process were reportedly performed as they should have, but still the receiving end did not feel as they would have gotten enough information on what was happening and how. The alleged mishap in intraorganizational communications deteriorated the reform significantly. Management's choice of the programming language was perhaps justified but still not welcomed by the people whose work it affected. The reluctance towards the new chosen programming language was emphasized by the fact that there were experiences of too little information shared on the whys and hows regarding this process renewal. According to principles of change management, the sufficient and well-executed information flow is essential to the successful implementation of change. Eventually the management realized what the situation was and they revoked the decision regarding the programming language as long as there were interfaces to enable black-box thinking and the basic idea of the use of components. This soothed the troubled team members to some extent and the successful pilots of the components and their use catered for the rest.

These experiences reflect to the theory, as mentioned, that even though theory provides for multiple models and examples an organization might want to try, not all measures are applicable in every context. Also the fact that the procedure through which an end is trying to be reached may be adjusted if need be. In the case organization the management realized this and altered their approach as the programming language was concerned. They still maintained the idea of component-based operation for improving their productivity and effective software development process.

The study was conducted quite successfully. However, as at the end of the study the process was still ongoing, it would be most interesting to examine once more the case organization after some time. To see whether the software process is really improved, how the people involved think of the process now and how the present state corresponds to the past expectations of the architects of the change.

References

- Downs, E., Clare, P. & Coe, I. 1992. Structured Systems Analysis and Design Method: Application and Context. Prentice-Hall. Hertfordshire.
- Fiedler, F. E., 1964. A Contingency Model of Leadership Effectiveness. *Advances in Experimental Social Psychology* (Vol.1). New York. Academic Press. Pp. 149-190.
- Fitzgerald, B., 1998. An Empirically-Grounded Framework for the Information Systems Development Process. Proceedings of ICIS1998, paper 10. Found at: aisel.aisnet.org/icis1998/10. Read 04.04.2011
- Fitzgerald, B., Russo, N. L. & Stolterman, E., 2002. *Information Systems Development*. McGraw-Hill. London. 194 p.
- Frakes, W. B. & Kang, K. 2005. Software Reuse Research: Status & Future. *IEEE Transactions on Software Engineering* 31 (7) July: 529-536.
- Holloway, S. 1989. *Methodology Handbook for Information Managers*. Gower Technical. Aldershot.
- Iivari, J., Isomäki, H., & Pekkola, S., 2010. The user – the great unknown of systems development: reasons, forms, challenges, experiences and intellectual contributions of user involvement. *Information Systems Journal*, 20, 2. Pp. 109-117.
- Introna, L. D. & Whitley, E. A., 1997. Against method-ism: exploring the limits of method. *Logistics Information Management*. Vol. 10 Nr 5. Pp. 235-245.
- Jacobson, I., Griss, M. & Jonsson, P. 1997. *Software reuse – Architecture, Process and Organization for Business Success*. Addison-Wesley. London.
- Jayarathna, N. 1994. *Understanding and evaluating methodologies*. McGraw-Hill. London.
- Li, Y., Yin, J. & Dong, J., 2006. A Component Management System for Mass Customization. *Computer and Computational Sciences*, 2006. IMSCCS '06. First International Multi-Symposiums on, 2006, 2, pp. 398-404.
- Meyers, B. C. & Oberndorf, P. 2001. *Managing Software Acquisition*. Open Systems and COTS Products. SEI Series in Software Engineering, Addison-Wesley.
- Morgan, G., 1986. *Images of Organization*. Sage. Beverly Hills. 423 p.
- Mujtaba, S., Feldt, R. & Petersen, K., 2010. Waste and Lead Time Reduction in a Software Product Customization Process with Value Stream Maps. Proceedings of 21st Australian Software Engineering Conference (ASWEC), 2010. pp. 139-148
- Olerup, A. 1991. Design Approaches: A Comparative Study of Information System Design and Architectural Design. *The Computer Journal*. Vol 34 (3). Pp. 215-224.
- Päivärinta, T., Sein, M. K. & Peltola, T., 2010. From ideals towards practise: paradigmatic mismatches and drifts in method deployment. *Info Systems Journal* (2010) 20, pp. 481-516

Päivärinta, T., Smolander, K. & Åby Larsen, E., 2010. Towards a Framework for Building Theory from ISD Practises. Forthcoming proceedings of 19th International Conference on Information Systems Development (ISD2010) Prague, Czech Republic, Aug. 25 - 27, 2010

Rico, D. F., 2004. ROI of Software Process Improvement : For Project Portfolio Managers and PMO's. USA: J. Ross Publishing Inc.

Schuh, P., 2004. Integrating Agile Development in the Real World. Charles River Media. Hingham. 364 p.

Sherif, K., Appan, R. & Lin, Z. 2006. Resources and incentives for the adoption of systematic software reuse. *International Journal of Information Management* 26: 70-80.

van Solingen, R., 2009. A Follow-Up Reflection on Software Process Improvement ROI. *IEEE Software* 26(5). Pp. 77-79.

Trauth, E. M. 2001. The Choice of Qualitative Methods in IS research. In Trauth, E. M. (edit.) 2001. *Qualitative Research in IS: Issues and Trends*. Idea Group Publishing. Hershey. 298 p.

Womack, J. P. & Jones, D. T., 1996. Beyond Toyota: How to Root Out Waste and Pursue Perfection. *Harvard Business Review*. Sep/Oct 1996, Vol. 74, Issue 5, pp. 140-158.

Zahran, S., 1998. *Software Process Improvement. Practical guidelines for business success*. Harlow: Addison-Wesley.

ERP System Implementation in Small and Medium-sized Enterprises: Defining the SME Context

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Abstract. The purpose of this paper is to present research in progress exploring the issue of Enterprise Resource Planning (ERP) system implementation in small and medium-sized enterprises (SMEs). SMEs are characterized by certain unique features which need to be understood when implementing an ERP system into their environment. This paper aims to identify the unique characteristics of SMEs which may have influence on the ERP system implementation. Based on a literature review various characteristics are recognized and grouped into three dimensions. These together form a framework of the SME context. The framework is proposed for further empirical investigation through a multiple case study.

Keywords: ERP system implementation, SME context, case study.

