AALBORG UNIVERSITY

DENMARK

Exploring Radical Innovation Projects from a Learning Perspective

Brix, Jacob

Exploring Radical Innovation Projects from a learning perspective

Industrial PhD Dissertation
Jacob Brix

AARHUS
UNIVERSITY

DANISH
TECHNOLOGICAL
INSTITUTE

Exploring Radical Innovation Projects from a Learning Perspective

Industrial PhD dissertation

Jacob Brix

Danish Technological Institute,
Center for Ideas and Innovation
&
Aarhus University,
Graduate School of Business and Social Sciences,
Department of Business Communication and Interdisciplinary
Center for Organizational Architecture

Acknowledgements

The creation and development of this dissertation was a learning experience that went beyond my imagination. As Industrial PhD student I was given opportunity to not only read and write about innovation and learning – I was also given the privilege to propose improvements and test the improvements in practice in large and small as well as public and private organizations; both nationally and internationally. Therefore, I am grateful to the Danish Technological Institute for the trust and responsibility I was given in doing this, as well as I appreciate the openness that was shown to me and my project in the involved case organizations. Moreover, I am thankful for the interest and countless dialogues I had (and still have) with my colleagues at the DTI.

My current competences and insights about radical innovation could not have been reached if it was not for a large group of people who assisted me during the study. As in all parts of life, I cannot mention everyone, but here are the ones who time after time assisted me in becoming more knowledgeable. Two people stand out. First, my corporate supervisor, Henning Sejer Jakobsen, for teaching me to create radical innovation in practice, and for fantastic travels around the world to create innovations with and for the DTI's customers. Secondly, my academic supervisor Ole Lauridsen, for outstanding supervision, for teaching me academic writing and for assistance in translating empirical findings into data ready for publication – and for your patience, not least.

Research-wise I wish to thank my research group at BCOM for feedback, support and interest in my project. Moreover, I wish to thank Rolandas Strazdas from Vilnius Gediminas Technical University for the mentorship during my stays in Lithuania. In addition I am grateful to Lois S. Peters and Gina C. O'Connor from Rensselaer Polytechnic Institute for the mentorship and the new projects we started up during my time as visiting scholar. Moreover, I am thankful for the collaboration with the scholars at ICOA, where I have been affiliated since February 2012. Furthermore, I thank George P. Huber from University at Texas at Austin and Richard M. Burton from Duke University for the many hours of feedback on earlier drafts of two of my papers.

Finally, I am especially grateful to my wife, Marie Brix, for the understanding and patience you showed me, when I was away from home time after time and again.

Table of Contents

Introduction

This Industrial PhD dissertation takes its point of departure in a real life setting, where focus has been on **exploring radical innovation projects from a learning perspective**. During the study, I was employed by the Danish Technological Institute[1] to assist them in documenting the effects of utilizing their radical innovation[2] method named the 'Creative Idea Solution©' (CIS) framework; in this context an improvement of the way the framework was being operationalized was in focus.

The reason for the DTI to apply for an Industrial PhD project was the difficulties they experienced in selling CIS projects with high uncertainty during the financial crisis. The present and the potential clients decisions were made based on short-termism and they were perhaps even downsizing; thus high uncertainty projects were not easily sold. Consequently, the DTI decided to take their own medicine and question the basic foundation for starting up and completing radical innovation projects. The experiences and implications presented in this dissertation represent the academic part of my endeavor, both to increase the understanding of radical innovation to improve the practice at the DTI.

Clarifying the concepts of the dissertation

To prevent misinterpretations, the title of the dissertation includes some concepts that need further clarification. The first concept is *exploring* which represents the way I collected data. In practice, the methodological choice I used to develop theory and claim new knowledge was participatory action research (Schein, 2008). In this methodology, data is collected by means of observation, interaction and intervention with the participants in the case organizations (Ibid) and the advantage of using action research is the proactive search for insights that would not have been found e.g. via surveying and desk research (Schein, 2008; Eisenhardt and Graebner, 2007). Therefore, the implication of using action research is the generation of *novel* theory and

---

[1] Visit: www.teknologisk.dk (Danish version) or www.dti.dk (English version) for further details
[2] Elaborated below

not *generalizable* theory by presenting rich stories with clear context descriptions (Whetten, 1989; Eisenhardt, 1989; Eisenhardt and Graebner, 2007).

The second part of the dissertation's title is ***radical innovation projects***, which represents the context of my exploration. In the CIS framework Brix and Jakobsen (2013) define radical innovation as *a 'paradigm stretching activity' in which the foundation for a product, process, business model, etc. is rethought leading to significant positive change; for example resulting in 'new performance features' and 'reduction of costs' greater than 30 percent (also cf. Leifer et al., 2000). In addition, radical innovation can also represent a new business platform to the company*. In practice, in a radical innovation project, there is a team from a case organization that follows (part of) the phases and steps in the CIS framework while being advised by the DTI's consultants. These consultants convinced some their customers to let me participate in their projects and this is how I got access to data. This access to develop unique case studies (Yin, 2009) therefore represents the empirical foundation for the dissertation.

The third and final part of the title is *a **learning perspective***. The dissertation has constructivism as its epistemological foundation. In constructivism learning is a process of individual knowledge construction and re-construction (Lauridsen, 2012; Brix and Lauridsen, 2012; Brix, in press). It is therefore the individuals who learn and not organizations: instead, it is the individuals who together make the development in the organization on the behalf on the organization so it can prosper (Argyris, 1999). The learning perspective is stressed to be a highly important aspect of innovation studies (cf. Crossan and Apaydin, 2010) because it represents the process of becoming more knowledgeable, when individuals together strive to reduce the high uncertainty they experience, e.g. during a radical innovation project (Brix, in press). After this clarification of the core concepts of the dissertation, the purpose and the goal of the study will be presented in the next section.

Purpose and goal

As stated above, the **purpose** of the study is to explore radical innovation projects from a learning perspective. In line with this, the **goal** of the study is to:

1) introduce the CIS framework to the innovation management literature;
2) to discover hitherto unnoticed shortcomings on an individual and a team level of analysis that can impede an organization in reaching the expected level of ambition during the CIS project; in this connection, propose solutions to reduce the degree of the shortcomings as well; and
3) to determine if specific added value of working with radical innovation can be identified on an organizational level of analysis.

The dissertation is laid out as an anthology consisting of four research papers.

The first paper introduces the CIS framework (Brix and Jakobsen, 2013) that is the contextual process for all data collection in the case organizations. This paper will lead to the accomplishment of the first goal and it will facilitate the following three papers in getting accepted for publication due to the systematic nature of the method, which according to Eisenhardt and Graebner (2008) strengthens replicability and thus the quality of case study research.

The operational research question guiding the first paper is: ***How can radical innovation systematically be created by utilizing the 'Creative Idea Solution© framework'?*** This question is dealt with in:

Brix, J. and Jakobsen, H.S. (2013) Corporate creativity: introducing the Creative Idea Solution© framework, *International Journal of Innovation and Learning*, Vol.13 No.4[3]

Next, the individual, the team and the organization levels of analysis are explored and studied individually in the three remaining papers. This deliberate separation of the three levels of

---

[3] *A co-author agreement is enclosed in appendix 1*

analysis can cf. Crossan et al. (1999) assist in producing transparent research outcomes that facilitate theory development. This is because the separation generates a specific framework for exploring what happens in organization when its members learn and become more knowledgeable (Ibid); here when striving to create of radical innovation. The results of this study will contribute with important findings to the innovation management literature. This is argued based on Crossan and Apaydin's (2010) systematic review of contemporary innovation research. Crossan and Apaydin (2010) conclude that empirical theory-building research is under-studied in the literature, because only six percent of the published papers seek to create original theoretical contributions. Moreover, research on the individual level of analysis is represented in five percent of existing innovation studies, and the team level of analysis is treated in six percent of the studies. Finally, research on an organizational level of analysis is common; however, focus in this dissertation is a process study within an organization, which is only represented by three percent of the existing innovation studies. Hence, using Crossan et al.'s (1999) tri-partition when analyzing the empirical data strengthens the potential for developing novel theory and thereby claiming knowledge to innovation research. Therefore the three remaining papers will treat the individual, the team and the organization level of analysis.

The second paper (Brix, in press) explores and analyses the individual level of analysis and it develops a framework that can be used to identify false assumptions and illusions taken-for-granted by the individual e.g. during meetings, idea development, etc. Therefore, the paper proposes a solution to improve radical innovation practices on an individual level. This paper thus contributes to the achievement of the second goal of the study. The operational research question guiding the second paper is: ***How can the individual person evaluate his/her personal knowledge when creating ideas, developing them and generating the final business models in the context of radical innovation?*** This operational research question is dealt with in:

Brix, J. (in press) Improving individual knowledge construction and re-construction in the context of radical innovation, *International Journal of Innovation and Learning*, Vol.xx No.yy

The third paper (Brix and Lauridsen, in press) explores and analyses the team level of analysis and it presents how the Building Excellence (BE) learning styles construct (Lauridsen, 2012; Brix and Lauridsen, 2012) can assist in improving collaboration, teamwork and communication in practice during a radical innovation project. Therefore, this paper also contributes to the achievement of the second goal of the study. The operational research question guiding the third paper is: ***How can learning competencies in a team perspective be improved in the context of radical innovation?*** This operational research question is dealt with in:

Brix, J. and Lauridsen, O. (in press) Improving learning competencies in the context of radical innovation: a team perspective, *International Journal of Innovation and Learning*, Vol.xx No.yy[4]

The fourth paper (Brix, in review) explores and analyses how organizational routines are affected during a radical innovation project. The analysis on the organizational level is made on routines as these represent the collective actions of the people in the organization (in contrast to individual habits) (Pentland and Feldman, 2005). The study determines that six positive side effects (added value) and one potential counterproductive side effect emerge during a radical innovation project. This contributes to an improved understanding of indirect value creation that emerges during a radical innovation project and it thus accomplishes the third and last goal of the dissertation. The operational research question guiding the fourth paper is: ***How are organizational routines affected during a radical innovation project in practice?*** This operational research question is dealt with in:

Brix, J. (in review) Exploring a radical innovation project as source of change in organizational routines, *Organization Science – Special issue on routine dynamics*, Vol.xx No.yy (Manuscript ID: OS-SPEC-13-7275)

---

[4] *A co-author agreement is enclosed in appendix 2*

Publication strategy

For the articles to live up to the requirements for the PhD degree they must constitute an anthology that includes contributions to research that has the potential to be published or that has already been published in reputable academic journals (cf. the assessment committee guidelines).

The dissertation's first three papers are published/in press in the International Journal of Innovation and Learning. The 'IJIL' is a research outlet classified as being 'group 1' on the Authority list published by the Danish Ministry of Science, Innovation and Higher Education. The final paper is in review for Organization Science, which is a 'group 2' research outlet on the above-mentioned Authority list. The special issue editor, professor Brian T. Pentland, encouraged the submission.

References

Argyris, C. (1999) *On Organizational Learning*, 2nd edition, Blackwell Publishing,

Brix, J. (in press) Improving individual knowledge construction and re-construction in the context of radical innovation, *International Journal of Innovation and Learning*, Vol.x No.y

Brix, J. (in review) Exploring a radical innovation project as source of change in organizational routines, *Organization Science – Special issue on routine dynamics*, Vol.xx No.yy pp.000

Brix, J. and Jakobsen, H.S. (2013) Corporate Creativity: introducing the Creative Idea Solution[©] framework, *International Journal of Innovation and Learning*, Vol.13 No.4 pp. 388-405

Brix, J. and Lauridsen, K.M. (2012) Learning styles and organisational development in practice: an exploratory study of how learning styles and individual learning strategies can facilitate organisational development, *International Journal of Innovation and Learning*, Vol. 12, No.2, pp. 181-196

Brix, J. and Lauridsen, O. (In press) Improving learning competencies in the context of radical innovation: a team perspective, *International Journal of Innovation and Learning*, Vol.xx, No.yy, pp.000

Crossan, M.M. and Apaydin, M. (2010) A multi-dimensional framework of organisational innovation: a systematic review of the literature, *Journal of Management Studies*, Vol.47 No. 6, pp.1154–1191.

Eisenhardt, K.M. (1991) Better Stories and Better Constructs: The case for rigor and comparative logic, *Academy of Management Review*, Vol.16 No.3 pp. 620-627

Eisenhardt, K.M. and Graebner, M.E. (2007) Theory Building from Cases: Opportunities and Challenges, *Academy of Management Journal*, Vol. 50, No. 1 pp. 25-32

InnovationInside (2010) 'The rise of the creative masses: transforming the workforce into an innovation force', *Innovation Force*, February.

Jakobsen, H.S. and Brix, J. (2012) The 'Vertical Innovation Process': constructing sustainable business models in practice, *Proceedings of the 5th ISPIM Innovation Symposium*, Seoul, Korea December: ISBN: 978-952-265-317-8

Lauridsen, O. (2012) *Fokus på læring 3.0*, Akademisk Forlag, Copenhagen

Pentland, B.T. and Feldman, M.S. (2005) Organizational routines as a unit of analysis, *Industrial and Corporate Change*, Vol.14 No.5 pp.793-815

Schein, E.H. (2008) *Clinical Inquiry/Research*. In. Rearson, P. and Bradbury, H. (2008) *Handbook of Action Research*, Sage Publication, London

Whetten, D.A. (1989) What constitutes a theoretical contribution?, *The Academy of Management Review*, Vol.14 No.4 pp.490-495

Yin, R.K. (2009) *Case study research – Design and Methods*, 4th edition, Sage Publications

Thesis Summary

Corporate Creativity: introducing the Creative Idea Solution© framework

The first article represents the first stage of my research process. Here I had to get acquainted with and understand the concept of 'radical innovation': what it is according to the DTI and, more importantly, how radical innovation outcomes can be created (sought) by using the CIS framework. This framework has been the research context for all the data collection of the dissertation, in so far as the steps in the framework were applied at all the case companies. The paper consists of two parts: an introduction to the CIS framework and a case study that presents how a radical innovation project was completed in practice.

The CIS framework

The CIS framework guides managers on a continuous basis to learn to exploit existing creativity theories and methods systematically when working with radical innovation projects in practice. The reason for stressing the integration of theories and methods from the creativity literature into an organizational context of innovation management is that managers and scholars when starting up new projects time after time apply brainstorming sessions in an inadequate way. This use of brainstorming has a fundamental fallacy to it that reduces the innovative potential in practice. This is argued, because the search for radical innovation is about stretching or even breaking patterns – a divergent approach, whereas Brainstorming sessions always end up by creating a strong convergent pattern by democratically choosing the 'best idea(s)'. Hence, when the level of ambition is high, other tools must be applied in a systematic manner to live up to the goal of the initiated project.

The CIS process is initiated by taking point of departure in the organization's existing 'Realization'. Here a new opportunity is to be understood and developed (see figure below). By having identified a new opportunity, a team from the organization starts up a Post-ject phase (also called Focus phase) where the existing knowledge that is known regarding the project's focus is collected and discussed. After this, the existing knowledge is challenged because false assumptions, either misunderstandings or outdated insights, often represent the basic foundation

of what is possible or impossible. When false assumptions are discovered they lead the team to

new insights. To utilize these new insights the team needs to collaborate with experts, often

external to the organization. Thus, these insights lead to the formulation of the new task – or the

task re-formulation, which will guide the team towards the second phase in the framework, the

Preject phase.