1 Introduction

Over the past decade Enterprise Resource Planning (ERP) system vendors have been moving their attention towards small and medium-sized enterprises (SMEs) by offering simplified and cheaper solution deemed to be suitable for these organizations. However, ERP system implementation remains a challenge for SMEs [1], and its successful completion is still an issue of concern [e.g., 2, 3]. The problems encountered by smaller firms are different from those encountered by large firms [4]. Because of various fundamental differences between large and small businesses, the findings from studies of IT/IS adoption in large enterprises (LEs) are unlikely to be applicable to SMEs [5-7]. Similar, the research on ERP implementation argues that findings from LEs cannot be applied to SMEs since they represent a fundamentally different environment [8-9]. Although a number of researchers have focused on the ERP implementation process, most of the ERP literature is based on findings from LEs [10-11]. The research on ERP in SMEs is still limited and more research needs to be carried out in order to gather sufficient knowledge about this phenomenon [12].

Compared to LEs, SMEs have fewer resources and experience in terms of management of new technologies [6]. Besides that, SMEs are represented by a spectrum of inherent characteristics which distinguish them from LEs, such as ownership, structure, culture, market, etc. [13]. These aspects of the SME context are likely to determine the way in which these organizations conduct ERP system implementation.

Therefore, it is important to recognize these distinguishing characteristics and consider how these differences may influence the ERP implementation issues faced by SMEs [14]. The extant research provides only scarce findings about the effect of these contextual characteristics on ERP system implementation.

The purpose of this research is to explore ERP system implementations in SMEs and investigate how the SME context affects particular issues within the ERP life-cycle. Thus the research is addressing the following research question: How does the SME context affect ERP system implementation? The research investigates influence of various SME characteristics on the ERP system implementation. It is believed that a proper understanding of the SME context will lead to a better comprehension of ERP system implementation and thereby contribute to future successful ERP implementation projects in these organizations.

The rest of the paper is organized as follows. First, a review of existing literature covering the issue of the SME context is provided. It is organized according to the focus of the literature, on IS in more general view, and then on ERP system literature. After that, based on the literature review, a framework of the SME context is developed. This framework is proposed for further research through the introduced research methodology. The paper concludes with presenting further research steps and discussing expected contribution of the research.

2 Literature Review

This section summarizes existing literature exploring the SME context issue. It covers various areas of research, grouped into three subsections according to the research focus.

2.1 SMEs & TQM/ KM

Here, two vital studies exploring the SME context with relation to Total Quality Management (TQM) [15], respectively to knowledge management (KM) [13], are introduced. These studies were selected as they provide an excellent overview of inherent characteristics differing SMEs from LEs.

The study by Ghobadian and Gallear [15] explored the differences between LEs and SMEs, and analyzed the relationship between the SME characteristics and TQM practices. The authors compiled an extensive list of issues differing SMEs from LEs, grouped into six areas: structure, procedures, behavior, processes, people, and contacts. The influence of these issues on TQM implementation practices was investigated, and as a result a model for the implementation of TQM in SMEs was developed.

In a study characterizing KM in small business environment, Wong and Aspinwall [13] looked at specific SME characteristics and their key problems and issues associated with KM. The authors, inspired by Ghobadian and Gallear [15], proposed a list of SME characteristics which can have an influence on implementation of KM. The characteristics were classified into six various groups: ownership and management;

structure; culture and behavior; systems, processes and procedures; human resources; customs and market. The study findings concluded that recognition of these elements is crucial in order to provide a compatible KM approach for SMEs.

2.2 SMEs & IT/IS

The research on IT/IS adoption has identified significance of organization size [e.g., 7, 16] and various issues of IT/IS adoption and implementation in small organizations have been explored. Some studies explored factors affecting IT/IS adoption in small businesses [5, 17]. Among the investigated factors are CEO characteristics, business size, employees' IS knowledge, information intensity, or competition. Most studies on IT implementation focused on various factors influencing MIS success [e.g., 18], system usage [e.g., 19, 20], and satisfaction [21-22]. Among the recognized factors are easy of use, perceived usefulness, top management support, consultant effectiveness, vendor supports, education, training, etc.

As a general finding, the studies identified barriers to IS/IT adoption in small enterprises. SMEs have been found to be constrained by limited resources [6, 23-25], limited internal IT/IS expertise [6, 23-28], and limited IS knowledge [24-26].

The study by Bili and Raymond [6] investigated the threats and opportunities of SMEs during IT adoption. In contrast to the rest of research, this study went further and emphasized importance of SME environment specificity. The authors developed a schematic summary of the unique SME characteristics with respect to strategic information systems. The SME specificity features were classified into five areas: environmental specificity, organizational specificity, decisional specificity, psychosociological specificity, and information systems specificity. The study provides a framework for analyzing the threats and opportunities created by IT in SMEs.

2.3 SMEs & ERP

A number of studies engaged in the issue of ERP systems in SMEs, investigated critical factors of successful ERP system implementation [e.g., 11, 29, 30-32]. These studies by identifying critical factors for successful implementation have noticeably contributed to our understanding of ERP system implementation in SMEs. Among the identified factors contributing to ERP implementation success are top managements support, project champion, external consultant, organizational communication, user involvement, proper project management, small internal team, focus on user requirements, proper package selection, etc.

Some studies investigated influence of various factors on ERP system adoption in SMEs, such as CEO characteristics [33-34], various organizational characteristics [33, 35-37], environmental characteristics [33, 35, 37], technological context [35, 37], and many other distinct variables [e.g., 9]. These studies provide findings about influence of particular factors on the successful acquisition of an ERP system. However, few studies examined the influence of the unique SME characteristics among the studied factors.

An exception article has been conducted by Gable and Stewart [14] who proposed a study focusing on the implementation issues in SMEs adopting SAP R/3. The study adopted four dimensions of the SME specificity framework by Blili and Raymond [6]: organizational, decisional, psycho-sociological, and information systems specificity, and proposed their application into the context of ERP systems. However, as the paper presents a research in progress, it only proposed a tentative model describing interacting variables with a brief presentation of possible effects of the four dimensions on ERP system implementations. Unfortunately, no follow-up study continuing in the proposed research was published.

3 The SME Context Framework

Examination of former research in SMEs enabled the author to develop a framework of SME characteristics potentially influencing ERP system implementation. Table 1 lists all the identified characteristics specific for these organizations, including reference studies. For a better overview they are grouped into three dimensions according to their character: organizational characteristics, environmental characteristics, and IS characteristics. The following section provides a detailed description and discussion of particular SME characteristics.

Table 1. The SME context framework.

Dimension	References
Organizational characteristics	
Resources	[6, 13-14, 23-25]
Ownership, management, and decision making	[6, 13-14]
Structure	[6, 13-14]
Culture	[13, 15]
Processes and procedures	[13, 15]
Environmental characteristics	
Market	[13]
Customers	[1, 6, 13]
Uncertainty	[1, 6]
IS characteristics	
IS knowledge	[24-26]
IT/IS technical expertise	[6, 23-28]
IS function, complexity, and success	[6, 14]

3.1 Organizational Characteristics

SMEs are constrained in terms of their financial [24] as well as human resources [13]. They usually do not dispose of capacity to develop and manage their own IS and thus they are likely to rely on the third parties such as vendors and consultants [6]. This might lead to a limited control over the information resources and thus increase the

level of risk [6]. As SMEs dispose with limited number of employees, it might be hard to assign dedicated staff to an ERP implementation project. Furthermore, these organizations may lack employees with appropriate skills necessary for such activity. In addition, because of the resource constraints SMEs generally invest less into employees training, as opposed to LEs which have resources to develop customized training and educational programs [13]. Lack of resources for sufficient training is likely to affect ERP system implementation in these organizations.

The managers of SMEs are often owners who dispose of the ultimate power of control and commonly oversee every aspect of the business [13]. Often they are the only ones with responsibility and access to the information needed to identify opportunities for using IT for strategic or competitive purposes [6]. There is thus few personnel eligible to justify such activity as the implementation of ERP system [14]. The owner-managers usually do not have enough time to reflect on strategic issues, as they are busy with day to day operations and their attention is more on core business operations [13]. Thus, it might be difficult from the owner-managers to recognize a need for change [13]. Decision-making is generally centralized with fewer layers of management and decision makers [13]. This implies that the decision-making cycle is usually short-term [6]. In addition, the decision process in SMEs is more intuitive, as limited number of formal information and decision models are employed [6, 14].

In contrast to LEs which usually have a bureaucratic structure, SMEs have a simple and centralized structure [13-14]. A simpler structure might facilitate the system requirements and tailoring of the IS according the firm's strategy [6]. The structure also imposes a low degree of employee's specialization in their jobs, as workers in small firms often perform a variety of tasks [13].

Compared to LEs, culture in SMEs is more organic and fluid [15]. In addition, it is often characterized as unified, with fewer interest groups [13]. The employees have usually a corporate mindset emphasizing the company as a single entity. The unified culture may provide SMEs with a strong foundation for change, as the employees easily understand what the company is trying to achieve [13]. This might be also applicable to better understanding and appreciation of the ERP system implementation projects.

The processes and operations in SMEs are smaller in scale and less complicated than those in LEs [13]. Their processes are also often more flexible and adaptable to changes [15]. Therefore, SMEs are likely to be more adaptable to implementing new initiatives [13]. However, the agile SME environment causes another problem. The need to react quickly in SMEs causes that most of the activities are governed by informal rules and procedures [13, 15]. The lack of clear processes and procedures might hinder ERP system implementation, as business process mapping may be difficult in such conditions.

3.2 Environmental Characteristics

Market encompassed by SMEs is mostly local, while only few of them have an international range [13]. In general SMEs are dependent on a small customer base with frequent and closer contacts with customers [13]. The position of an SME in a supply chain may also influence ERP system implementation projects. Major SMEs' custom-

ers, sometimes even suppliers, who are typically powerful in their supply chain, may force SMEs to a system compatible with their extant solution and thus influence ERP system implementation in these organizations [1].

Moreover, SMEs are typically characterized by a high level of environmental uncertainty [6]. The uncertain and unstable environment with doubtful viability of the business may significantly affect any long term investments on information technologies [1].

3.3 IS Characteristics

With regard to IS, SMEs have been reported having limited IS knowledge [24], as there is usually not enough managerial expertise available to plan, organize and direct the use of information resources [6]. The lack of IS knowledge may lead to insufficient attention by management to IS [26] and in turn to lack of strategic planning of IS [25]. Moreover, SMEs are constrained by their limited IT/IS internal technical expertise [24, 26-27]. Many SMEs possess insufficient level of in-house IT/IS expertise necessary for successful IS adoption [25, 28].

The IS function in most SMEs is typically in an early stage of evolution [14], usually subordinated to the accounting function [6]. Typically, IS application in SMEs are transaction-oriented [6], usually acquired as pre-programmed software packages [14]. It is because of their limited internal IT/IS expertise that SMEs are more likely to purchase a package software, instead of developing a system in-house [18]. Finally, organizational IS have little impact on decisional and organization effectiveness in SMEs [14].

4 Research Methodology

As the purpose of the proposed research is to identify new insights within ERP system implementation in SMEs, an exploratory qualitative research approach employing a multiple case study design is applied. Case studies allow collection of rich data and are appropriate to study a contemporary phenomenon within its natural setting [38].

Personal interviews are used as the primary data collection technique. Recognizing the importance of a multiple stakeholder perspective while conducting research on ERP systems, interviews with various respondents involved in the ERP implementation within each organization have been conducted. The respondents represent different positions, including top and middle management, end users, IT responsible persons, etc. In addition, vendors or consultants who have been involved in the ERP implementation were also interviewed. The interviews were semi-structured and face-to-face, following Myers & Newman's [39] guidelines for conducting qualitative interviews. The interview questions covered various issues of ERP system implementation through the entire ERP life-cycle [40], including issues such as ERP implementation motivation, selection process, implementation team activities, critical success factors, user training, ERP system usage, ERP outcomes, maintenance, etc. The interviews were recorded and are now being transcribed for further data analysis.

The data analysis concentrates on identifying influence of the SME context on particular issues of ERP system implementation emerging from the interview data. First, within-case analysis are conducted in order to well understand the individual cases [41]. Then, a cross-case analysis of all the cases is applies, looking for similarities and differences between the cases. While the SME characteristics identified from former literature are used as an underlying framework, the analysis is expected to also identify new insights emerging from the interview data.

Progress to Date

I have finalized the data collection and I am currently working on the data analysis and reporting. In total, 4 organizations are studied. The cases are SMEs operating within the private sector in the Czech Republic. In total, 34 interviews were conducted across the four organizations. The main data collection was carried out during the period from February to October 2010, with some follow-up data collection conducted in spring 2011.

5 Conclusion

Based on the literature review the SME context framework has been developed. It summarizes characteristics of SMEs identified from former literature. The purpose of the proposed research is to investigate effect of the SME contextual variables on ERP system implementation issues. By identifying the effect of the SME context, the research will contribute to the research on ERP system implementation in organizations. The results from this research are expected to contribute to the scarce knowledge about the effect of the SME context on ERP system implementation projects. The acquired knowledge is expected to be useful for SMEs about to implement an ERP systems, as well as ERP vendors. The understanding of the specific organizational context is expected to contribute to successful implementation of ERP systems in these organizations.