The Creative Idea Solution© framework
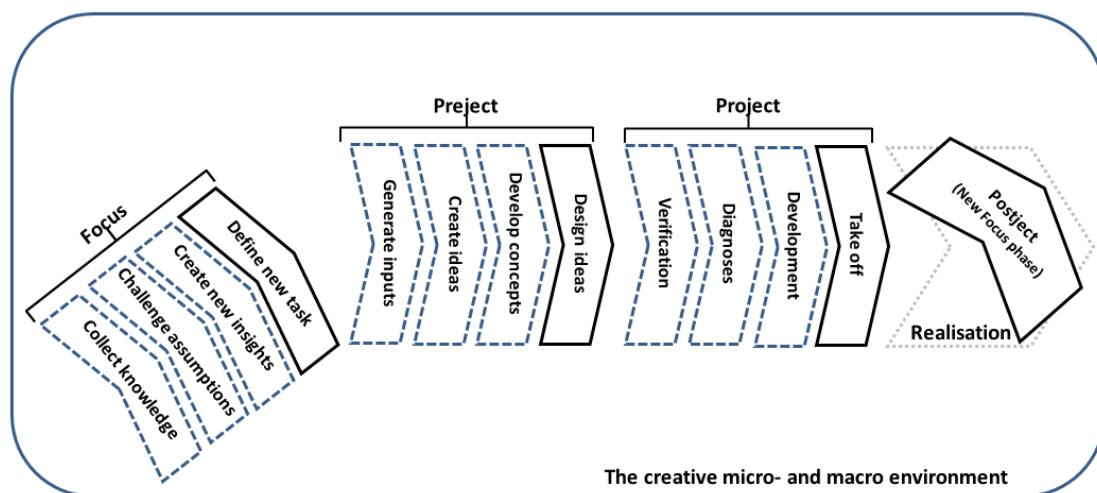
In the first step of the Preject phase focus is on generating inputs (on yellow stickers) – often in

large workshops where many people, both stakeholders to the project and external experts, are

invited. A cornerstone of the CIS framework is that the inputs generated are collected and

utilized through an idea management system. This idea management system allows the team

members to read the inputs, and together they can start creating ideas by reflecting upon them in

'opportunity recognition workshops'. During the opportunity recognition workshops a

negotiation of meaning takes place and multiple ideas are described based on the inputs.

Afterwards the multiple ideas are distributed to the individual members of the project team.

When the ideas cannot be further developed the next step in the framework is to develop

concepts. To move beyond a one product – one solution perspective, the developed ideas are

reconstructed into multiple business model pretotypes to uncover the full potential. Finally, the

business model pretotypes that seem promising are designed and made ready for presentation for

the organization's decision-makers. These pretotypes could be made e.g. by means of 3D prints, mock-ups and/or a project report.

The case study

The results are based on a nine-month action research case study completed in a Danish department of an international technological manufacturing corporation. The results stress that managers must realize that working with radical innovation is a time-consuming learning process. This is because new information must be sought and insights must be created to reduce the high uncertainty that characterizes this type of projects. Furthermore, the study demonstrates that the focus on creating a thorough 'reality check' in the Focus phase can assist in removing false assumptions and hereby in finding new perspectives on the task to be completed/explored. This reality check resulted in important insights, which helped the team avoid their false assumptions; furthermore it facilitated the team in changing perception towards the re-formulation of the task to be developed. In the Preject phase, the generation of inputs, the creation of ideas, and the development of concepts had a positive effect on the organization: the unexpected added value of this process was multiple spin-offs that could be immediately implemented and thus improve the operations and the daily business processes (incremental innovation). In the Preject phase the project team developed 30 business model pretotypes and the project team found six of them viable to be implemented. These six business model pretotypes were presented to the Board of Directors, who commenced two of the projects in 2011. Based on the presentation of the CIS framework and the indications that were presented in the case organization utilizing the framework in practice, it is claimed that the initiation of a radical innovation project with high uncertainty can result in incremental innovation to an organization, even before the expected results of the initiated project have been made visible.

Improving individual knowledge construction and re-construction in the context of radical innovation

The second article presents an eight-month longitudinal action research project that was completed with five Lithuanian SMEs from April 2011 to November 2011. The focus of the paper is the individual level of analysis. Here the fieldwork resulted in the identification and development of four working concepts, and the subsequent intervention was based on the Individual Knowledge Construction (IKC) framework (see below). The IKC framework was developed to assist the individuals in understanding their personal level and type of knowledge used during discussions and decision-making; and not least, to realize when they were not knowledgeable enough to make decisions. The four working concepts were: *non-relational, assumption, connection* and *movement*.

The working concepts

Non-relational represents situations where the individual cannot relate to the ideas, which the colleague/team-members present. Thus, it describes situations where the individual could not understand his/her peer. The 'non-relational' aspect is important. First, because it demonstrates that one cannot take for granted that everyone will understand what is communicated in the context of a radical innovation project, and second, because of the different types and levels of knowledge each individual has.

Assumptions represent situations where an individual cannot explain the reason for his/her personal opinion during a discussion and it represents situations where an individual states that s/he knows e.g. a concept, but s/he cannot explain the meaning behind the concept or use the concept appropriately in practice. This lack of understanding and lack of knowledge is argued to represent that the individuals could not make themselves clear in a satisfactory manner to their peers during the idea development process. Hence, the individuals assume that they know what they know, without doing so.

Connection is a situation where an individual can understand and relate to the information presented by the colleague/teammate. However, it is observed that the individual needs

additional information to completely understand what the peer is trying to communicate. This theme is important, because it represents a typical situation, where the individuals have to 'tune in' with one another to create understanding, i.e. regarding the use of a specific professional discourse, or in the context of what the presented information concerned, i.e. a product idea, process idea, etc.

Movement is a situation where the individual rapidly understands and relates to the presented information and gives a prompt response to the peer. The situation, which describes movement, is twofold. First, when the individuals are treating already known elements, e.g. while discussing existing products and complementing elements (discussions regarding incremental innovation), and secondly, when an individual experiences a breakthrough, which opens for many new perspectives. Here the individual rapidly communicates different ideas to the peer(s).

The four working concepts were observed in all the case studies they and represent situations, which the participating individuals experienced cf. the field observations.

IKC framework

The four working concepts concerned the level of individual knowledge and types of knowledge. Therefore the literature regarding constructivism was reviewed to develop a model that could be used as intervention to identify when the individual team members were not knowledgeable enough to e.g. make decisions or to develop new ideas (see below).

The review resulted in a matrix model labeled the IKC framework. The horizontal part of the IKC framework includes four types of knowledge, being: factual (knowledge about facts), process (knowledge about reaching a certain goal), practical (knowledge about how things work when used), and theoretical (knowledge about how things act in theory).

Individual Knowledge Construction (IKC) framework

Level / Type	Factual knowledge	Process knowledge	Practical knowledge	Theoretical knowledge
Extended Abstract				
Relational				
Multistructural				
Unistructural				

The vertical part of the model identifies the individual's level of knowledge. This identification has come about by evaluating what the individual person is capable of by means of using verbs as means of identification. The level of knowledge consists four parts, being:

1) unistructural (the individual can memorize, identify, recognize, define, quote, imitate, etc.),

2) multistructural (the individual can classify, describe discuss, outline, illustrate, separate, etc.),

3) relational (the individual can integrate, analyze, explain causes, predict, compare and contrast, paraphrase, solve a problem, etc.), and

4) extended abstract (the individual can theorize, hypothesize, generalize, invent, make an original case, etc.).

The IKC framework can be used to exemplify a direct picture of the type of and the usability of the knowledge the individual has when working with radical innovation in practice.

The multiple case study

The results from the multiple case study determined the existence of the usage of false assumptions and not knowledge about facts when the participants in the teams created and developed ideas. Therefore it is important that the individuals working with innovation in

practice question their taken-for-granted knowledge. In line with this, it is important that the individuals not only evaluate their practical experiences, but also take into consideration how recent their experiences are when they base new arguments and/or counter-arguments on these. The feedback from the intervention shows that the IKC framework can help improving the operational level of working with individual knowledge in the context of radical innovation. This is argued because the insights created by using the model can serve with specific indications of the individual team member's knowledge deficit. The individual will get a direction for searching for specific information, e.g. by asking a colleague or an external expert that can help reduce his/her lack of knowledge.

Summing up, the work with innovation in practice may not live up to its full potential if the project itself and the ideas that are developed in the project are based on false assumption. This is of course also the case if these projects are based on outdated experiences in the context of what is possible and impossible, e.g. regarding technology and software in general.

Improving learning competencies in the context of radical innovation: a team perspective

The third article presents an eight-month longitudinal action research project that was completed with five Lithuanian SMEs from April 2011 to November 2011. The purpose of the paper is to explore the team level of analysis and by this means to search for methods to improve team efficiency in practice in the context of radical innovation projects. In the existing literature there is much focus on meta-knowledge about *what* team members know, and *why* they act as they do, but the literature on *how* team members learn and thus *how* they become more knowledgeable when collaborating in search for innovative solutions is in its embryonic state. The study introduces five working concepts that were developed during the action research, and the counter productiveness of the working concepts was sought to be reduced by introducing the team members to the concept of learning styles and by letting them develop a team learning profile.

The working concepts

Five working concepts were developed during *the action research in the context of the five CIS projects*. These working concepts are labelled: *'Rapid documenting', 'Fidgety', 'Reticence', 'Laid-back attitude',* and *'Non-aligned'*.

Rapid documenting describes situations where the individuals write, draw or take a picture with their smartphone of something that seems relevant to them during the workshops, meetings and seminars. The participants keep these notes/drawings/photos to themselves and do not make them public. There is no system as to how the individuals make the documentation, but it seems that the documentation needs to be done quickly. This behaviour and situations alike were frequently observed in all cases.

Fidgety represents situations where impatience is observed – especially in the context of seminars and meetings. During the seminars many participants are rocking back on their chair or they are shaking their legs – others are fiddling with their pens, doodling or constantly checking their phones. When attending meetings, some individuals pace the other participants when they seemingly feel things are moving too slow forward.

Reticence is experienced when only a few individuals participate actively in dialogues and discussions during the workshops, often by referring to what has just been said (echoing) and by afterwards presenting a new input. In addition, when someone that has not contributed to the dialogue during the session suddenly starts to speak, it seems that the remaining group members listen more carefully compared to when the really active individuals discuss.

Laid-back attitude has a certain affinity to the above-mentioned reticence. This attitude is observed in the body language of the participants when they work on their projects, both during the seminars, in the meetings, and during the workshops. Some individuals are relaxed regarding how they place themselves e.g. on the chair. During the progress in the projects this laidback attitude is observed to irritate some of the fellow participants: they roll their eyes, they look away with angry faces, but they do not comment upon their teammates behaviour.

Non-aligned represents situations where there is mutual misunderstanding between two or more individuals when they communicate. Even though the individuals speak the same language and they are addressing the same subject, they are seemingly talking in different directions.

The literature was reviewed to search for potential theories that could serve with a relevant framework to shed light on the developed working concepts and the Building Excellence (BE) learning styles construction was found appropriate. This is because it had been utilized in exploratory innovation research beforehand with implications and recommendations to both the academic community and to organizational practice. Therefore the working concepts were analysed by using the BE model. The results establish that the BE model is relevant to describe the underlying behaviours that cause the individual team members to act differently from one another when working concentrated during the CIS project.

The multiple case study

As intervention, the teams were introduced to the Building Excellence (BE) learning styles construction during a seminar and here they also created team learning profiles. As result, their team effectiveness was improved in practice.

This is claimed because the team members created new insights for how they individually could work more efficiently – and more importantly, they got insights into and an understanding of how their fellow team members worked more efficiently (concentrated). The dialogue on the different ways of working efficiently for reaching the common goal of the team was found highly beneficial for the five teams as they found that their collaboration and ways of communicating were improved by understanding the effect of the 28 variables constituting the BE learning styles construction.

Exploring a radical innovation project as source of change in organizational routines

The purpose of the study is to explore a radical innovation project as a source of change in organizational routines (hence, the organizational level of analysis). The goal is to demonstrate that the scope and impact of investing in high uncertainty projects is much further reaching than would be indicated by traditional technological performance measures on innovation. To enable this, a bold setup for identifying changes in organizational routines was developed by defining 28 ostensive routine (abstract pattern) variables by utilizing theory from organization design literature. This was done to facilitate the data collection and analysis on performative routines (specific actions). Seven propositions were established based on the analysis that both claim knowledge to the existing literature, and facilitate organizations in practice to further understand the unnoticed, but positive performance effects (change of routines) that emerge during such a project. The propositions were claimed on the basis on an eight-month participatory action research study in five departments/institutions in a Danish municipality. The propositions that were constructed on the premise of the data analysis are:

Proposition 1: managers can test the appropriateness of their performative routines in relation to efficiency and effectiveness by initiating and completing a radical innovation process.

Proposition 2: managers can improve the performative routines for exploration and exploitation by completing a radical innovation project.

Proposition 3: uncertainty from the external environment (complexity) is decreased during a radical innovation project.

Proposition 4: the performative routines used to search for and constructing new knowledge with external partners are improved during a radical innovation project.

Proposition 5: the employees and management's 'readiness to change' is increased during a radical innovation project.

Proposition 6: the tacitness of information that needs to be communicated to the projects stakeholders (and understood by them) increases during a radical innovation.

Proposition 7: the basis of incentives is moved from a result-oriented evaluation towards a more behavior-oriented evaluation during a radical innovation project.

The case study

The key implication in an organizational perspective is that the myopic focus on technological measurements of innovation projects should be broadened when monitoring and evaluating these projects in practice. This is argued, since this study determines that a large and hitherto unnoticed element has been left out of the consciousness of management thinking, being the non-technological innovations emerging unnoticed across the entire organization as a radical innovation project evolves – here referred to as the change and/or the approval of the organizational routines used to govern everyday activities and innovation efforts. It can thus boldly be claimed that even though a radical innovation project might fail concerning the intended purpose, the multiple emerging changes and/or verification of organizational routines optimize the organization's focus and performance in such way that success on an organizational level of analysis is evident. This is argued since six concrete propositions including performative routines were influenced in a positive manner in the five participating institutions/departments. Finally, even though many of the performative routines used to fulfill the ostensive routines have been improved/confirmed as being appropriate on both a strategic, tactical and operational level of analysis, the increase of new insight and knowledge makes it more difficult for the organizational members to create a common understanding amongst the project's stakeholders. This is because the information that needs to be shared is different from what is ordinarily communicated internally and externally and therefore the documented increase in 'tacitness of information' is the single disadvantage found in the development of the seven propositions that potentially can inhibit the success in the organizations if appropriate actions are not taken.

Resumé af afhandlingen på dansk

Corporate Creativity: introducing the Creative Idea Solution© framework

Afhandlingens første artikel afspejler første del af mit studium. På dette stadie var formålet, at jeg skulle få kendskab til og forstå konceptet 'radikal innovation', dvs. forstå hvad radikal innovation er ifølge Teknologisk Institut – og endnu vigtigere, hvordan man kan skabe radikal innovation i praksis ved at benytte den såkaldte CIS-metode (herefter CIS). CIS har været den faste ramme for min dataindsamling, da alle afhandlingens case-organisationer har været igennem (dele af) metodens forskellige trin og faser. Denne artikel består af to dele: (i) en introduktion til CIS og hvordan den operationaliseres, og (ii) et casestudie som viser, hvordan et radikalt innovationsprojekt blev gennemført i praksis.

CIS metoden

CIS eksemplificerer, hvordan man på en systematisk og kontinuerlig måde kan udnytte eksisterende kreativitetsteori og metoder, når man arbejder med radikal innovation i praksis. Grunden til at CIS integrerer kreativitetsteori, er, at hovedparten af ledere/konsulenter, der starter nye projekter op, benytter brainstorms, hvilket er uhensigtsmæssigt. Illusionen om, at brainstorming er det bedste værktøj til at skabe innovation med, hæmmer potentialet for radikal innovation i praksis. Dette skyldes at radikal innovation fokuserer på at strække eller bryde tankemønstre (paradigmer), det vil sige, at man arbejder med en divergent tilgang, hvorimod brainstorming altid afsluttes med en konvergent tilgang, hvor man demokratisk stemmer om den eller de bedste ideer. Kort sagt, hvis ambitionsniveauet for ens innovationsprojekt er højt, skal man bruge andre værktøjer og systematiske metoder fra kreativitetens verden for at opnå målet, man har sat sig for sit projekt.