References

1. Seethamraju, R. and J. Seethamraju. Adoption of ERPs in a Medium-sized Enterprise - A Case Study. in Australasian Conference on Information Systems (ACIS). 2008. Christchurch.
2. Malhotra, R. and C. Temponi, Critical decisions for ERP integration: Small business issues. *International Journal of Information Management*, 2010. 30(1): p. 28-37.
3. Upadhyay, P., R. Basu, and P.K. Dan, Issues before Indian Small and Medium Scale Enterprises Opting for ERP Implementation, in *Information Intelligence, Systems, Technology and Management*, S. Dua, S. Sahni, and D.P. Goyal, Editors. 2011, Springer Berlin Heidelberg. p. 41-50.
4. Welsh, J.A. and J.F. White, A small business is not a little big business. *Harvard Business Review*, 1981. 59(4): p. 18-27.
5. Thong, J.Y.L., An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems*, 1999. 15(4): p. 187-214.
6. Bili, S. and L. Raymond, Information technology: Threats and opportunities for small and medium-sized enterprises. *International Journal of Information Management*, 1993. 13(6): p. 439-448.
7. DeLone, W.H., Firm Size and the Characteristics of Computer Use. *Mis Quarterly*, 1981. 5(4): p. 65-77.
8. Mabert, V.A., A. Soni, and M.A. Venkataramanan, The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector. *Omega*, 2003. 31(3): p. 235-246.
9. Buonanno, G., et al., Factors affecting ERP system adoption: A comparative analysis between SMEs and large companies. *Journal of Enterprise Information Management*, 2005. 18(4): p. 384-426.
10. Muscatello, J.R., M.H. Small, and I.J. Chen, Implementing enterprise resource planning (ERP) systems in small and midsize manufacturing firms. *International Journal of Operations and Production Management*, 2003. 23(7/8): p. 850-871.
11. Loh, T.C. and S.C.L. Koh, Critical elements for a successful enterprise resource planning implementation in small-and medium-sized enterprises. *International Journal of Production Research*, 2004. 42(17): p. 3433-3455.
12. Haddara, M. and O. Zach. ERP Systems in SMEs: A Literature Review. in 44th Hawaii International Conference on System Sciences (HICSS). 2011. Kauai, Hawaii USA
13. Wong, K.Y. and E. Aspinwall, Characterizing knowledge management in the small business environment. *Journal of Knowledge Management*, 2004. 8(3): p. 44.
14. Gable, G. and G. Stewart. SAP R/3 Implementation Issues for Small to Medium Enterprises. in *Americas Conference on Information Systems (AMCIS)*. 1999.
15. Ghobadian, A. and D. Gallea, TQM and organization size. *International Journal of Operations and Production Management*, 1997. 17(2): p. 121-163.
16. Raymond, L., Organizational Context and Information Systems Success: A Contingency Approach. *Journal of Management Information Systems*, 1990. 6(4): p. 5-20.
17. Thong, J.Y.L. and C.S. Yap, CEO characteristics, organizational characteristics and information technology adoption in small businesses. *Omega*, 1996. 23(4): p. 429-442.
18. Raymond, L., Organizational Characteristics and MIS Success in the Context of Small Business. *Mis Quarterly*, 1985. 9(1): p. 37-52.
19. DeLone, W.H., Determinants of Success for Computer Usage in Small Business. *Mis Quarterly*, 1988. 12(1): p. 51-61.

20. Palvia, P., D.B. Means, and W.M. Jackson, Determinants of computing in very small businesses. *Information & Management*, 1994. 27(3): p. 161-174.
21. Montazemi, A.R., Factors Affecting Information Satisfaction in the Context of the Small Business Environment. *Mis Quarterly*, 1988. 12(2): p. 239-256.
22. Yap, C., C. Soh, and K. Raman, Information systems success factors in small business. *Omega*, 1992. 20(5-6): p. 597-609.
23. Thong, J.Y.L., Resource constraints and information systems implementation in Singaporean small businesses. *Omega*, 2001. 29(2): p. 143-156.
24. Cragg, P.B. and M. King, Small-Firm Computing: Motivators and Inhibitors. *Mis Quarterly*, 1993. 17(1): p. 47-60.
25. Levy, M. and P. Powell, Information systems strategy for small and medium sized enterprises: an organisational perspective. *The Journal of Strategic Information Systems*, 2000. 9(1): p. 63-84.
26. Cragg, P.B. and N. Zinatelli, The evolution of information systems in small firms. *Information & Management*, 1995. 29(1): p. 1-8.
27. Iacovou, C.L., I. Benbasat, and A.S. Dexter, Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *Mis Quarterly*, 1995. 19(4): p. 465-485.
28. Fink, D., Guidelines for the Successful Adoption of Information Technology in Small and Medium Enterprises. *International Journal of Information Management*, 1998. 18(4): p. 243-253.
29. Upadhyay, P., S. Jahanyan, and P.K. Dan, Factors influencing ERP implementation in Indian manufacturing organisations: A study of micro, small and medium-scale enterprises. *Journal of Enterprise Information Management*, 2011. 24(2): p. 130-145.
30. Snider, B., G.J.C.d. Silveira, and J. Balakrishnan, ERP implementation at SMEs: analysis of five Canadian cases. *International Journal of Operations and Production Management*, 2009. 29(1): p. 4-29.
31. Doom, C., et al., Critical success factors for ERP implementations in Belgian SMEs. *Journal of Enterprise Information Management*, 2010. 23(3): p. 378 - 406.
32. Sun, A.Y.T., A. Yazdani, and J.D. Overend, Achievement assessment for enterprise resource planning (ERP) system implementations based on critical success factors (CSFs). *International Journal of Production Economics*, 2005. 98(2): p. 189.
33. Chang, S.-I. and S.-Y. Hung, Critical Factors of ERP Adoption for Small- and Medium-Sized Enterprises: An Empirical Study. *Journal of Global Information Management*, 2010. 18(3): p. 82-106.
34. Shiau, W.-L., P.-Y. Hsu, and J.-Z. Wang, Development of measures to assess the ERP adoption of small and medium enterprises. *Journal of Enterprise Information Management*, 2009. 22(1): p. 99.
35. Ramdani, B., P. Kawalek, and O. Lorenzo, Predicting SME's adoption of enterprise systems. *Journal of Enterprise Information Management*, 2009. 22(1): p. 10.
36. Raymond, L., S. Rivard, and D. Jutras, Evaluating Readiness for ERP Adoption in Manufacturing SMEs. *International Journal of Enterprise Information Systems*, 2006. 2(4): p. 1-17.
37. Raymond, L. and S. Uwizeyemungu, A profile of ERP adoption in manufacturing SMEs. *Journal of Enterprise Information Management*, 2007. 20(4): p. 487-502.
38. Yin, R.K., *Case Study Research: Design and Methods*, ed. i. 4. 2008: Sage.
39. Myers, B.L., L.A. Kappelman, and V.R. Prybutok, A comprehensive model for assessing the quality and productivity of the information systems function: toward a theory for information systems assessment. *Inf. Resour. Manage. J.*, 1997. 10(1): p. 6-25.
40. Esteves, J. and J. Pastor, An ERP Lifecycle-based Research Agenda. 1^o International Workshop on Enterprise Management Resource and Planning Systems EMRPS, 1999(Venice, Italy): p. 359-371.
41. Eisenhardt, K.M., Building Theories from Case Study Research. *The Academy of Management Review*, 1989. 14(4): p. 532-550.

IT Governance in Corporate Social Media – A Case Study

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Abstract. Organizations are increasingly using social media for business purposes such as marketing, internal and external communication as well as crowdsourcing ideas for product and service development. Relatively few of these organizations have, however, established guidelines for restricting, controlling or encouraging desirable behavior in the use of social media, and aligning its strategic objectives with those of the organization. The concept of corporate governance of information technology (IT) has yet to be applied to the specific case of social media, and there is a need for establishing guidelines for creating policies and guidelines for its alignment with business strategy. Based on earlier literature on social media services, IT governance, and strategic IT alignment, we introduce a Social Media Governance framework. This framework is then used to analyze an exploratory case study in a Finnish industrial corporation, and we outline the emergent issues related to corporate social media governance and strategic alignment.

Keywords: Social media, IT governance

1 Introduction

Initially a tool for communication among private users, social media has increasingly been taken into use among corporations for business purposes, such as internal and external communication, marketing, and crowdsourcing ideas for product and service development, e.g. [1], [2], [3], [4]. The adoption of social media in organizations is not necessarily a straightforward process, and its novelty means that guidelines for its successful adoption and strategic alignment have yet to be established. As a result, many organizations using social media for the first time have relied on experimental, ad hoc processes for its adoption, and while they recognize the importance of

integrating social media into their business, they are finding it difficult to move from experimenting with social media services to integrating it with business goals.

One of the reasons behind why social media adoption is difficult for organizations is the fact that Web 2.0 technologies bring about a cultural shift related to the openness and empowerment of customers and employees [5]. Traditional businesses that do not have a history of open internal and external dialogue are having difficulties accepting the fact that social media empowers direct and very public communication with unprecedented numbers of people, which forces a change in the established patterns of communication. In similar cases (electronic integrated channels such as e-commerce) it has been suggested that established business processes need to be re-engineered, as they are no longer appropriate in the new environments [6].

Our earlier research [7] established challenges related to organizational social media adoption and use in a case organization. The biggest challenges encountered in the study were internal: a lack of social media ownership and authorization. The study found that confusion related to who within the organization is authorized to engage customers in discussion is a potential challenge for organizations, and that organizational users are struggling with aligning their personal social media identities with their corporate ones. [7]

IT governance, on the other hand, is an established organizational function aiming to control the formation and implementation of IT strategy and provide direction to achieve competitive advantages for the corporation [8]. IT and business alignment plays an important role in IT governance, as it aims to integrate IT within the organization [9]. This alignment is highly relevant in the context of social media as well, as it often deals directly with end customers, and therefore has an even greater impact on business than administrative IT such as payroll or accounting systems.

The aim of this study is to focus on the use of social media from an IT governance perspective, and to answer the research question “*How should social media be governed in an organization?*” This is done by first reviewing literature on the use of social media from an IT governance perspective [10], [11], [12], [8], and business and IT alignment [9], [13]. Later on, these will be compared to issues reported in our case organization. Based on these findings, the study will conclude with a categorization of governance issues that need to be considered when debating the adoption of a social media service. As this is a research-in-progress paper, the case study, discussion and conclusions of this paper will be extended upon their completion.

2 Related Literature

In the following sections we review two major areas that are central to our analysis of the case company and the associated framework: definitions of the central terms used throughout this study, and the applicability of IT governance and strategic alignment to corporate social media use.

2.1 Web 2.0, Social Media and Enterprise 2.0

Several definitions exist for the concept of Web 2.0. For example, Web 2.0 can be defined as a revolution in the computer industry caused by the move to the internet as a platform [14], a paradigm shift in which users create content [15], and more practically as a personalized, communicative form of the Internet that emphasizes active participation, connectivity, collaboration and sharing of knowledge and ideas among users [16]. The ambiguity of these definitions reflects the relative newness of the concept, as definitions evolve with its continuing development.

Social media, on the other hand, is often defined as a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content [4]. Web 2.0 is often described as a platform while social media typically refers more directly to the content created by users. The prefix “social” or the suffix “2.0” is often tacked onto more traditional business terms to imply that companies use Web 2.0 technologies or social media in their business, as is the case with “social business” or “Enterprise 2.0”.

Finally, Enterprise 2.0 can be defined as Web 2.0 technologies being used in an organizational context [17]. Enterprise 2.0 applications explicitly exclude many of the platforms typically associated with Web 2.0 and social media (Facebook, Wikipedia and YouTube for example), as they are aimed primarily at individuals rather than organizations. In organizational use, some companies prefer to use the term “social business” in order to show that they use social media not only for dialogue with customers but also inside the organization, in business partner co-operation, stakeholder communication and recruiting.

2.2 IT Governance

There is a lack of consensus on the exact definition of IT governance. For example the IT Governance Institute [11] states that IT governance is an integral part of enterprise governance that consists of the leadership and organizational structures and processes that ensure that the organization sustains and extends its strategy and objectives in relation to IT. On the other hand, IT governance specifies the decision rights and accountability framework that encourages desirable behavior in the use of IT [10]. IT governance is also defined as the organizational capacity to control the formation and implementation of IT strategy and provide direction to achieve competitive advantages for the corporation [8]. Finally, IT governance is defined as structures, processes and relational mechanisms enterprises that aim to secure that IT delivers business value to business in a transparent manner [12]. Most definitions agree that IT governance involves decision-making regarding IT assets (hardware and software), the processes employed, personnel and the strategic IT goals of the organization.

Several frameworks exist for the implementation of IT governance in practice. For example Cobit provides best practices for the processes of the IT organization and how they are assessed and monitored, but offers little support for the division of decision rights within the enterprise [11]. The IT Infrastructure Library (ITIL), on the

other hand, provides best practices in the field of service management and delivery, but does not cover the strategic impact of IT and the relationship between IT and business. The information security standard BS 7799/ISO 17799 is also often linked with IT governance [18].