I et CIS-projekt tager man udgangspunkt i organisationens eksisterede realisering. Her skal man identificere og udvikle en ny mulighed (et nyt innovations projekt) på baggrund af realiseringen (se CIS-metoden nedenfor). Når en ny mulighed er beskrevet, sammensætter man et team fra organisationen, der skal starte et Postjekt (hvilket også kaldes Fokus-fasen). I Fokusfasen

diskuterer teamet den viden, hver enkelt teammedlem har i forbindelse med den nye mulighed, og man forsøger at fastlægge, hvad der er kendt og ikke kendt viden om den nye mulighed.

Creative Idea Solution© metoden
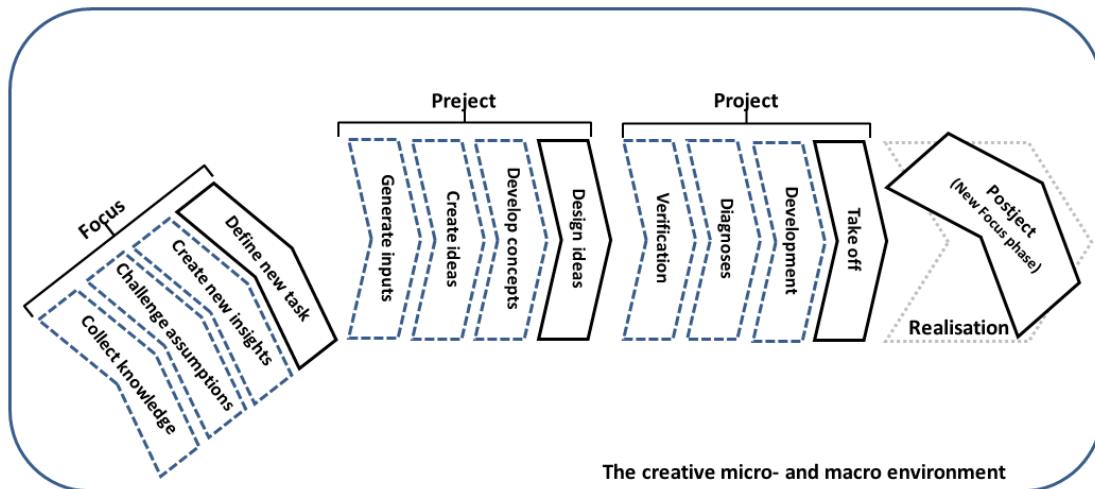
Når teammedlemmerne ikke kan samle mere viden om den nye mulighed, bliver teamet udfordret af projektlederen (ofte en ekstern konsulent), da man søger at identificere falske antagelser eller forældede erfaringer, der kan hæmme teamet i reelt at indse, hvad der er muligt og/eller umuligt mht. den nye mulighed. Hvis/når der identificeres falske antagelser i teammedlemmernes viden, leder det til ny indsigt. For at forstå implikationerne af den nye indsigt, bør teamet samarbejde med eksperter, ofte udefrakommende, for at forstå, hvordan den nye indsigt kan øge muligheden for at opnå det ønskede mål med projektet. Når den nye indsigt har bundfældet sig, kan teamet formulere den nye opgave for projektet, der har ændret sig pga. den nye viden.

Denne reformulering af opgaven leder teamet til Prejektfasen i CIS. I det første trin i denne fase skal teamet skabe inputs med udgangspunkt i den opgave, der blev formuleret i Fokusfasen. Dette sker ofte ved store workshops, hvor mange personer inviteres, både projektets interessenter og eksterne eksperter. Her faciliterer konsulenter deltagerne via metoder fra kreativitetsteorien; kernen er at samle deltagernes tanker ved at skrive dem ned på post-its (at skabe inputs). En fundamental del i CIS er, at disse inputs indsamles og indtastes i et idea management system (IMS), så intet går tabt. Dette IMS gør det muligt for teamet efterfølgende

at læse de mange inputs og dermed forholde sig til dem, så de kan forberede sig til næste trin i CIS, som er 'erkendelse af muligheder'.

Når teamet sammen erkender muligheder på baggrund af de mange inputs, sker dette som en 'forhandling af mening', som ender med en beskrivelse af flere forskellige nye ideer (defineret som erkendte muligheder). Det enkelte teammedlem vælger de ideer, han/hun finder relevante, og når den pågældende ikke kan udvikle mere på ideen/erne, er næste trin i CIS, at man skal udvikle koncepter.

For at udnytte ideernes fulde potentiale eksemplificerer CIS-metoden, hvordan man kan udarbejde forskellige pretotyper for forretningsmodeller. Begrundelsen for at udarbejde flere pretotyper er, at man kan opnå større potentiale ved at undersøge flere applikationsområder ved at arbejde med *funktionen* bag ens nye teknologiske gennembrud sammenlignet med en proces, hvor man udelukkende søger en produkt = en løsning. Når teamet sluttelig har udviklet pretotyper, som de mener vil kunne føre til at opgaven fra Fokusfasen kan gennemføres, skal disse pretotyper præsenteres for organisationens beslutningstagere. Præsentationen kan eksempelvis understøttes af 3D-prints, mock-ups og andre fysiske objekter, der kan hjælpe til forståelse af pretotypen for en person, der ikke aktivt har deltaget i CIS-forløbet.

Casestudiet

Casestudiet baserer sig på et ni måneders aktionsforskningsprojekt, der blev gennemført i en dansk afdeling af en international teknologisk fremstillingsvirksomhed. Resultaterne fastslår vigtigheden af, at ledere reelt forstår konsekvenserne af at igangsætte et radikalt innovationsprojekt med høj usikkerhed. Disse projekter er langsigtede, fordi ny information skal søges af teamet, og når informationen findes, skal teamet forstå konsekvenserne af den nye indsigt, de har skabt. Kort sagt skal man ikke forvente at sende en faktura på baggrund af projektets resultater de første 6-18 måneder. Endvidere viser resultaterne, at det er vigtigt at udfordre teammedlemmernes viden, da flere falske antagelser blev identificeret i projektets Fokusfase. Gennemførelsen af Prejektfasen havde flere afledte effekter af positiv karakter:

Teamet fandt flere områder, der kunne forbedres i deres drift af virksomheden (inkrementel innovation). Derudover blev 30 forretningsmodels-pretotyper udviklet, hvoraf teamet præsenterede seks af disse for bestyrelsen. To af disse forslag blev efterfølgende igangsat.

Improving individual knowledge construction and re-construction in the context of radical innovation

Den anden artikel er baseret på et otte måneders aktionsforskningsprojekt, der blev gennemført sammen med fem litauiske SMV'er fra april til november 2011. Artiklens fokus er på at studere radikal innovation på det individuelle analyse niveau, hvor feltarbejdet resulterede i en identificering og beskrivelse af fire gennemgående arbejdskoncepter. En analyse af disse, antoges det, kunne føre til, at man kunne forstå deres effekt på gennemførelsen af et radikalt innovationsprojekt i praksis. Efterfølgende blev der gennemført en intervention, hvor 'the Individual Knowledge Construction framework' (IKC-matricen) blev udviklet og benyttet for at vise teammedlemmerne i de fem SMV'er, hvordan deres argumentationer og beslutninger kunne forbedres, så de ville mindske udviklingen af deres ideer (og dermed projekter) på baggrund af falske antagelser og forældede erfaringer. De fire arbejdskoncepter er: *non-relational*, *assumption*, *connection* og *movement*.

Forklaring af arbejdskoncepterne

Non-relational. Dette koncept udspringer af situationer, hvor det enkelte teammedlem ikke kan forstå eller relatere sig til de ideer, som vedkommendes kollega fortæller om. Arbejdskonceptet tydeliggør, at man ikke skal tage for givet, at alle kan forstå alt hvad der kommunikeres om ideudvikling, når man arbejder med radikal innovation.

Assumptions. Dette koncept udspringer af situationer, hvor en person i teamet ikke kan forklare årsagen til sin personlige holdning under en diskussion; personen har blot denne holdning. Konceptet indbefatter også situationer, hvor en person i teamet fortæller, at vedkommende godt kender "x", men personen kan til trods for sin erklærede viden ikke forklare hvad "x" er, eller

hvordan "x" virker. Kort sagt, det virker som om at personen ved, hvad man taler om, selvom det ikke er tilfældet.

Connection. Dette koncept udspringer af situationer, hvor et teammedlem kan relatere sig til, hvad vedkommendes kollega fortæller. Dog viste observationerne i feltarbejdet, at personerne der talte sammen skulle 'tunes in' for at opnå den fulde forståelse af det, som kollegaen var ved at orientere om. Dette kunne være pga. benyttelsen af forskellige fagtermer og anden fagjargon kollegerne imellem.

Movement. Dette koncept udspringer af situationer, hvor en person hurtigt forstår at relatere sig til, hvad vedkommendes kollega fortæller, og hvor der kvitteres med et hurtigt svar. Arbejdskonceptet movement baseres på to situationer. For det første sker movement, når teammedlemmerne diskuterer allerede kendt stof, eksempelvis i en dialog om eksisterende produkter, der kan forbedres ved små justeringer. For det andet sker movement, når en person får et gennembrud, som åbner for nye perspektiver på den stillede opgave. Her kommunikerer personen hurtigt med kollegerne, og energiniveauet er højt.

De fire arbejdskoncepter blev observeret under deltagelse i alle fem case-virksomheder, og koncepterne repræsenterer situationer, som de deltagende teammedlemmer oplevede.

IKC matricen

De fire arbejdskoncepter omhandlede alle det individuelle perspektiv på videnniveau og videntyper. For at analysere arbejdskoncepterne blev litteraturen omhandlende konstruktivisme reviewet. Dette blev gjort for at udvikle en model, der kunne bruges som intervention til at identificere, hvornår et teammedlem ikke havde tilstrækkelig viden til at tage beslutninger eller til at videreudvikle nye ideer. Reviewet resulterede i udarbejdelsen af IKC matricen (se nedenfor). IKC matricen består af en horisontal del, der indeholder fire videntyper. Disse er: factual (viden om fakta), process (viden om at nå et specifikt mål), practical (viden om, hvordan ting virker, når de bliver brugt), og theoretical (viden om hvordan ting virker i teorien). Den vertikale del af IKC matricen bruges til at identificere den individuelle persons videnniveau.

Denne identificering sker på baggrund af en evaluering af, hvad den pågældende person kan gøre med sin viden.

Individual Knowledge Construction (IKC) matricen

Level / Type	Factual knowledge	Process knowledge	Practical knowledge	Theoretical knowledge
Extended Abstract				
Relational				
Multistructural				
Unistructural				

Kilde: Brix (in press)

Videnniveau-delen består af fire enheder:

1. Unistructural (personen kan identificere, huske, genkende, definere)
2. Multistructural (personen kan beskrive, diskutere, illustrere og opdele i mindre dele)
3. Relational (personen kan analysere, forklare årsager, forudsige, sammenligne, løse simple problemer)
4. Extended abstract (personen kan generalisere, tage emnet op i ny kontekst, foreslå nye hypoteser)

IKC matricen kan bruges til at eksemplificere et direkte billede af den type af viden og det videnniveau, som et teammedlem baserer sine argumenter på, og som personen udvikler sine ideer på under et radikalt innovationsprojekt.

Multi-casestudiet

Resultaterne fra casestudierne viser, at flere af teammedlemmerne udvikler deres ideer på baggrund af falske antagelser. Det er derfor vigtigt, at de teammedlemmer, som arbejder med innovation i praksis, udfordrer deres egen viden, så de ikke tager den som den endegyldige sandhed. Samtidig er det vigtigt, at man ikke kun baserer sine argumenter på erfaringer, men at man også tager forbehold for, om disse erfaringer kan være forældede, når man bruger dem til

(mod)argumentation. Den feedback, som IKC-matricen fik af teammedlemmerne, viste, at

matricen kan bruges til at forbedre arbejdet med radikal innovation på det operationelle niveau.

Dette skyldes, teammedlemmerne ud fra arbejdet med matricen kunne identificere deres egen

manglende viden og aktivt søge hjælp til at dække denne manko.

For at opsummere: Arbejdet med radikal innovation i praksis vil næppe leve op til projektejernes

høje ambitionsniveau, hvis ideerne i projektet udvikles på baggrund af falske antagelser, eller

hvis beslutninger tages på baggrund af forældede erfaringer. Selvom IKC-matricen er i sin første

udgave, har den allerede bidraget til, at arbejdet med falske antagelser i mindre grad udvikler sig

fremover i de fem case-virksomheder.

Improving learning competencies in the context of radical innovation: a team perspective

Afhandlingens tredje artikel bygger på et otte måneders aktionsforskningsprojekt, der blev

gennemført sammen med fem litauiske SMV'er fra april til november 2011. Artiklens fokus er

at studere teams i forbindelse med radikale innovationsprojekter for at undersøge, hvordan man

kan forbedre deltagernes samarbejde, ledelse og kommunikation i praksis: kort sagt, hvordan

man kan forbedre teamets effektivitet. I den eksisterende forskningslitteratur omhandlende

teams skrives der primært om, *hvad* teammedlemmer ved, og *hvorfor* de agerer som de gør, men

artikler som omhandler, *hvordan* teammedlemmer lærer, og derfor, *hvordan* de bliver klogere

under deres søgen på innovative løsninger, er ikke udforsket i samme grad. På baggrund af

feltarbejdet udvikles der fem arbejdskoncepter, der omhandler adfærd, som både fremmer og

hæmmer samarbejde, ledelse og kommunikation i de deltagende teams.

Arbejdskoncepterne

De fem arbejdskoncepter, der blev udviklet på baggrund af de fem casestudier, var: *rapid

documenting, fidgety, reticence, laid-back attitude* og *non-aligned*.

Rapid documenting beskriver situationer, hvor en projektdeltager pludselig skriver noget ned, laver en tegning eller tager et billede med sin smart-phone. Dette sker under både workshops, møder og seminarer. Deltageren holder det ny-dokumenterede for sig selv, og der gøres ikke noget for at dele disse noter, m.v. med kollegerne. Der er ingen systematik i, hvornår forskellige deltagere laver 'rapid documenting'; fællesnævneren er udelukkende, at dokumenteringen skal ske hurtigt.

Fidgety beskriver situationer, hvor der blev observeret utålmodighed, især i forbindelse med mødeaktiviteter og seminarer. Under seminarerne rokker flere deltagere på deres stole, de sidder uroligt med benene; andre klikker med kuglepenne, laver skriblerier eller kontroller deres smart-phones. Under møderne er der nogle deltagere, der skynder på deres kolleger, når de mener, at tingene går for langsomt.

Reticence beskriver situationer, hvor kun få deltagere deltager aktivt i diskussionerne, eksempelvis under workshops. De aktive deltagere snakker hurtigt, og bruger hinandens argumenter til at bygge videre på deres egne. De tilbageholdende deltagere bliver især synlige, når en af dem pludselig bryder ind i samtalen. Når dette sker, virker det, som om resten af teamet lytter mere efter, end når de meget aktive diskuterer.

Laid-back attitude beskriver situationer, som kan ligne adfærden i 'reticence'. Laid-back attitude beskriver dog det kropssprog, som nogle projektdeltagere sender til hinanden under møder, workshops og seminarer. Disse personer sidder eksempelvis henslængt i stolene, og de signaler, disse personer sender til deres kolleger, skaber en tydelig irritation: Der bliver rullet med øjnene og kigget vredt, men ingen sætter ord på deres tydelige utilfredshed.