2.3 Strategic IT Alignment

The concept of strategic IT alignment can be looked at from many perspectives. According to one, strategic alignment stems from two main relations: the strategic fit between the external and internal scopes of the firm and the functional integration of information technology within the organization [9]. This definition encompasses four elements: business strategy, infrastructures and processes, and IT strategy, infrastructures and processes. Similarly, strategic IT alignment is a continuous and iterative “tuning” between business strategy, value creation, processes and IT within and between organizations [19]. Strategic alignment can be divided into four areas: internal and external drivers, and operational and strategic focuses [8]. Extrapolating on this, it is considered that strategic IT alignment from an e-business perspective, stating that strategic alignment simultaneously needs to consider the relationships between strategies, structure and technology [13].

2.4 IT Governance and Strategic Alignment in Social Media

Due to the relative newness of the topic, very little academic research exists on the exact topic of IT governance and strategic alignment in social media. For this reason, we have chosen to review IT governance and strategic alignment in practitioner literature, as well as academic research on IT governance and strategic alignment in other electronic channels, such as e-commerce and discussion forums.

Successful investment in social media requires the alignment of social media strategy to the business strategy of the organization [20], and as the importance of social media in organizations grows, social media governance should be included in their IT governance plans. Extrapolating on this, it has been argued that IT strategy should not be considered separately from business strategy, reducing the need for alignment [21]. This sentiment is echoed by thoughts that elements of social media strategy should be embedded in business strategies directly [22].

There is also a strong push for writing separate social media strategies. The current trend in social media practitioner literature is to recommend that companies beginning to use social media write social media strategies first, and only then follow this up by selecting the platform to be used [3], [23].

It has been argued that organizations must consider how they wish to leverage social media by identifying areas in which social media can help achieve existing goals, as well as emphasizing the importance of defining clear rules and responsibilities for the people involved [24].

Social media governance is also discussed in practitioner literature. For example it has been stated that social media governance starts from strategy issues such as developing a social media strategy or identifying corporate social media objectives

[25]. The role of risk assessment in social media governance is emphasized, as is the need to create policies, procedures and guidelines and technical controls. The importance of implementing a monitoring and reviewing framework has also been highlighted [25]. Similarly, it is believed that organizations need to create metrics for measuring the impact of social media [24].

Concepts of strategic alignment have successfully been applied to e-business [13], and it is our belief that these concepts can be extrapolated to cover the specific needs of social media as well. Applying the IT governance framework [8], we have created the following framework for social media governance as depicted in Figure 1. This framework provides a continuum from our earlier research where challenges in the corporate social media adoption were divided into internal and external issues.

	Focus	Operational	Strategic
Driver			
External		Integration of customer relationship Reputation Data protection Privacy Network identity	Compliance with laws and TOS of third party services
Internal		Code of ethics Social media policy and guidelines Authorization Ownership	Benchmarking Social media metrics Strategic alignment

Fig. 1. Social Media Governance Framework

The first quadrant of the framework (external/operational issues) discusses concepts such as integrated customer relationships, data protection, privacy and network identity. Integrated customer relationships are important for companies, also in social media governance. Social media provides companies a possibility to deepen the customer relationship for example by having a dialogue in social media services.

Data protection and privacy are relevant because social media is typically a very public communication platform, so revealing private customer data or sensitive information about the organization can lead to undesirable consequences. The issue of network identity is especially relevant, as many corporate users of social media have established private entities in the major social media platforms (such as Facebook or Twitter) prior to being required to use them in the organizational context, and may wish to keep their private lives and network identities separate from their work identities.

In the internal/strategic quadrant, the governance is extended beyond routine operational procedures to policies affecting the organizations overall performance. It deals with compliance issues, such as compliance with the rules of the social media platform used. Many platforms restrict the use of their services for business purposes such as direct sales, a rule which is often forgotten by organizational users wishing to

contact their customers. This quadrant also deals with legal compliance, as laws regulate the ways in which customer data, for example, can be shared.

The third quadrant (internal/operational issues) addresses topics such as ethical codes, social media policies and guidelines and social media authorization and ownership. As discussed in our literature review, there is demand for guidelines and policies for the use of social media, as clear rules for its use have yet to be established. Establishing authorization is also important, as organizational users don't necessarily know who is allowed to and responsible for interacting with customer and other stakeholders in social media. Similarly, if ownership is not established, it is difficult to allocate costs and responsibilities related to its use. This is challenging due to the silo-breaking nature of social media, which encompasses many of the more traditional organizational functions: communications, sales, marketing and R&D.

The fourth and final quadrant (internal/strategic issues) discusses alignment, benchmarking and social media metrics. The importance of aligning business with social media was widely discussed in the literature review. If the alignment is critical in IT government, it is even more important in the business-oriented use of social media. Benchmarking is a common tool among companies beginning to use social media: they wish to know what their competitors are doing. Metrics for social media still need to be established, created so that they are connected to the business.

3 Research Method and Case Company Description

3.1 Research Method

In order to answer the research question “*How social media should be governed in an organization?*” we use an exploratory case study. A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups or organizations), e.g. [26], [27]. In the empirical setting, we study a case company dealing with issues related to social media adoption and use. The following subsection introduces the case company in more detail.

3.2 Case Company

The case organization used in this study is a multinational company specializing in metal manufacturing and related services. The company's customers include a wide range of businesses that use metal as part of their products or services. In 2010, it had an operating income of €83 million, and staffed 8,100 employees.

In late 2009, the company decided to investigate potential uses of social media as part of its strategy, particularly in relation to HR, marketing and communications. The investigation was initiated by the company's board of directors, who were aware of competitor presence in social media, and wanted to benchmark the company's own presence. The findings of the study concluded that competitors in the metal industry

had found social media to varying extents, but that usage seemed to be uncertain and somewhat aimless, with no obvious strategies or clear objectives.

Previous to the investigation, social media use had been restricted in the organization, with access to social media websites being blocked to all employees on company-owned computers. This policy was gradually changed during 2010, with restrictions being lifted from groups of employees, leading up to full access for all white collar staff. No notifications were given to employees regarding this change in policy until the autumn of 2010.

3.2 Data Collection

Data collection began with informal discussions with company representatives to define the research question, and continued with six expert interviews of company employees, who were selected in collaboration with the marketing and communications departments of the company. These were supplemented with a full-day workshop with nine company representatives, as well as text-based material such as policies and other company documentation regarding social media.

Interviewees and workshop attendees were selected based on function in the company and its potential relevance to social media. They were managers from HR, marketing, communications and R&D. The reasoning behind interviewee and workshop attendee selection was based mostly on recommendations derived from informal discussions with company representatives. HR staff was included in the interviews as company representatives believed that social media will play an increasingly relevant role in recruiting in the future. Similarly, communications staff was included as the company representatives believed that social media will become increasingly relevant to both external and internal communications. Marketing staff were included due to the fact that customers had been asking questions about the company's products in various social media, and R&D staff were involved as the company deals with the development of specialist products, and would like to see its experts engaging more with customers through social media. Both recently hired and more established employees were included in order to gain a well-rounded view of the company's current state.

The interviews were recorded and later transcribed. The interviews included open questions like "describe the use of social media in your company", as well as more specific questions related to ownership and related issues.

Interviewees based in Finland were interviewed face to face, while international interviews were conducted using the company's videoconferencing facilities. The majority of the interviews were conducted in Finnish and translated into English, while non-native Finnish speakers were interviewed in English. The workshop was conducted in English. Notes from the workshop were kept by two attendees and reviewed by the two authors for consistency, and written material produced by the attendees during the workshop was transcribed.

As this is an exploratory study, data collected from the interviews and workshop was analyzed by the two authors for emergent issues. Emergent issues were defined as findings related to the strategic alignment and corporate governance needs of social media. Appendix 1 contains a list of interviewees and case study participants as well as their functions in the organization.

3 Corporate Social Media in the Case Company

We will next analyze the qualitative data gathered from the case organization. The structure of our analyses follows the Social Media Governance Framework. As expected for a company new to the use and utilization of social media services, the interviewees were mostly concerned with internal operational issues. Also external operational issues have been given thought in the company. Strategic questions, so far, has been considered mainly from internal perspective.

Internal/Operational issues. Even though the company had lifted the restrictions related to the use of social media websites by the employees, the associated policies still seem to be largely unclear. One of the biggest questions is related to the overall control of the company's presence in social media, particularly as to the responsibilities connected to this presence.

“How we “take control” has to be managed somehow, who is responsible, what is the target for main channels.” – VP of External Communications

“The employees in the organization want structure and a there is a need to get organized.” – VP of External Communications

“Ownership has not been defined here. /.../ If ownership was to be defined and the existing Facebook profiles and YouTubes and Twitters and so on were defined, what is done with them and why, we could we could really benefit from them. As they are, I don't believe that they are useful at all.” – HR Officer

Particularly uncertainty surrounds the policies related to dealing with customers: what can be told them in the social media and by whom, who has the authority to be the public voice of the company?

“We have to know what are the target groups we need to reach. And what can we say there? - VP of External Communications

“What answers to give employees: who can answer customer inquiries?” – Internal Communications Officer

“It has been argued that people don’t have the authority to do stuff: oh, we didn’t know we could comment on some of these social media forums and places like LinkedIn. We didn’t realize that we were allowed to do that.” – General Manager of Cluster Marketing

“These people [experts in product development] don’t know that forums exist. They don’t come in. If they do know that they exist, “we’re not authorized, it’s not my job.” – General Manager of Cluster Marketing

A key internal operational issue is related to the view of social media use to be more recreational rather than productive work, something that can be genuinely useful for the company:

“Working time needs to be concretely reserved [for social media use], so far it has perhaps been seen as having fun and has not been understood as work...” –HR Officer

“Well, that’s not really work is it, it’s not really something we should be doing, and if my boss looks over my shoulder and sees me reading such and such a forum it’s not proper work” — General Manager of Cluster Marketing

Roots of this kind of culture are deeply embedded in the tradition of old, hierarchical organization:

*“[We are dealing with] the remnants of a hierarchical organization, where control is quite dominant. We have lots of managers and people who have lived with this culture for decades, and for them it’s just incomprehensible that people could be given the freedom to produce content for the organization’s own channels”
- SVP of Communications and Investor Relations*

Internal/Strategic issues. It is, however, realized in some parts of the organization, that corporate social media could offer tools in reaching the strategic goals of the company, even if it is not yet quite clear how:

“The vision of the company is to be the undisputed number one in own industry branch. How can social media help us make this happen?” – VP of External Communications

It is further understood, that commitment to corporate social media services as an additional tool to communicate with customers is a long term effort, requiring time and resources:

“I see it as a downside or threat that, if we decide to enter social media, we can’t [try it and then decide to] leave just like that. We should internally resource it so that somebody is responsible for it, maybe not full-time but so that it is a clear part of somebody’s job description” – HR Officer

A question preoccupying the marketing manager of our case company, as undoubtedly managers in all companies engaged or considering presence in social media, is the question of measuring the usefulness of these services:

"I wouldn't know what success looks like as far as [the company] on Facebook is concerned.... what would we define success as?/.../ You want to know what success looks like? 570 (members in the company Facebook group)!" — General Manager of Cluster Marketing

External/Operational issues. The key external operational issue from the HR manager's perspective is related to the network identity and privacy of the employees operating on the social media on behalf of the company:

"I don't want to appear under my own name. If my boss asked me to administer the company's Facebook page using my own [privately established] profile, I would say no. If it was for internal use only, I might consider it." - HR Officer

Another common issue is the fear of possible damages to the reputation of the company:

"One obvious threat is on the reputation management side. One threat could be that, for example in this group on Facebook... a few disgruntled customers turn up and start complaining about late deliveries or stuff like that" – General Manager of Cluster Marketing

"There is a threat that the discussion topics are out of our control, not in our hands. People are afraid of what will happen in social media if you go there. There are reputational risks related to negative talks." – Managers of Communications

Also matters related to the use of third party services in general are far from being clear. A communications consultant facilitating the workshop suggested the company to think what do the functionalities of third party services offer for company. Do they want to have conversations with customer, for example, or share documents?

External/Strategic issues. The external strategic issues being considered are first and foremost related to laws and regulations, that have an impact on what can and cannot be publicly discussed:

"[We are] listed on the stock exchange, and as such are regulated by laws and rules. There are things which we cannot discuss outside the company, and sensitive information might get leaked because not everybody necessarily understands what can be said [publicly in social media]" - HR Officer

4 Summary and Conclusions

In this study, we introduce a Social Media Governance Framework, which is built on the earlier research on social media, IT governance and strategic IT and business alignment. In the empirical setting, we analyzed qualitative interview data collected in a multinational company specializing in metal manufacturing and related services.

The Social Media Governance Framework proved to be a valuable tool in the empirical analysis, helping us categorize the rich interview data into internal and external, as well as operational and strategic issues.

Our findings indicate a clear need for guidelines at the operational level. Very often the guidelines have an echo of denying things but more than not allowing things, the guidelines are creating the structure and framework how to operate in a new environment. The employees need to know if they are allowed to use social media services or not, know who can represent the company in social media channels, know what they can discuss with stakeholders in social media and what not. There is a huge difference if the employees have to excuse or hide their Facebook use compared with the situation where using social media services has become an established way of working.