Non-aligned beskriver situationer, hvor to eller flere deltagere misforstår hinanden. Selvom deltagerne taler samme sprog, og de taler om det samme emne, så går samtalen i to forskellige retninger.

Litteraturen omkring teamudvikling blev reviewet for at finde teorier/metoder, der kunne bidrage med et værktøj til at analyse arbejdskoncepterne med, og valget faldt på Building Excellence (BE) læringsstilsmodellen, da den før var blevet brugt med givtige resultater til at

forbedre arbejdet med innovation i praksis på teamniveau. Resultaterne fra analysen af arbejdskoncepterne viste, at BE-modellen kunne give svar på, hvorfor de forskellige projektdeltagere havde forskellig adfærd: De koncentrerede sig på forskellige måder, og havde således behov for at arbejde på forskellige måder for at være mere effektive.

Multi-casestudiet

Som intervention blev projektdeltagerne i de fem teams præsenteret for BE-modellen i et seminar, og efterfølgende fik hvert team til opgave at udarbejde en teamlæringsprofil. Denne intervention forbedrede effektiviteten af teamarbejdet i praksis, fordi det enkelte teammedlem fik en bedre forståelse for at øge sin personlige læringseffektivitet (koncentration), og ikke mindst fordi teammedlemmerne via teamlæringsprofilen fik en fælles forståelse for, hvordan hver i sær i teamet koncentrerede sig bedst muligt for at arbejde mere effektivt. Den fælles dialog om flere måder at arbejde effektivt og koncentreret på skabte et forbedret samarbejde i teamet, ledelsen af teamet blev lettere, og kommunikationen teammedlemmerne iblandt blev forbedret.

Exploring a radical innovation project as source of change in organizational routines

Afhandlingens fjerde (og sidste) artikel er baseret på et otte måneders aktionsforskningsprojekt i fem afdelinger/institutioner i en dansk kommune. Formålet med artiklen er at studere et radikalt innovationsprojekt som årsag til forandringer af organisatoriske rutiner (dermed det organisatoriske analyseniveau). Målet med artiklen er at vise, at igangsættelsen og gennemførelsen af et radikalt innovationsprojekt har flere positive afledte effekter, end hvad man hidtil har antaget, når man traditionelt måler på og vurderer innovationsindsatsen i organisationerne i OECD-landene.

Organisatoriske rutiner deles i litteraturen op i to: ostensive rutiner (abstrakte handlinger) og performative rutiner (konkrete handlinger). For at analysere effekten på organisatoriske rutiner i

de fem afdelinger/institutioner i kommunen, blev der via organisationsdesign-litteraturen defineret 28 abstrakte variabler. Disse variabler muliggjorde dataindsamling og –analyse af de ansattes performative (konkrete) handlinger, og af hvordan disse konkrete handlinger var blevet påvirket under deltagelse i et radikalt innovationsprojekt. Resultaterne af analysen ledte til udviklingen af syv propositioner, som bidrager med ny viden til litteraturen, og som kan medvirke til, at beslutningstagere i praksis bedre vil kunne forstå de positive effekter (forbedring/bekræftelse af performative rutiner), som sker ubemærkede under et radikalt innovationsprojekt. Dette er vigtigt viden for beslutningstagerne, som skal vælge, om de vil igangsætte et radikalt innovationsprojekt eller ej, eftersom resultaterne indikerer, at man får inkrementel innovation som gratis 'added value' udover det ønskede mål med projektet.

Propositionerne, som blev udarbejdet på baggrund af analysen er:

Proposition 1: Ledere kan teste egnetheden af deres performative rutiner i forbindelse med 'efficiency' og 'effectiveness' ved at påbegynde og gennemføre et radikalt innovationsprojekt.

Proposition 2: Ledere kan forbedre deres performative rutiner for at udforske 'exploration' og udnytte 'exploitation' ved at påbegynde og gennemføre et radikalt innovationsprojekt.

Proposition 3: Usikkerhed fra organisationens eksterne miljø 'complexity' mindskes, ved at der påbegyndes og gennemføres et radikalt innovationsprojekt.

Proposition 4: De performative rutiner, de ansatte bruger til at søge efter og skabe ny viden sammen med eksterne partnere 'virtualization', forbedres, ved at der påbegyndes og gennemføres et radikalt innovationsprojekt.

Proposition 5: De ansattes og ledelsens forandringsparathed, 'readiness to change', øges, ved at man påbegynder og gennemfører et radikalt innovationsprojekt.

Proposition 6: Kompleksiteten af den information, 'tacitness of information', der skal kommunikeres til (og forstås af) projektets interessenter, stiger, ved at der påbegyndes og gennemføres et radikalt innovationsprojekt.

Proposition 7: Basis for incitamenter, 'basis for incentives', ændres fra at være resultatorienteret til at være mere adfærdsorienteret ved at der påbegyndes og gennemføres et radikalt innovationsprojekt.

Casestudiet

Studiet viser, at man bør fokusere på mere end blot teknologiske måleindikationer, når man evaluerer effekten af arbejdet med innovation i praksis. Dette skyldes, at et stort og indtil nu uudforsket element har været overset i litteraturen: den ikke-teknologiske innovation - her defineret som forbedring af organisatoriske rutiner. Det er organisatoriske rutiner, som opretholder den daglige drift, og arbejdet med søgen efter innovation, der bliver forbedret via arbejdet med radikal innovation. Derfor indikerer studiet, at selvom at målet med et radikalt innovationsprojekt ikke opnås, så vil der alligevel ske en ikke-teknologisk innovation i organisationen, så at de brugte resurser, såvel mandetimer som penge, ikke er spildte. Denne indikation understøttes af de seks udviklede propositioner, der viser tendenser til forbedring af (eller bekræftelse af) den måde, hvorpå man driver sin organisation i praksis. Den eneste potentielt negative sideeffekt, der opstår ved at påbegynde og gennemføre et radikalt innovationsprojekt, er den øgede kompleksitet af information, der skal kommunikeres (og forstås) af projektets interessenter. Her bør man tage de nødvendige tiltag for at undgå misforståelser m.m. hos interessenterne.

First paper

Brix, J. and Jakobsen, H.S. (2013) Corporate Creativity: Introducing the Creative Idea Solution© framework, *International Journal of Innovation and Learning***, Vol.13 No.4**

See appendix 1 for co-author agreement

Corporate creativity: introducing the Creative Idea Solution© framework

Jacob Brix*

Business and Social Sciences,
Aarhus University,
Fuglesangs Allé 4, DK-8210 Aarhus V, Denmark
E-mail: jabk@asb.dk
*Corresponding author

Henning Sejer Jakobsen

Danish Technological Institute, Technology Partnership,
Kongsvangs Alle 29, DK-8000 Aarhus C, Denmark
E-mail: hja@dti.dk

Abstract: In this paper, the Creative Idea Solution© framework (CIS) is presented as a response to the call made by Kozbelt et al. (2010), Lubart (2001) and Rietzschel et al. (2009). The CIS framework integrates theory and methods from creativity research into an open and continued innovation process, and the authors argue that this interdisciplinary approach diminishes the gap between the two literatures. To indicate the value of the proposed framework in practise, a nine month action research case study was conducted in an international technological manufacturing company. The results and the learning outcomes from this action research are presented and the indications which emerged are compared to the existing literature.

Keywords: creativity; radical innovation; continuous innovation; open innovation; learning; action research; project manager's dilemma; innovation as a function; Creative Idea Solution©; CIS; interdisciplinary approach.

Biographical notes: Jacob Brix is an Industrial PhD student at Aarhus University, Business and Social Sciences in Denmark and he is employed at the Danish Technological Institute – Technology Partnership. He holds a Master of Arts in International Business Communication and Corporate Communication.

Henning Sejer Jakobsen is a Senior Innovation Consultant at the Danish Technological Institute – Technology Partnership. He holds a Master of Science in Engineering and Executive MBA. He has many years of practical experience regarding creativity and innovation and he is the creator of the Creative Idea Solution© framework. Finally, he is the Company Supervisor in Jacob Brix's Industrial PhD project.

1 Introduction

Innovation and learning are two of the most important words in businesses today (InnovationInside, 2010; Kess et al., 2010; Sanchez de Pablo Gonzalez del Campo and Skerlavaj, 2011), and it has been so for many years. Managers and CEOs continue to stress the importance of being innovative and they stress that learning is one of the means to an end (cf., Billet, 2001; Brix and Lauridsen, Forthcoming; Kanchana et al., 2011; Krot and Lewicka, 2011). But the fact is that innovation still seems as a black box which is impossible to decipher (Fagerberg, 2005), and when organisations have had success with their innovation projects, the managers and CEOs are often not satisfied with the result (cf., Christensen and Raynor, 2003; Graham and Bachman, 2004; InnovationInside, 2010). With the level of well-educated and experienced workforce working in most organisations, it is argued that the potential for success is large and that the reason for the high failure rate and the experienced in-satisfaction derives from half-hearted attempts when starting the very innovation projects (also cf., Clapham, 2003; Csikszentmihalyi and Sawyer, 1995; Haapasalo and Kess, 2001).

Based on the authors' experiences, it has been realised that brainstorming sessions (Osborn, 1953) are often applied in practise in a business perspective when starting a new innovation project. This conventional wisdom is also found in practise by scholars (Hansen and Birkenshaw, 2007). However, there is a clear paradox present in the literature, because applying brainstorming sessions is a good decision when consulting the innovation process literature (i.e., Kelley, 2001; Tidd and Bessant, 2009) and a bad decision when consulting the creativity literature (i.e., Csikszentmihalyi, 1997; Nijstad and Stroebe, 2006; Runco and Albert, 2010). Thus, when corporate managers in general juxtapose creativity with brainstorming, they do not, according to creativity literature, exploit the full potential of the future innovation project(s). The argument for this perceived shortcoming is the fact that the event-based brainstorming sessions are not put into a systematic framework and that the sessions are characterised by sporadic ideation, which according to the authors is not desirable.

Instead of claiming yet another middle-range or grand theory (Merton, 1949) of creativity in a business perspective, the authors reply to the call made by Kozbelt et al. (2010), Lubart (2001) and Rietzschel et al. (2009), and an integrative framework for applied creativity in an open and continuous innovation process is presented (cf., i.e., Chesbrough, 2003; Scharmer, 2009), where focus is on the creative sub-processes. This integrative framework is referred to as Creative Idea Solution (CIS) (Jakobsen and Rebsdorf, 2003; Brix et al. 2010; Brix, 2011). By focusing on the creative sub-processes the CIS framework

1   explains the importance of the micro- and macro-environment

2   it demonstrates the tools/methods practitioners should utilise

3   it indicates when practitioners should use these tools/methods in the process

4   CIS informs about the mentality and mindset which the practitioners should strive to have during the different phases in the process (ibid).

The justification for introducing CIS into a theoretical discussion is thus the focus on the creative sub-processes, which according to scholars (Csikszentmihalyi, 1997; Nijstad and Stroebe, 2006; Runco and Albert, 2010) are needed to be explored empirically.

To be able to claim knowledge about the CIS framework, a longitudinal case study made by the authors constitutes the empirical evidence for where CIS was utilised. More specific, new knowledge is claimed about the CIS framework itself, and based on the indications from longitudinal case study new knowledge is claimed for how corporate managers can learn to exploit existing creativity theory and methods as relevant tools in the innovation context. This paper thus strives to reduce the presented gap between the innovation and creativity literature.

First, the CIS framework is presented, in which the relevant literature is reviewed and then the longitudinal case study in which CIS was utilised is elaborated upon.

2 The CIS$^©$ framework

Creativity is not a completely new phenomenon in innovation literature. The number of articles of creativity in businesses (i.e., Puccio et al., 2006), creative processes (i.e., Finke et al., 1992; Simonton, 1997; Wallas, 1926) and organisational creativity (Amabile, 1988, 1996; Ford, 1996; Puccio and Cabra, 2010; Woodman et al., 1993) is exploding at the moment (Kozbelt et al., 2010), and it is argued that the business world is starting to understand the value of knowing how to use creativity as a tool in an innovative setting (also cf., O'Connor and DeMartino, 2006). According to Kozbelt et al. (2010) there is a need for creating a framework for how to apply creativity in practise in organisations; a framework which includes the sub-processes and the broader theoretical and empirical perspectives created in the creativity literature (also, cf., Amabile, 1996; Haapasalo and Kess, 2001; Isaksen et al., 2006; Lubart, 2001; Shalley et al. 2004). The authors claim that the CIS framework can reduce this knowledge gap.

Because the CIS framework integrates different theories and methods from creativity literature, the paper does not apply one single definition of creativity. Following the suggestion of Amabile (1996) the creative process is divided into a conceptual and an operational definition. The way in which creativity is operationalised in the different steps of the CIS framework is presented in the introduction to the CIS framework. The working conceptual definition of the creative process is:

> "The focused gathering of knowledge regarding the existing wish/problem, the questioning of the assumptions behind this knowledge and the intentional exploration of how the unknown through thought-breaking methods can assist the project team in creating new inputs, on which ideas can be created and developed by a persistent individual into designed ideas."

In the CIS framework innovation is defined as *the successful implementation of designed ideas*. As a compliment to this, innovation is categorised into two perspectives: the area of innovation and the (expected) effect (cf., Damanpour, 1987). The area of innovation is divided following the nomenclature created by OECD in the Oslo Manual. This nomenclature is divided into: product, process, marketing and organisational innovations (OECD, 2005). The effect of the innovation is following McFadzean's (1998) tri-partition of 'the creative magnitude' by focusing on:

1 paradigm preserving (incremental innovation)

2 paradigm stretching (radical innovation)

3 paradigm breaking (transformative innovation).

It is argued that this categorisation can assist in clarifying the specific type of innovation, and its (expected) effect on both the organisation and the market, when successful. Below the CIS framework is presented in Figure 1:

Figure 1   The CIS© framework (see online version for colours)
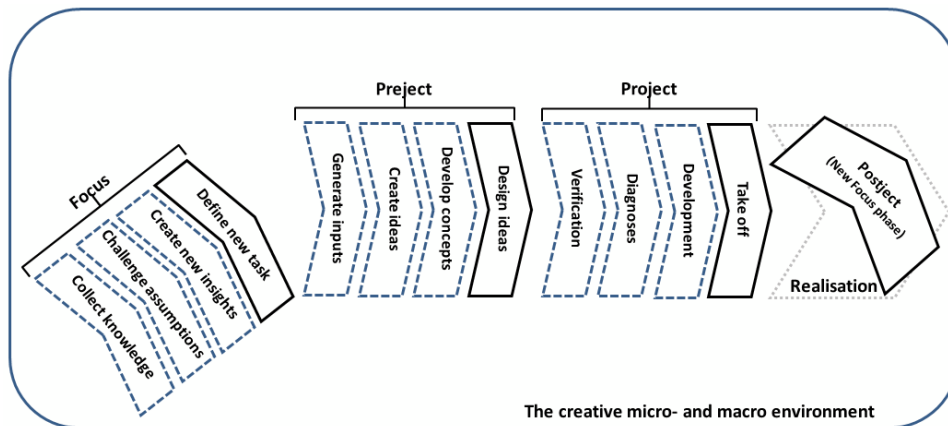
Note: Authors' elaboration

The CIS framework is inspired by Amabile's (1996) revised componential model of creativity and Parnes' (1967) creative problem solving model (also, cf., Treffinger et al. 2006). The CIS framework thus stresses the fact that the immediate environment, the social environment and the organisational context – both internal and external – have significant effect on the creative innovation process (i.e., cf., Anussornnitisarn et al., 2010; Dobny, 2011) in which individuals are working together. Hence, to demonstrate that information from outside the project team is both needed and used, the displayed arrows are stippled. CIS is divided into three different, however complementary, phases which together constitute the process that is central for the framework. These phases are not to be treated separately if a successful process is demanded (also, cf., Amabile, 1996; Parnes, 1967). CIS is thus divided into:

1   Focus (Postject)

2   Preject

3   Project (Brix, 2011; Jakobsen and Rebsdorf, 2003).

The CIS process should, when implemented for the first time in an organisation, run on a continuous basis in the process of Preject, Project, Postject (Focus). The postject is the activity to be done parallel with the realisation as a lateral process (De Bono, 1977) to ensure continued improvement and innovation based on the learning – success and mistakes – done in the Preject and Project phases. Postject is a new Focus which is the basic to a new Preject, etc. The implementation of CIS will add to the organisations existing business process and the authors state that the implementation will create synergy between them. However, this argument needs more empirical evidence to be regarded as valid.

This paper elaborates on the Focus (Postject) and the Preject phases and the four steps in each of them. When introducing the CIS framework for the first time in an

organisation, one takes departure in the Focus phase by collecting knowledge. Then, when a project team has been through all the steps in the CIS framework, the new Focus (also called Postject) is to be started. To be a continuous innovation model, it is argued that the goal is to have the CIS framework as a function in the organisation running on equal basis as, i.e., marketing (cf., Jakobsen and Rebsdorf, 2003).

3 Delimitation of the paper

This paper is delimited by leaving out the third phase *Project management*, because this is already well described by many other scholars (Kerzner, 2009; Mikkelsen and Riis, 2005; Olsen and Pedersen, 2006; see also PMI – *Project Management Journal*). Hence, the paper demonstrates the integration of different tools and methods from creativity literature in the Focus and Preject phases and how the in total eight steps complement one another in the CIS framework (Brix, 2011; Jakobsen and Rebsdorf, 2003). Moreover, the CIS framework is unlike Parnes' (1967) and Treffinger et al.'s (2006) creative problem solving model, because CIS is created to find potential and to explore this potential in a business setting. CIS is thus not created for problem-shooting situations. The authors argue that it would be applicable for problem-shooting situations, but research is further needed to demonstrate this.

Additionally, the authors experience that CIS is less applicable in cooperation with sub-contractors and with artisans in general. CIS is, however, applicable in the service industry, in cooperation with public authorities, i.e., municipalities; and in small and medium sized private organisations, both national and international. The characteristic of these groups is that they proactively desire radical product and/or process innovation. Hence, CIS is relevant for organisations who themselves wish to work proactively with innovation, and CIS is therefore less applicable for organisations who are forced to be innovative to survive the future.

Below, the CIS framework is presented in detail. The underlying assumptions which the CIS framework builds upon are made explicit in the left side of the tables, and the activities that have should be organised during the process of going through the CIS framework are presented in the middle. At last, the references which are used for inspiration are written in the right side of the tables.

4 The creative micro- and macro-environment

Table 1 describes the impact which the micro- and macro-environment have on the creative innovation process. The microenvironment is the immediate setting in which the team is present, and the macro-environment describes the organisational surroundings (both internal and external) in which the team members navigate.

4.1 Focus (Postject) phase

The CIS framework begins with the Focus phase as being a lateral process (De Bono, 1977). The Focus starts with the collection of knowledge regarding existing processes

and products/services of the organisation. Thus, Focus is on what the organisation is working with, how it is working with it and why it is working with it. The Focus phase is a very important part of in the CIS framework, because managers in general take for granted that they know what causes the perceived problem (Kerzner, 2009; also, cf., Csikszentmihalyi, 1997). Hence, the Focus phase assists managers in postponing judgement and evaluate if the perceived potential/problem is adequate to explore.

Table 1   The creative micro- and macro-environment

Directions and assumptions	Activity	References
The microenvironment influences the creative innovation process. It is of great importance that this is understood and accepted before applying the CIS framework in practise	*Micro-environment:* New and stimulating surroundings encourage and catalyse creative output during the creative process. Judgement is not allowed. Being away from the organisation is important to avoid functional fixedness and to increase change of perception	Csikszentmihalyi (1997), Amabile (1996) and Glucksberg (1962)
The macro-environment influences on the creative innovation process. It is crucial that the macro-environment does not inhibit the strivings of the project team	*Macro-environment:* The social and institutional context must understand and accept the creative strivings if success is desired. (Readiness and openness to new initiatives is a must)	Csikszentmihalyi (1997) and Christensen (1997)
Focus must be on the *process* and not the outcome of the process. The CIS framework is applied when organisations wish to learn from the unexpected to cope with the future (to seek radical innovation)	The CIS framework is systematic and it has clear steps which include tools/theories from creativity research to gain new emerging insights for new knowledge creation. (disciplined creativity)	O'Connor and DeMartino (2006) and Christensen (1997)

Note: Authors' elaboration

Table 2 demonstrates the four steps which should be completed in order to be able to reformulate the original focus into the new task (the 'real' focus) which is regarded relevant for the rest of the creative innovation process.

In the Focus phase, creativity is operationalised as *the intentional transformation of existing patterns of thought regarding the total organisation*. In short, the elements which the team take for granted and the assumptions which the team have are challenged by laddering methods and by provoking new insight by visiting other industries, which at first may not have anything to do with the team's core competencies. Because CIS has an open innovation perspective based on a context-oriented framework, it is imperative that external sources, i.e., other industries and/or people from other professions are invited to provoke new insights based on the found assumptions. This intentional provocation assists in creating additional new insights for the group; insights which can be used when defining and/or redefining the new task.

Table 2   The Focus (Postject) phase

Directions and assumptions	Activity	References
Collect knowledge: The Focus (and thus the Postject) starts with the question: what do we know: use open and closed questions	Collect the existing knowledge – both related to what is known and what is not known; find existing assumptions on which decisions are made	Csikszentmihalyi and Sawyer (1995), Isaksen et al. (2006), Parnes (1967) and Darsø (2001)
Challenge assumption: Challenge our knowledge: do we really know what we know? When the assumptions have been challenged, it is easier to invite relevant experts to participate in the next step of the process	Make a reality check of the existing assumptions by applying laddering techniques and provocation, remove false assumptions; view the assumptions from different perspectives (also referred to as removing paralysis)	Csikszentmihalyi and Sawyer (1995), Von Oech (1983), Jakobsen and Rebsdorf (2003) and De Bono (1977)
Create new insights: Search and find new insights and perspectives by exploring unknown domains (in general) in which new potential areas might emerge. These new insights will assist in removing part of the existing paralogism in the project team	Search for new insights by changing focus; illumination (aha-experience after time of incubation); adaptive originality and breaking existing rules (Big-C and little-C). New direction demand new insights which have to be found/created and explored	Amabile (1996), Csikszentmihalyi (1997), De Bono (1977), Perkins and Salomon (1989), Wallas (1926) and Winnicott (1971)
Define new task: Based on the three previous steps the task is re-defined which direct focus for the upcoming preject and thus the innovation project(s)	What originally was considered (expected) to be the focus is re-formulated to fit the new insights which have been created. This redirected focus is the basis for first step in the Project phase	Amabile (1996) and Jakobsen and Rebsdorf (2003)

Note: Authors' elaboration

4.2 *Project phase*

In the Project phase creativity is operationalised as *a radical exploration of the defined task by use of pattern-breaking methods*. During the entire Project phase, judgement is suspended, which imply that references to economy, earlier bad experiences, impossibility etc. are not allowed (Jakobsen and Rebsdorf, 2003; Osborn, 1953; Parnes, 1967). In short, emphasis is on breaking patterns and exploiting the thoughts the individuals have during this type of process, where the quantity of input are more important than the quality (Runco and Albert, 2010; Rietzschel et al. 2009; Simonton, 1997). However, because the inputs which are created in the CIS framework have been generated according to a specific task (from the redefined task in the Focus phase), rather than being created in a random process of 'freewheeling' (i.e., cf., Treffinger et al., 2006; Osborn, 1953), it is argued that the created inputs from the CIS are more applicable to the future innovation process than the inputs derived from a brainstorming session.

In Table 3, the theories and methods which inspire – and which are utilised in the Project phase are demonstrated:

Table 3 The Preject phase

Directions and assumptions	Activity	References
Generate input: Everyone can learn to think creatively. Patterns are broken by provoking creative thinking and high energy level is needed to create multiple inputs	Paradigm preserving, stretching or breaking methods; Divergent thinking; lateral thinking; provocative operation; suspended judgement; synectics (analogies). (Insights from the Focus phase are likewise sources of inputs)	Amabile (1996), De Bono (1977), Guilford (1950), McFadzean (1998) and Osborn (1963)
Create ideas: Exploring extreme radical suggestions always results in higher level of originality and creativity. Going for Big-C always leave small-C; not vice versa. When creating ideas this way, a project team searches for multiple breakthroughs. Additionally, inputs may not be combined; all inputs must be treated as an individual entity; there is no democratic judgement for 'the best idea'. Multiple inputs can be elaborated upon parallel to different designed ideas.	Creative magnitude – smaller C or larger C; controlled sporadic process (geisterblitz); develop multiple ideas by adding more knowledge and information to each of the input to search for some kind of breakthrough (horizontal development) by adding more and more knowledge in each input regardless the final use	Csikszentmihalyi (1997) and Winnicott (1971)
Develop concepts: Each breakthrough found when creating ideas have to go through a 'vertical process' to become a concept. This is done by creating additional ideas related to the original breakthrough in all of the steps of a business model	Explore the created ideas in multiple perspectives still without judgement (vertical development). Regardless what type of idea the breakthrough is created upon all other areas related to the breakthrough must be worked through, i.e., the breakthrough must be related to: product, process, system, business, social, financial, cultural and a political/legislative perspective before it is considered as being a concept	Amabile (1996), Christensen and Raynor (2003), Finke et al. (1992) and Jakobsen and Rebsdorf (2003)
Design ideas: The developed concepts should be presented according to all aspects in a business model. Moreover, different business models can be created based on the same idea. (Each business model involves some compromises which influence the other ideas in the business model)	Each idea provides different possible concepts – some more radical than others. Each of the concepts have to be described as a business model based on the vertical process to be considered a designed idea; described and illustrated, so the functions of the designed ideas and the tasks/problems they fulfil/solve are clear and transparent, i.e., as rapid prototyping, 3D illustrations, etc., including text.	Csikszentmihalyi (1997), Wallas (1926) and Jakobsen and Rebsdorf (2003)

Note: Authors' elaboration

In the Preject phase the first two steps treat the generation of inputs and the creation of ideas. Inputs are thoughts which have been registered on a piece of paper, in a software system, in a drawing etc. First, the project group generates all the inputs which it possibly can (according to the new or redefined task from the Focus phase). This is done in one formal step where relevant external persons must be invited to assist in the radical exploration of the new insights. In the period following the formal input generation, the participants register additional inputs, which come to their mind as 'illumination' after time of 'incubation' (cf., Wallas, 1926). Then, in the next step of the Preject phase, the participants create ideas by adding what they believe to be relevant information to the different inputs, i.e. a short description. This is what the authors refer to as horizontal development. When the ideas have been created by adding the short descriptions, the participants have to select one or more ideas, which they will develop further. The team members then develop the ideas in depth, where they seek new insight and inspirations from different perspectives, cf., De Bono's (1977) exploration of valleys theory. When the different 'valleys' have been explored, the new insights are described and illustrated, so the potential the idea(s) seek to strive after is clear. It is important to note that there is no guarantee that an input is turned into an idea and afterwards a successful innovation (Rietzschel et al., 2009). Based on this perspective, it is stressed that it is of most importance that it is one person who is responsible for developing an idea, and not a group of people, who is responsible for carrying the developed idea through the CIS framework. The authors argue that this personal ownership increases the conditions for the potential growth of the idea(s), because no underlying knowledge has been lost in the process due to the shift of responsibility (Jakobsen and Rebsdorf, 2003; also, cf., Brix et al. 2010). In addition, it is possible to move back and forward between the four steps in the Preject phase, however, the Preject phase is not to be considered completed before each of the four steps have been scrutinised. In sum, the first two phases of the CIS framework constitute a prolonged pre-innovation process, where judgement is suspended until necessary, cf., project manager's dilemma (Mikkelsen and Riis, 2005; Kerzner, 2009) regarding available information and knowledge, and the importance of the decision-making in the process. The results and the implications of utilising the focus and Preject phases from the CIS framework will now be presented by means of a longitudinal case study. First, the method and the unit of analysis (UoA) are presented.

5   Method

The authors carried through nine months of clinical action research (Schein, 2009) with the UoA. The clinical action research was completed as Brix and Lauridsen (forthcoming), where the authors participated in the processes and where they explored these processes both directly and retrospectively (Brix and Lauridsen, Forthcoming; Schein, 2009). Based on the clinical action research methodology, the authors collected data and gained in-depth personal insights of the application of the CIS framework by using participant observation, participation and post-project interviews (Crotty, 2005; Yin, 2009). To ensure the validity of the authors' understanding and their personal reflections regarding the complete case material (the data), the authors presented this material to the UoA, and the UoA commented upon this material and then validated it for usage in an academic setting (also, cf., Brix and Lauridsen, forthcoming). The paper thus demonstrates the application of the Focus and Preject phases from the CIS framework in

a context of unusual research access (Yin, 2009), where new technology and machinery were to be produced in a confidential setting. The authors investigated the application of CIS's first two phases in depth and within its real-life context, where many variables of interest and multiple sources were present (Yin, 2009; also, cf., Eisenhardt and Graebner, 2007). Based on these arguments, it is argued that this single-case study stands strong in claiming new knowledge to the call made by Kozbelt et al. (2010), Lubart (2001) and Rietzschel et al. (2009) concerning the utilisation of CIS as an integrative framework. Additionally, the longitudinal case study will present indications that demonstrate how the theories and methods from the creativity literature react to innovative practise (also, cf., Eisenhardt, 1991).

5.1 Unit of analysis

The UoA wishes to remain anonymous in the paper. The UoA is a Danish department of an international technological manufacturing corporation. The core competence (Drejer, 2006; Prahalad and Hamel, 1990) at the UoA is the production of machinery which processes waste for recycling and for the direct heating industry. Today, the UoA delivers technology and machinery worldwide to its public and private customers. Based on increased competition and a two year internal incremental process innovation project (McFadzean, 1998; OECD, 2005), where the UoA had reduced production costs around 25%, the UoA wanted to advance the core competences and strengthen the organisations market position (Barksdal et al., 1982) by acting proactively with radical product and process innovation (OECD, 2005). Based on these strivings, the authors were invited to carry through the first two phases of the CIS framework at the UoA. The results and indications are presented below:

5.2 Results

The UoA invited the authors to solve the following task: *to find/create a process/machinery that could complement the existing core competencies at the organisation.* That is, the UoA wanted to focus on an innovation activity which could complement the existing technology offered to the customers.

5.2.1 The creative micro- and macro-environment

Before starting the Focus phase, the assumptions regarding the micro- and macro-environment for the CIS framework were explained to the team and to the management. This clarification of how the authors in the following process would organise the creative microenvironment and how the organisational macro-environment influenced the process seemed relevant for the team, however on beforehand they found it hard to really understand why they should, i.e., have meetings away from the organisation and why they should go visit other organisations. During the Focus phase, the team started to notice the change of mind-set as they experienced that being away from the organisation assisted them in changing perception and remove functional fixedness regarding the upcoming innovation project. In the post project interview, the manager stated that the organisation of the creative process should be done by an external facilitator, because he argued that the organisational culture would inhibit an internal person in facilitating the process, because s/he would be too biased and find it hard, if not

impossible, to change perception and pose questions which could remove focus from functional fixedness.

In short, the results which were found when presenting the creative environment supports Csikszentmihalyi's (1997) strong focus on 'setting the stage' for working with creativity (the microenvironment) and Amabile's (1996) and Christensen's (1997) focus on full acceptance from the macro-environment to go through a project which will result in organisational change.