As expected in the early stages of corporate social media use, the case company is mostly preoccupied with internal questions, with external matters being still distant. Similarly, the focus is still on operational issues, with strategic issues being more of a concern in the future.

At a strategic level, company management has to pay special attention to the integration of social media with business objectives. When experimenting with social media, many companies begin the adoption process by experimenting with social media tools, but if the companies want business value from them, the use of social media needs to be integrated with business strategy. It is rational to start from business objectives, and think how social media can help in achieving them. However, in some cases, the use of new tools may provide companies a significant competitive edge. As depicted in the Strategic Alignment Model [9], business value can be created from the strategic or technological perspective. The metrics of social media need also be connected with business objectives. It may be nice to know how many people like the Facebook page of the company, but it may not be the most relevant objective from the strategic point of view.

This study contributes to theory by introducing a new framework that consists of traditional information systems elements of alignment and governance embedded in a modern environment of social media. The practical contribution of this study is in offering companies considering or developing corporate social media an analytical tool for adopting social media in a corporate environment. In the beginning, the focus of the social media in the organizations is very operational and internal of nature. With the social media governance framework, the organizations can look further in their social media use, as well as paying attention to strategic and external issues.

In the next phase of our research, we will further analyze the interview data. An interesting way to continue our research would be to study the use of social media in an organization where social media services have been used for a long time, and where it is a natural part of a business strategy. This way we could see if the social media governance framework was valid also in a more advanced of environment.

Another research avenue would be comparing the social media governance in large and small companies.

References

1. Anderson, P., What is web 2.0, Ideas, Technologies and Implications for Education, vol. 60 (2007)
2. Kangas, P.; Toivonen, S.; Bäck, A., "Ads by Google" and Other Social Media Business Models. VTT (2007)
3. Bernoff, J.; Li, C. Harnessing the power of the oh-so-social web, MIT Sloan Mgmt Review, vol. 49, pp. 36 (2008)
4. Kaplan, A.M.; Haenlein, M. Users of the world, unite! The challenges and opportunities of Social Media, Bus. Horiz., vol. 53, pp. 59-68 (2010).
5. Jacobs, A.; Nakata, K. Evolving the social business: A look at stages of growth for web 2.0 integration with business activities, In: First Interdisciplinary Workshop on Communication for Sustainable Communities (2010)
6. Earl, M. J. Evolving the E- Business, Business Strategy Review, vol. 11, pp. 33-38 (2000)
8. Raghupathi, W. Corporate governance of IT: a framework for development, Commun ACM, vol. 50, pp. 94-99 (2007)
9. Henderson, J. C.; Venkatraman, N. Strategic alignment: Leveraging information technology for transforming organizations, IBM Syst J, vol. 32, pp. 4-16 (1993)
10. Weill, P.; Ross, J.W. IT Governance: How Top Performers Manage IT Decision Rights for Superior Results. Harvard Business Press (2004)
11. IT Governance Institute, "Board briefing on IT governance (2010)
12. Dahlberg, T.; Lahdelma, P. IT Governance Maturity and IT Outsourcing Degree: An Exploratory Study (2007)
13. Rival, Y. An assessment of E-business strategies using the strategic alignment model, In: EMCIS (European and Mediterranean Conference on Information Systems) (2004)
14. O'Reilly, T. What Is Web 2.0. Design Patterns and Business Models for the Next Generation of Software. (2005)
15. Mande, D.M.; Wigand, D. M. Taming the social network jungle: From web 2.0 to social media (2010)
16. McLoughlin, C.; Lee, M.J.W. Social software and participatory learning: Pedagogical choices with technology affordances in the web 2.0 era," in ICT: Providing Choices for Learners and Learning. Proceedings Ascilite Singapore (2007)
17. McAfee, A. Enterprise 2.0, version 2.0, At: [Http://blog.Hbs.edu/faculty/amcafee/index.php/faculty_amcafee_v3/enterprise_20_version_20](http://blog.Hbs.edu/faculty/amcafee/index.php/faculty_amcafee_v3/enterprise_20_version_20) (2006)
18. Calder, A.; Watkins, S. IT Governance: A Manager's Guide to Data Security and BS 7799/ISO 17799. Kogan Page Publishers (2005)
19. Derzsi, Z.; Gordijn, J. A framework for business/it alignment in networked value constellations, In: Proceedings of the Workshops of the 18th International Conference on Advanced Information Systems Engineering (CAiSE 2006), pp. 219–226 (2006)
20. Thonis, A. The alignment of web 2.0 and social media with business strategy. (2009)
21. Smaczny, T. Is an alignment between business and information technology the appropriate paradigm to manage IT in today's organisations? Management Decision, vol. 39, pp. 797-802 (2001)
22. Wasu, S. No, I cannot help you create a social media strategy!
<http://www.asiadigitalmap.com/2010/04/no-i-cannot-help-you-create-a-social-media-strategy/> (2010)

23. Berg, O. Don't start with the tools <http://my.intrateam.dk/gb/blogpost/dont-start-tools> (2010)
24. Dau, P. The 4 Ps of Social Media Governance <http://socialmediatoday.com/peggy-dau/146128/4-ps-social-media-governance> (2010)
25. Wollan, R.; Smith, N. *The Social Media Management Handbook: Strategy, Culture, Metrics, Policies, Processes, Roles and Responsibilities* (2010)
26. Benbasat, I; Goldstein, D.K.; Mead, M. The case research strategy in studies of information systems, *MIS Quarterly*, pp. 369-386 (1987)
27. Yin, R.K. *Applications of Case Study Research*. Sage Publications, Inc (2003)

Appendix 1

Table 1. List of interviewees by function and location

Function	Interviewee title	Location
HR	Executive Vice President of HR	Finland
HR	HR Officer	Finland
Communications	Senior Vice President of Communications and Investor Relations	Finland
Marketing	General Manager of Cluster Marketing	Finland
Marketing	Segment Solutions Manager	Sweden
R&D	Manager Technical Market Development	Sweden

Table 2. List of workshop attendees and location

Function	Interviewee title	Location
HR	Human Resources Development Specialist	Finland
Communications	Communications and Investor Relations	Finland
Communications	Vice President of External Communications	Finland
Communications	Communications Manager	Sweden
Communications	Communications Officer	Finland
Communications	Communications Officer	Finland
Communications	Internal Communications Officer	Finland
Marketing	Web Manager	Brussels
Marketing	Sales & Marketing Trainee	Brussels



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