5.2.2 Focus phase

The management at the UoA presented the organisation, its history and afterwards the team members presented the existing technology and machinery which the UoA offered to its customers. As part of the process, the authors and the team visited two customers, one in Germany and another in Denmark together, to see how the machines (both new and older models) worked in practise. Moreover, the authors wanted the team members to speak with the daily operators of the machines to get new perspectives. The meeting with the daily operators gave the team new insights, because the team members, i.e., realised that 'soft' materials often could generate problems because this kind of material would plug the machinery and slow down the process, and they realised that the outlet where the processed material was accumulated, was difficult to access with the crane shovels. Moreover the authors visited another customer, without the team, and asked the customer for additional information regarding the daily operation. This was done to get additional knowledge about how the technology and machinery could be thought in a larger context. This visit was meant to inspire the authors later in the process.

After the collection of knowledge, four different people from different professions were invited, who should assist the authors in challenging the assumptions and thus remove the team members' states of paralysis. These external people were: a laser physicist with a speciality in fusion, a biologist with a speciality in how crocodiles flense their prey, a software engineer with expertise in Visio detects and repair, and finally a practitioner who used the machinery sold by the UoA on a daily basis. Together with the team members, the authors started to consult the invited experts regarding how they could see the team's task from their perspective, and the authors asked the invited experts to challenge the team members' assumptions and what they took for granted.

Afterwards the team members stated that it was fruitful and very insightful to have 'most' of these people in the process, because they were not coloured by the team's internal 'way of thinking', because the invited professionals questioned the assumptions which the team had and took for granted, which gave the team new perspectives on the organisation's core competences, which, according to the team, was really insightful.

The tendencies the team experienced from the Focus phase indicate that De Bono's (1977) exploration of valleys do result in important insight for the team members when they are to avoid functional fixedness and change perception (Glucksberg, 1962). Additionally it is stressed that Csikszentmihalyi and Sawyer's (1995) and Von Oech's (1983) focus on creating a thorough 'reality check' can assist a team in removing paralysis and find new perspectives on the task which is to be completed/explored.

Finally, based on the extensive exploration of opportunities and the provocation of the assumptions in the team, a new task was defined by the team members based on the new insights found in the Focus phase. The new defined task was: *to create a new process (technology) which could create a radical new way to process scrap/waste/refuse*

into directly recyclable material. This, redefined task was accepted to be explored in a focused manner in the Preject phase and in the rest of the CIS framework.

5.2.3 Preject

During the Preject phase the team generated 543 input (inputs both from formal workshop and the following time of incubation – illumination), and 359 ideas were created by description. 73 concepts were developed based on these descriptions, and 30 idea designs (business models) were initiated, where 6 of them were completed. The process thus resulted in six individually designed and ready to be implement projects, where the remaining 24 not completed idea designs were somewhat close to be completed.

When starting the first part of the Preject, some of the team members found it difficult to turn off logic and judgemental thinking during the generation of inputs. Some of the team members stated that "*they had learned to think logically and evaluate throughout their entire education as engineers!*" The manager complimented this statement and further developed it: "*when we work with 'wild ideas', it is very hard to stop thinking 'how can I send an invoice to the customers based on this in few weeks?' (…) In the real world, we need to earn money every single day, and I guess that most people in organisations are trained to think short term and sales!*"

These statements stress the fact that it for some individuals is difficult in practise to aim at 'the unknown', when they are to generate focused input. An important perspective when referring to Csikszentmihalyi's (1997) Large C – small c theory (creative magnitude), where aiming at the large C always result in many small cs, and not vice-versa. The participants did comment that the different methods which were applied in the CIS process, when inputs were to be generated, increased the number of inputs which the team generated. One team member stated "*I have learned that we can be creative and that creativity has to be organised in an innovation process; but I would stress that it is hard to organise it [creativity], but luckily not impossible!*" During the process, another team member argued "*Until now, we have relied on the 'everyday creativity', but now we have learned to organize creativity, so we know how to provoke it and to exploit the potential of it when necessary (…)getting an understanding of this [the organisation of creativity] is a great mind-set for us!*"

Based on these perspectives, it is argued that the UoA indicates an interesting potential in the application different methods from the creativity literature as complimenting tools in the CIS process (cf., Table 3 – 'generate input'). This argument supports McFadzean's (1998) creative continuum hypothesis, however, it needs further research.

In the same perspective, the authors experienced that the team members were fast to go from 'exploration mode' to 'solution mode' in the process, when they were to create ideas. The authors experienced that if something seemed promising, then the team members were ready to quit large parts of the CIS process and turn an idea into a project. This fast evaluation was excused by the above mentioned logical thinking and invoicing, and it further stresses the fact that researchers in general need to underscore that striving for radical innovation by exploring the extreme is a learning process which can be very difficult and time-consuming. Based on this finding, it is stressed that it is imperative for a team and its members get continuous support from both the micro- and macro-environment in the process, if not, it is likely that the team will down-prioritise

and/or fail its task. This argument supports Christensen's (1997) and Amabile's (1996) conclusions that openness and readiness to positively welcome new initiatives is a must from the macro-environment.

The idea development was initiated by freely letting the team members chose one or more fertilised inputs, to further develop into ideas. The manager stated in the post project interview that they had not tried to work with the parallel development of multiple ideas before, and he stated that it was not more difficult, than working with one idea. The only downside the manager could find was the fact that more man-hours had to be set aside to develop these ideas, because it took longer time than he expected. This statement stresses the fact that innovation is a time-consuming learning process, where the team members seek new information and insight, where there can be weeks between the incubation, where team members are confused and the illumination, where they get the 'aha-experience' (Wallas, 1926). When the authors asked for the reason for why the manager gave more resources (time) for the team to develop the ideas, he stated that he could see the potential and the benefits in having around 30 focused ideas developed in a parallel manner, which the board of directors would be able to choose from, instead of presenting them one single idea. The team members moreover stated that they found it more interesting and motivation to work with their own personal project(s) in the project, because they found it more inspiring and it gave them more energy, compared to the hitherto experiences they have had with user-driven innovation projects. This indication supports Amabile's (1996) perspective that motivation and ownership of something that has to be developed is imperative, if success is needed.

The findings from the Preject phase support the literature in different ways. The authors found indications which suggest that it can be difficult to work creatively if the participants are influenced by a result-oriented macro-environment (also, cf., Christensen, 1997). However it was realised that applying McFadzean's hypothesis of using different thought-breaking-methods increase and facilitate the participants work with creativity, which support Amabile's (1996) argument that everybody can learn to be creative, if they are given purposeful instruments.

5.3 Following the CIS process

The manager of the UoA stated that the organisation have had many innovation projects completed as user-driven innovation initiatives, and that they found these projects valuable because of the close cooperation with their customers. However, the manager stated: "*We learned from the CIS process that applying user-driven innovation projects are good for incremental innovation, but not for getting insights for creating something new or radical (...) this [the CIS process] has been an eye-opener for us and it has given us tools to seek and explore places where we would normally not go to get new insights!*". This opinion was also acknowledged by the team members, who stated that working with 'wild ideas' (paradigm breaking ideas) resulted in insightful and more relevant outcomes than expected. To sum up, the UoA realised that the original task they had presented was not as relevant for them to solve, because they saw the potential in exploring the transformational and extreme radical ideas, because they found that they could benefit from the indirect outcomes of this search, which could be directly implemented into their current technology. This indication supports Csikszentmihalyi's 'Big C – Little C' theory.

When referring to the entire Project phase, the manager stated in the post-project interview: "*the many developed ideas are not forgotten even though they have not been realized, they are just down-prioritised because two of the designed ideas are to be started up as innovation projects; one regarding the new technology and another regarding the machinery in which the technology is to be implemented!*" and he continued "*We did not expect a transformational breakthrough – and we do not know if we will get it, however, we have until now had so many spin-offs from the process, which are directly implementable in our daily business!*"

The manager finalised the interview with the statement: "*Normally, if we complete a user-driven innovation project, we sometimes increase productivity around 30-50 per cent, but if this new technology in few years is really going to work, our new machine will look very different from what we offer our customers today, and we expect that it will increase productivity by 70–80 per cent!*"

As such, even though the UoA has not completed the two initiated innovation projects, they have already taken a significant leap compared to the UoA's hitherto innovation projects.

6 Implications

6.1 Research

This paper serves as a source of inspiration and it gives interesting indication to the call made by Kozbelt et al. (2010), Lubart (2001) and Rietzschel et al. (2009). The authors claim and support that applying theory and methods from creativity research into an integrative innovation framework (as the CIS framework) result in beneficial learning outcomes for organisations having innovative desires. The paper further indicates valuable insights regarding the parallel development of multiple ideas with individual ownership, which is where the CIS framework stands out from other creative innovation processes, such as the Creative Problem Solving model (Parnes, 1967; Treffinger et al., 2006). Based on the experiences of this paper, the authors stress that the parallel development of multiple ideas can contribute to accelerated innovation, because much more potential is sought and found during the process, compared to other processes where one single idea is developed. The authors call for further empirical research to document these indications. Finally, the paper demonstrates that parallel development of multiple ideas is more time consuming than developing one idea, but the value of having created multiple ideas is, however, much more valuable for practitioners because they learn from the mistakes and they create new insights when utilising this approach with the multiple development.

6.2 Practise

By integrating the Focus and Project phases of the CIS framework into innovation projects, organisations are forced to explore the unknown and learn from it. The value of the large extension of the initial innovation process makes the project managers dilemma (Kerzner, 2009) less relevant, because information is sought and insights are created before anyone is allowed to make a decision. Additionally, the presented case organisation got increased insight into applying pattern-breaking methods in practise; this

has given the professionals new tools to apply when they want to work creatively, instead of applying brainstorming sessions as the normal prescription. In short, the UoA found it highly relevant and insightful to work with and implement a systematic and continuous innovation process as the CIS$^{©}$ framework because they changed their ordinary way of approaching innovation projects.

7   Conclusions

Innovation and learning are two important phenomena in both literature and organisational practise. Both phenomena are considered as being logical that is, they consist of making sense out of chaos. As a compliment to the innovation literature, this paper claims new knowledge to the call made by Kozbelt et al. (2010), Lubart (2001) and Rietzschel et al. (2009), where theory and methods from creativity research are integrated into a creative innovation process. Hence, the authors present a framework which strives to create chaos out of order, where focus is on getting inspired from the unexpected, in order to learn and get new insight, which can be used before initiating an innovation project.

The utilisation of the CIS$^{©}$ framework claims new knowledge of how managers can learn to exploit existing creativity theory and methods systematically in innovative sub-processes. The claims are based on a longitudinal case study completed in a Danish department of an international technological manufacturing corporation, and the claims present a number of interesting indications and propositions which can add to the existing pool of knowledge.

First, the paper stresses the fact that managers must realise that pre-innovation work is a time-consuming learning process, where new information and insights are to be sought. Second, the micro- and macro-environment play a crucial role in the process. Moreover, the paper supports Csikszentmihalyi's (1997) strong focus on 'setting the stage' before working with creativity (the microenvironment) and the indications which were found underpin Amabile (1996) and Christensen's (1997) focus on full support and understanding from the macro-environment in the process. Third, the paper indicates that Csikszentmihalyi and Sawyer (1995) and Von Oech's (1983) focus on creating a thorough 'reality check' can assist in removing paralysis and find new perspectives regarding the task which is to be completed/explored. This reality check, supported by the visit at other locations and the provocative questioning by external experts, results in important insights which assist practitioners in avoiding functional fixedness and it facilitates the practitioners in changing of perception (Glucksberg, 1962). Fourth, the authors experienced that some of the participants found it difficult to work creatively if they were influenced by a result-oriented macro-environment. However, it was realised that applying McFadzean's (1998) hypothesis of using different thought-breaking methods increases and facilitates the participants work with creativity; indications which support Amabile's (1996) argument that everybody can learn to be creative, if they are given purposeful instruments. Fifth, the paper indicated that individual ownership of the project(s) in the project resulted in increased interest and enhanced motivation among the team members; results which released more energy to the process. This indication supports Amabile's (1996) perspective that motivation and ownership of something that has to be developed is imperative if success is needed. At last, the UoA realised that the original task they had presented as an innovation project was not as relevant for them to

solve, because they saw the potential in exploring the transformational and extreme radical ideas because they found that they could benefit from the indirect outcomes of this search. This indication supports Csikszentmihalyi's (1997) 'Big C – Little C' theory. To conclude, the authors argue that this paper represents a valuable contribution to the innovation and creativity literature, a contribution which needs more empirical research.

References

Amabile, T.A. (1988) 'A model of creativity and innovation in organizations', *Research in Organizational Behavior*, Vol. 10, pp.123–167.

Amabile, T.A. (1996) *Creativity and Innovation in Organizations*, No. 9-396-239, Harvard Business School Publishing, Boston.

Anussornnitisarn, P. et al. (2010) 'Sustaining organisational innovation and learning through external knowledge', *International Journal of Innovation and Learning*, Vol. 7, No. 1, pp.85–99.

Barksdal, H.C. et al. (1982) 'Portfolio analysis and the product life cycle', *Long Range Planning*, Vol. 15, No. 6, pp.74–83.

Brix, J. (2011) 'Education in creativity increases organisational development', *Uddannelse og Udvikling*, Vol. 9, No. 4, pp.28–32.

Brix, J. and Lauridsen, K.M. (forthcoming) 'Learning styles and organisational development in practice: an exploratory study of how learning styles and individual learning strategies can facilitate organisational development', *International Journal of Innovation and Learning*.

Brix, J. et al. (2010) 'User Communities in the innovation process', *Proceedings from the Danish Academy of Management*.

Damanpour, F. (1987) 'The adoption of technological, administrative and ancillary innovations: impact of organizational factors', *Journal of Management*, Vol. 13, No. 4, pp.555–590.

Dobny, B.C. (2011) 'The relationship between innovation orientation and organisational performance', *International Journal of Innovation and Learning*, Vol. 10, No. 3, pp.226–240.

Drejer, A. (2006) 'Strategic innovation: can we learn something by applying a learning perspective?', *International Journal of Innovation and Learning*, Vol. 3, No. 2, pp.144–160.

Eisenhardt, K.M. (1991) 'Better stories and better constructs: the case for rigor and comparative logic', *Academy of Management Review*, Vol. 16, No. 3, pp.620–627.

Eisenhardt, K.M. and Graebner, M.E. (2007) 'Theory building from cases: opportunities and challenges', *Academy of Management Journal*, Vol. 50, No. 1, pp.25–32.

Ford, C.M. (1996) 'A theory of individual creative action in multiple social domains', *Academy of Management Review*, Vol. 21, No. 4, pp.1112–1142.

Glucksberg, F. (1962) 'The influence of strength of drive on functional fixedness and perception recognition', *Journal of Experimental Psychology*, Vol. 63, pp.36–41.

Haapasalo, H. and Kess, P. (2001) 'In search of organisational creativity: the role of knowledge management', *Creativity and Innovation Management*, Vol. 10, No. 2, pp.110–118.

Hansen, M.T. and Birkenshaw, J. (2007) 'The innovation value chain', *Harvard Business Review*, June.

Kanchana, R. et al. (2011) 'Interrelationships among knowledge management, organizational learning and innovation', *International Journal of Innovation and Learning*, Vol. 9, No. 2, pp.145–162.

Kess, P. et al. (2010) 'Developing an assessment model for a learning organization', *International Journal of Innovation and Learning*, Vol. 8, No. 2, pp.107–126.

Krot, K. and Lewicka, D. (2011) 'Human side of innovation-individual and organisational environment-related aspects: the case of IBM', *International Journal of Innovation and Learning*, Vol. 9, No. 4, pp.352–371.

Lubart, T.I. (2001) 'Models of the creative process: past, present and future', *Creativity Research Journal*, Vol. 13, Nos. 3–4, pp.295–308.

McFadzean, E. (1998) 'Enhancing creative thinking within organisations', *Management Decisions*, Vol. 36, No. 5, pp.309–315.

Nijstad, B.A. and Stroebe, W. (2006) 'How the group affects the mind: a cognitive model of idea generation in groups', *Personality and Social Psychology Review*, Vol. 10, No. 3, pp.186–213.

O'Connor, G.C. and DeMartino, R. (2006) 'Organizing for radical innovation: an exploratory study of the structural aspects of RI management systems in large established firms', *Journal of Product Innovation Management*, Vol. 23, No. 6, pp.475–497.

Parnes, S.J. (1967) *Creative Behavior Guide Book*, Scribner Publishers, New York.

Perkins, D.N. and Salomon, G. (1989) 'Are cognitive skills context-bound?', *Educational Researcher*, Vol. 18, No. 1, pp.16–25.

Puccio, G.J. et al. (2006) 'A review of the effectiveness of CPS training: a focus on workplace issues', *Creativity and Innovation Management*, Vol. 15, No. 1, pp.19–33.

Rietzschel, E.F. et al. (2009) 'Group creativity as a multifaceted, multistage phenomenon', *Research on Managing Groups and Teams*, Vol. 12, pp.1–27.

Sanchez de Pablo Gonzalez del Campo, J.D. and Skerlavaj, M. (2011) 'The organisational learning process as facilitator of innovation', *International Journal of Innovation and Learning*, Vol. 9, No. 4, pp.401–421.

Schein, E.H. (2009) 'Clinical inquiry/research', in Bradbury, H. and Rearson, P. (Eds.): *Handbook of Action Research: Concise Paperback Edition*, Sage Publishers, London.

Shalley, C.E. et al. (2004) 'The effects of personal and contextual characteristics on creativity: where should we go from here?', *Journal of Management*, Vol. 30, No. 6, pp.933–958.

Simonton, D.K. (1997) 'Creative productivity: a predictive and explanatory model of career trajectories and landmarks', *Psychological Review*, Vol. 104, No. 1, pp.66–89.

Von Oech, R. (1983) *A Whack on the Side of the Head: How to Unlock your Mind for Innovation*, Warner Books, USA.

Woodman, R.W. et al. (1993) 'Toward a theory of organizational creativity', *Academy of Management Review*, Vol. 18, No. 2, pp.293–321.

Yin, R.K. (2009) *Case Study Research: Design and Methods*, 4th ed., Sage Publishers, UK.

Bibliography

Amabile, T.A. (1996) *Creativity in Context: Update to 'The social Psychology of Creativity'*, Westview Press, Boulder.

Billet, S. (2001) *Learning in the Workplace: Strategies for Effective Practice*, Allan and Unwin Australia.

Chesbrough, H.W. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston.

Christensen, C. (1997) *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*, Harvard Business School Press, Boston.

Christensen, C. and Raynor, M.E. (2003) *The Innovator's Solution*, Harvard Business Review Press, Quebec, Canada.

Clapham, M.M. (2003) The development of innovative ideas through creativity training', in Shavinina, L.V. (Ed.): *The International Handbook on Innovation*, Elsevier Science Ltd., St. Leonards, Australia.

Crotty, M. (2005) *The Foundations of Social Research: Meanings and Perspectives in the Research Process*, Sage Publications Ltd., New York.

Csikszentmihalyi, M. (1997) *Creativity – Flow and the Psychology of Discovery and Invention*, Harper Perennial.

Csikszentmihalyi, M. and Sawyer, K. (1995) 'Creative insight: the social nature of a solitary moment', *The Nature of Insight*, Edited by Sternberg and Stevenson, Cambridge University Press, New York.

Darsø, L. (2001) *Innovation in the Making*, Samfundslitteratur, Frederiksberg.

De Bono, E. (1977) *Lateral Thinking: A Textbook of Creativity*, Penguin Books, London, England.

Fagerberg, J (2005) *Innovation: A Guide to the Literature*, in Fagerberg et al. (Ed.): *The Oxford Handbook of Innovation*, Oxford University Press, New York.

Finke, R.A. et al. (1992) *Creative Cognition: Theory, Research and applications*, MIT Press, Cambridge, MA.

Graham, D. and Bachmann, T.T. (2004) *Ideation – The Birth and Death of Ideas*, John Wiley and Sons, Inc., New Jersey.

Guilford, J.P. (1950) 'Creativity', *American Psychologist*, No. 5, pp.444–454.

Innovationinside (2010) 'The rise of the creative masses: transforming the workforce into an innovation force', *Innovation Force*, February.

Isaksen, S.G. et al. (2006) *Creative Problem Solving: An introduction*, 4th ed., Prufrock Press Inc., Texas.

Jakobsen, H.S. and Rebsdorf, S. (2003) *Ideation and Creative Innovation*, Gyldendal, Copenhagen.

Kelley, T. (2001) *The Art of Innovation*, Doubleday Currency Inc., London.

Kerzner, H. (2009) *Project Management – A Systems Approach to Planning, Scheduling and Controlling*, 10th ed., John Wiley and Sons, New Jersey.

Kozbelt, A. et al. (2010) 'Theories of creativity', in Kaufmann, J.C. and Sternberg, R.J. (Eds.): *The Cambridge Handbook of Creativity*, Cambridge University Press, New York.

Merton, R.K. (1949) *Social Theory and Social Structure: Toward the Codification of Theory and Research*, Free Press, New York.

Mikkelsen, H. and Riis, J.O. (2005) *Grundbog I Projektledelse*, 10th ed., Prodevo, Rungsted, Denmark.

OECD (2005) *Oslo Manual – Guidelines for Collecting and Interpreting Innovation Data*, 3rd ed., European Commission and OECD Publishing.

Olsen, P.B. and Pedersen, K. (2006) *Problem-Oriented Project Work – A Workbook*, Roskilde University Press, Roskilde, Denmark.

Osborn, A. (1963) *Applied Imagination*, Scribner Publishers, New York.

Osborn, A.F. (1953) *Applied Imagination*, Oxford, England.

Prahalad, C.K. and Hamel, G. (1990) 'The core competence of the corporation', *Harvard Business Review*, May–June, pp.79–90.

Puccio, G.J. and Cabra, J.F. (2010) 'Organizational creativity – a systems approach', in Kaufmann, J.C. and Sternberg, R.J. (Eds.): *The Cambridge Handbook of Creativity*, Cambridge University Press, New York.

Runco, M.A. and Albert, R.S. (2010) 'Creativity research – a historical review', in Kaufmann, J.C. and Sternberg, R.J. (Eds.): *The Cambridge Handbook of Creativity*, Cambridge University Press, New York.

Scharmer, H.O. (2009) *Theory U: Leading from the Future as it Emerges*, Barrett-Koehler Publishers, San Francisco.

Tidd, J. and Bessant, J. (2009) *Managing Innovation – Integrating Technological, Market and Organizational Change*, John Wiley and Sons, Inc., West Sussex, England.

Treffinger, D.J. et al. (2006) *Creative Problem Solving: An Introduction*, 4th ed., Prufrock Press Inc., Austin, Texas.

Wallas, G. (1926) *The Art of Thought*, CAPE – London.

Winnicott, D.W. (1999) *Playing and Reality*, Tavistock/Routledge Publishers (First published in 1971), New York.

Second paper

Brix, J. (in press) Improving individual knowledge construction and reconstruction in the context of radical innovation, *International Journal of Innovation and Learning***, Vol.xx No.yy**

Improving individual knowledge construction and re-construction in the context of radical innovation

Jacob Brix

Aarhus University, Business and Social Sciences,
Fuglesangs Allé 4, DK-8210 Aarhus V, Denmark
E-mail: jabk@asb.dk

Abstract: This study presents implications imperative to the industry on increasing the success of working with innovation in practice. As a compliment to this, knowledge is claimed to the under-represented individual level of aggregation in the innovation management literature, where a bold setup for claiming knowledge via action research is presented.

Keywords: radical innovation; individual learning; action research; creative idea solution framework; theory-building and testing; multiple-case study.

Biographical notes: Jacob Brix is an industrial PhD student at the Department of Business Communication at Aarhus University, Business and Social Sciences in Denmark and he is employed at the Danish Technological Institute – Centre for Technology Partnership. He holds a Master of Arts in International Business Communication and Corporate Communication.

1 Introduction

There is a myriad of papers published in the context of working with innovation in organisations. Consequently, the vocabulary regarding innovation constantly increases as research becomes more specific and as practitioners learn more from their practical experiences, cf. Kuhn's (1962) perspective on the development of 'normal science'. Since innovation studies have existed for somewhat a century, where the macro level focus has been directed at 'national innovation systems' (Lundvall, 2007) and 'triple helix systems' (Leydesdorff and Etzkowitz, 1998), and where scholars and practitioners have explored, described and explained the organisational level of managing innovation and the importance of continuously working with innovation (i.e., Tidd and Bessant, 2009; Trott, 2012; Kanchana et al., 2011; Pastuszak et al., 2012), research is slowly moving to the individual level of exploring and analysing innovation (i.e., Krot and Lewicka, 2011; Raqshin and Nirjar, 2012). It is not to state that the individual level of innovation goes unnoticed in research, i.e., Cohen and Levinthal (1990), Kim (1993) and Billet (2002) stress the importance of focusing on the individual person in the organisation in the innovation process. Moreover, Crossan et al. (1999) and Lehesvirta

(2004) stress the importance of the interrelatedness of the individual, the group/team and the organisation in which the individual work when innovating.

Based on the current state of innovation research, the purpose of this study is to claim knowledge to the under-represented individual level of aggregation (cf. Crossan and Apaydin, 2010), where focus is on the individual person as a learner who is constantly in the process of constructing and reconstructing his/her personal knowledge (cf. Kastberg et al., 2007; Brix and Lauridsen, 2012) when creating ideas, developing them and generating the final business models. As a compliment to the individual focus, the study will claim knowledge regarding explorative action research (Schein, 2008) in the context of radical innovation (developed further below). Based on the study's purpose, three goals are presented:

The first goal is to explore and provide a practical understanding of *how the individual participant in a radical innovation project constructs and reconstructs his/her personal knowledge*. To direct focus during data collection a working definition of knowledge construction and reconstruction is established based on the literature, and four general phenomena deriving from data collection are constructed into working concepts describing characteristic situations in radical innovation practices.

The second goal is theory-building, where a working hypothesis is crafted based on the four concepts. Thus, the working concepts are explained by the literature and they are accordingly reconstructed into a working hypothesis which is coined the individual knowledge construction (IKC) framework.

The third goal is theory testing. The purpose of this goal is to test and evaluate how the IKC framework is received in real life practice, as being part of the author's intervention in the context of the action research methodology (Schein, 2008). The results from the study will present implications to improve personal knowledge construction and reconstruction in the context of radical innovation and it will direct future research. Before presenting the research context and the empirical evidence, the concepts of knowledge construction and reconstruction are elaborated upon and the term radical innovation is clarified.

1.1 Clarifying the applied concepts

1.1.1 IKC and reconstruction

Cohen and Levinthal (1990) were some of the first scholars to emphasise on the importance of the individual person in the context of innovation, where they, at the time, proposed the bold statement that knowledge was not a commodity as, i.e., a product, but rather it was to be considered as something individual belonging to the individual person in the organisation. Similarly other scholars pointed out the importance of the individuals in the organisational development and learning literature, where Argyris and Schön (1974) stated that it is the individuals who learn and it is the individuals who together make the development in organisations on the behalf of the organisation. What happened in the developing stages of focusing on the individual person as a learner in innovation and development studies was a paradigm-shift (Kuhn, 1962) from a cognitive paradigm of information processing, where the human mind is viewed as a computer cf. Merrill (1994) and Reigeluth (1979), towards the paradigm of constructivism, which is highly influenced by Piaget (1972), who focused on knowledge construction, and Dewey (1997)

who focused, i.e., on learning from reflective practice, and not only as something happening on the school bench (also cf. Moon, 2004; Schön, 2009).

Contemporary learning theorists, i.e., Illeris (2007), Elkjaer (2005), Lauridsen (2012) and Briggs and Tang (2011) focus on how the individual constructs and reconstructs his/her personal knowledge in a professional setting. According to these scholars, the individual learner is responsible to work actively with information to relate the information to the existing and prior knowledge to become more knowledgeable. As a compliment to this, Illeris (2007) further develops Piaget's theory construction, where he presents the concept of 'cumulative learning', as part of the assimilative learning process, and 'transformational learning' as something moving beyond the accommodative learning processes (cf. Illeris, 2007). Illeris (2007) states that cumulative learning occurs when the individual cannot link the information to his/her prior knowledge and that the cumulative process often is described by two types of activities, either 'mechanical learning', being learning by heart, or 'mnemonic learning', which is learning by linking the information to something already known (foundation of assimilation). The result of cumulative learning is according to Illeris (2007) that the individual will be able to remember and recall the cumulative learned elements. A critique to Illeris's cumulative learning is claimed by Lauridsen (2012), who states that cumulative learning is not a learning process; rather, it is a process of gathering death capital, which is non-usable, but which can serve as relevant information for later knowledge construction. Hence, it is argued that individual learning is not about the acquisition of information as a cumulative process, but it is about reflecting and structuring information via the existing knowledge and the active usage of the information which initiates the assimilative and/or accommodative learning processes at the individual level (Briggs and Tang, 2011; Lauridsen, 2012). Transformational learning is according to Illeris (2007) when the individual experiences the change of taken-for-granted frames of reference, i.e., meaning perspectives, mind-sets and habits (also cf. Mezirow, 2000). Based on these contemporary theory developments, IKC and reconstruction (learning) in this study is defined as:

> An iterative process of relating new information to existing knowledge with the goal of creating a conceptual change in the individual understanding by constructing new knowledge and/or by restructuring the existing knowledge.

The definition demonstrates that the outcomes of IKC and reconstruction are not static or linear entities; therefore the knowledge which the individual person has is continuously subject to potential change as the learner becomes more knowledgeable (also cf. Briggs and Tang, 2011; Illeris, 2007; Lauridsen, 2012). Thus, the transformation from public accessible information to personal knowledge construction can, i.e., be done by an individual who actively makes a comparison, who evaluates consequences, etc. In short, knowledge is first constructed when it has been through an individual thought process of reflection where it is put into a context the individual learner can recognise and relate to. This implies that knowledge cannot be shared by email or one-way communication, only information can be shared, because of the supposition that knowledge is constructed by the 'active individual' who reflects upon and constructs a connection with the new information to his/her existing knowledge (also cf. Brix and Lauridsen, 2012). In relation to the data collection made for this study, the definition and the supporting arguments direct focus for the author's action research at the units of analysis, which according to

Schein (2008) is imperative in theory building research. To move forward in the clarification of the applied concepts, the notion of radical innovation is discussed below.

1.1.2 Radical innovation

It is claimed that radical innovation remains a field of research which is still in its embryonic state. The evidence for this supposition is based on Leifer et al.'s (2000) argument that innovation research is biased towards incremental innovation, and it is strengthened by referring to Crossan and Apaydin's (2010) important literature review which concludes that a vast amount of research conducted in the context of innovation is juxtaposed directly towards simultaneous exploration and exploitation (March, 1990; Levinthal and March, 1993), where focus according to Crossan and Apaydin (2010) should be only on exploration in the context of, i.e., radical innovation.

Additionally, there is an increase in scholars arguing that radical innovation should be treated as a 'function' in organisations as well as marketing, accounting, etc. (O'Connor et al., 2008; Brix and Jakobsen, in press), because of rapid and disruptive changes in the nature of organisations, for example regarding technological changes, increase of complexity and changes in legislation (Huber, 2011); elements which makes innovation itself a moving target.

However, concepts such as radical innovation, discontinuous innovation, breakthrough innovation and transformative innovation, to name a few, are used and misused without more specific consideration in both research and practice (cf. Christensen, 1997; O'Connor et al., 2008; Leifer et al., 2000; Christensen and Raynor, 2003) – a usage which diminishes the true value of the innovation concept and a misuse which makes it difficult to integrate research findings into the development of radical innovation as a normal science with its own discourse, etc. (Kuhn, 1962). Thus, since there is increasing agreement of the importance of the long-term orientation on innovation activities, such as radical innovation, the concept radical innovation is clarified for this study to facilitate the understanding and to facilitate the comparison with the increasing body of literature.

To distinct some of the applied concepts presented above, Brix and Jakobsen (in press) argue that a 'breakthrough' emerges in the context of idea generation and idea development when pursuing potential radical innovation outcomes. Radical innovation in this study is defined as a 'paradigm stretching' activity (Brix and Jakobsen, in press) where the foundation for a product, process, business model, etc., is rethought leading to a significant positive change, for example resulting in: 'new performance features' and 'reduction of costs greater than 30%' (Leifer et al., 2000), and/or a whole new line of business to the company (O'Connor and McDermott, 2004). In short, radical innovation is regarded as 'real' innovation, and not just organisational development. Discontinuous/transformational innovations are asserted to be characterised by new-to-the-world offerings and/or they change the market cf. Schumpeter's (1943 [2010]) creative destruction, where new products/services make existing offerings redundant. Having clarified the concepts, the next section presents the research process and its context.

2   The research process and its context

The empirical evidence was collected by the author via action research in real life projects aiming at radical innovation outcomes. Thus, the collected data do not represent a business school setup designed by the author. The empirical evidence is thus based on the author's in-depth personal insights, observations, field notes, recordings and interviews made at the case companies. The context of the study followed Brix and Jakobsen's (in press) 'creative idea solution framework' in practice at five SMEs in Lithuania, where external innovation experts facilitated and consulted the participants in the progress in the first two phases of the CIS framework. Using the CIS framework provides the study with a normative context, which is imperative in a multiple-case study research (Yin, 2009; Eisenhardt, 1991; Eisenhardt and Graebner, 2007).

The applied action research methodology was Schein's (2008) 'educational intervention and facilitation', where the researcher is 'licensed to observe what is going on but not licensed to influence the situation beyond what the client has contracted for' (Schein, 2008). In the concrete case studies (presented below) the author was licensed to intervene regarding the learning perspective of the concrete practice in which the organisational team members were participating, cf. the defined focus above. The data collection was done by following the two primary phases in the CIS framework, being the 'focus phase' and the 'preject phase', where the organisational members initiated a radical innovation process starting with questioning their existing knowledge and assumptions regarding the subject/direction of the defined project, towards generating and developing ideas and finally creating business models on these ideas (Brix and Jakobsen, in press).

The delimitation of the research approach and the research context is thus that the author will not gain empirical evidence which represents the success or failure of the CIS projects in practice. However, since the focus of the study is on the process of knowledge construction and reconstruction, the final pecuniary result of the radical innovation projects will be of less relevance to inform the study and its goals. Additionally, the study treats the individual level of knowledge construction and reconstruction and it does not treat the group/team or organisational level of analysis. It is thus important to notice that the findings in this paper are specific to the individual process of learning, and it is hence not to be related directly to group/team or organisational levels of aggregation in research without noticing this delimitation.

3   Exploring the real life application of the CIS framework

The units of analysis in this study are constituted by 17 individuals from five different Lithuanian SMEs who completed the first two phases of the CIS framework (Brix and Jakobsen, in press) in the period from April 2011 to November 2011. Inspired by Leifer et al. (2000), Table 1 demonstrates a short overview of the five case companies, the industries they are connected with and the focus of their radical innovation projects. [Due to confidential reasons the company names have been changed and the focuses of the CIS projects are more superficial than the ones utilised in practice].

Table 1 Overview of the case companies and their radical innovation focus

Company	Industry	CIS focus
LT-a	Service industry – B2B	ICT-based social platform for open innovation
LT-b	Service industry – B2B	Membership-based workshop facility [physical] that provides members with access to tools and equipment
LT-c	Service and direct sale industry – B2B and B2C	Web-based wellness platform
LT-d	Service and production industry – B2B	Robot 'skyscraper window cleaner'
LT-e	Service and information technology industry – B2B	Data processing application for small and medium-sized enterprises based on language technologies and semantic tools

Source: Author's elaboration, inspired by Leifer et al. (2000)

The case companies were all different and they did not have any conflicting interest in the process of working with radical innovation. All SMEs operate in one or more sectors/industries, but the service sector is represented by all SMEs. This adds an extra normative element to the study because the focus of all the initiated CIS projects were directed at radical innovation project in the context of developing new business models regarding services.

Based on the fieldwork, four general phenomena were identified associated with the participants' knowledge construction and reconstruction. These phenomena represent 'situational knowledge outcomes' which describe situations which the individual participants were frequently observed to experience during the action research. The operational method utilised for identifying the phenomena and developing the working concepts in this study was based on three steps: First, something relevant to personal knowledge construction and reconstruction was observed during the action research. Second, the relevant observation was described, and third, the author's interpretation of the observation was clarified. By addressing these steps when presenting the phenomena and constructing the working concepts, it is supposed that the evidence will be presented in a transparent manner, which will enhance the replicability of the study in future research, which cf. Schein (2008) and Eisenhardt and Graebner (2007) is imperative in strengthening the outcomes of explorative research.

3.1 Creating transparency of the working concepts

The explorative action research resulted in the four working concepts, which shed light on the first goal of the study. The working concepts are 'non-relational', 'assumptions', 'connection' and 'movement'. The creation of the working concepts is explained by addressing the three steps described in the operational method above.

Non-relational represents empirical evidence where the individuals could not relate to the ideas which the colleague/team-member presented. Thus, it represents situations where there was a missing linkage between the information which was presented to the individual, i.e., during a conversation/discussion, and the individual's personal understanding. In short, the individual could not understand his/her peer. The 'non-relational' aspect of the author's observation is argued to be important, because it demonstrates that one cannot take for granted that everyone will understand what is

communicated in the context of a radical innovation project; and therefore this aspect of the observation is regarded as important to the study.

Assumptions represent situations where the individuals could not explain the reason for their personal opinion in the context of a discussion, and it represents situations where the individuals stated that they knew, i.e., a concept, but they could not explain the meaning behind the concept or use the concept appropriately in practice. This lack of explanation and lack of knowledge is argued to represent that the individuals could not explain themselves in a satisfactory manner to their peers during the idea development process. This experience is regarded as the individuals assumed that they knew what they knew, without doing so. Therefore, the working concept 'assumptions' is regarded as relevant observation to the study.

Connection indicates situations where there is an understanding and where the individual can relate to the information presented by the peer. However, it was observed that the individual needed additional information to understand completely, what the peer was trying to communicate. This theme is argued to be important, because it represents a typical situation, where the individuals had to 'tune in' with one another to create understanding, i.e., regarding the usage of a specific professional discourse, or in the context of what the presented information concerned, i.e., a product idea, process idea, etc. Because this situation was observed frequently, it is stressed to be important in the context of radical innovation projects.

Movement is a situation where the individual rapidly understands and relates to the presented information and where there is a prompt response to the peer. The situation which describes movement is observed to be twofold. First, situations where the individuals are treating already known elements, i.e., in situations of discussing existing products and complementing elements (discussions regarding incremental innovation), and secondly, when an individual experiences a breakthrough (cf. the comment above), which opens for many new perspectives, where different ideas rapidly are communicated by the individual. Thus, 'movement' is argued to be an important part of the empirical evidence, because it is the source of many new insights, and it is therefore stressed to be an important element in the context of exploring radical innovation.

The four working concepts were present and observed in all the case studies, and the working concepts represent situations which all the participating individuals experienced regarding their situational knowledge outcome, cf. the author's observations in the field. Based on the observations, the literature concerning individual learning is reviewed to construct a working hypothesis, which can assist in explaining the working concepts.

4   Relating the working concepts to the literature

Generally, the existence of different levels of individual knowledge is highly represented in the observed context of radical innovation, i.e., by addressing the description of the presented working concepts, it becomes evident that the participating individuals experience situations of not understanding (non-relational), knowing something (assumptions and connection), towards understanding completely (movement), and they experience a continuous process of not knowing, knowing something, and being highly knowledgeable when they are working with the radical innovation processes.

To explain the observed working concepts via the existing literature, the 'structure of the observed learning outcome (SOLO) taxonomy' developed by Briggs and Tang (2011)

is utilised. The argument for selecting the SOLO taxonomy, and not, i.e., Bloom's taxonomy (Bloom et al., 1956) is based on following criteria: first, the SOLO taxonomy is based on a constructivist orientation, where the steps in the taxonomy are constructed upon each other; second, the taxonomy is created to evaluate learning outcomes at the adult individual level [at an university student level]; and third, it describes the achievable actions which an individual can complete with his/her existing personal knowledge (Briggs and Tang, 2011). Henceforth, it is claimed that the taxonomy is appropriate to apply in informing the working concepts, because there is a fit both theoretically, via the constructivist perspective, and practically because of the explanatory concepts. In short, the taxonomy is argued to be relevant when analysing the working concepts.

Figure 1 The SOLO taxonomy
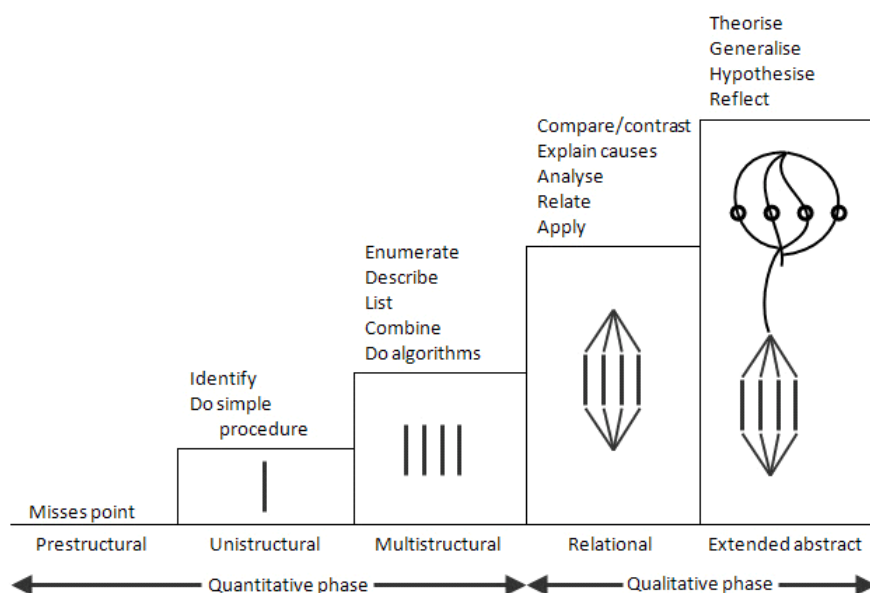
Source: Briggs and Tang (2011)

Table 2 Explaining the individual capabilities in the SOLO taxonomy (achievable actions)

Extended abstract	Theorise, hypothesise, generalise, reflect, generate, create, compose, invent, originate, prove/solve from first principles, make an original case…
Relational	Apply, integrate, analyse, explain, predict, conclude, summarise, review, argue, transfer, make a plan, characterise, compare, contrast, differentiate, organise, debate, construct, paraphrase, translate, solve a problem…
Multistructural	Classify, describe, list, report, discuss, illustrate, select, narrate, compute, outline, separate…
Unistructural	Memorise, identify, recognise, count, define, draw, find, label, match, name, quote, recall, recite, order, tell, write, imitate…
Prestructural	Missing the point, no knowledge is constructed...

Source: Inspired by Briggs and Tang (2011)

The SOLO taxonomy describes that the more knowledge the learner constructs, the more elaborated tasks s/he will able to complete with the knowledge in practice, cf. the listed verbs presented in the model (Briggs and Tang, 2011), see also Table 2 for an extended list of verbs/achievable actions.

The left column of Table 2 demonstrates the level of knowledge, and the right column demonstrates the capabilities/achievable actions of the learning individual. In short, as the learning individual becomes more knowledgeable, the higher cognitive tasks s/he will be able to accomplish.

Moving from the left to the right in the SOLO taxonomy (Figure 1), the individual becomes more and more skilled and s/he will construct a higher level of knowledge in the process (cf. Briggs and Tang, 2011). Hence, when the individual is able to assimilate and/or accommodate new information into the constructed knowledge from the unistructural phase towards the extended abstract phase, then the individual will move from not having a clear understanding towards being an expert who can theorise and create new abstract and original results as an outcome of working with the knowledge. It is supposed that the definition of knowledge construction and reconstruction used in this study corresponds the development of the individual's capabilities in the SOLO taxonomy, which generates a complementary fit to the argument of utilising it to analyse the working concepts. The implication for this supposition is that the individual learner has different levels of knowledge and that the person also contains of death capital of cumulated information which s/he cannot apply correctly because the person cannot relate the information to the existing knowledge because of a missing linkage (also argued by Lauridsen, 2012).

4.1   Explaining the working concepts via the SOLO taxonomy

The 'prestructural' phase in the left side of the taxonomy demonstrates that the individual misses the point, where there is no knowledge construction and thus no learning. In the prestructural phase the individual is able to cumulate data and information – elements which the individual does not understand to put correctly into context. In the prestructural phase, Lauridsen (2012) argue that the individual is working with 'death capital', which might or might not be of future value to the individual (ibid.). It is supposed that the prestructural phase of the SOLO taxonomy is equivalent to the description of the observed situations in the 'non-relational' working concept founded in the action research, where there is no understanding or where the individual cannot relate to the information which is presented. Based on this comparison, it is argued that the 'non-relational' concept is not part of individual knowledge; rather, it is part of the cumulative information which possibly can be utilised and relevant in a later situation (cf. Lauridsen, 2012).

When an individual starts to, i.e., recognise and identify different elements and when s/he can relate these elements into a context, s/he can start to learn by assimilating and accommodating new information into his/her personal knowledge, first in the 'unistructural' phase and then the 'multistructural' phase as the person becomes more knowledgeable (Briggs and Tang, 2011). Here Briggs and Tang (2011) argue that the individual learner is constructing 'surface learning'. Hence, the uni- and multistructural phases represent the primary phases of knowledge construction where an individual is starting to learn, where the individual, i.e., is capable of identifying, recalling and describing his/her personal knowledge (i.e., cf. Illeris, 2007; Lauridsen, 2012). It is

argued that the description of the uni- and multistructural phases describe the working concept of 'assumptions', where the individuals think they know, what they know. Moreover, in the context of 'assumptions', the findings by Rozenblit and Kiel (2002) can assist in explaining this type of situation. Rozenblit and Kiel (2002) argue that many professionals work on the basis of illusions, where overconfidence regarding certain subjects leads to decision making on the basis of unrightfully evidence and/or assumptions of incomplete everyday theories. In short, the observed situations in which the participating individuals experienced that they based their arguments on assumptions/illusions, can be explained by the uni- and multistructural phases in the SOLO taxonomy, because the individuals are capable of, i.e., recognising, describing and discussing (cf. Table 2) certain elements, but they cannot explain why or compare the element with similar contexts. Hence, the 'assumptions' working concepts represent situations, where the individual practitioners according to the literature are not knowledgeable enough to evaluate or decide next step in the radical innovation process, because they accordingly will be deciding based on assumptions and illusions and thus not insight regarding real life situations and facts.

The relational level of knowledge represents situations where the individual is capable of explaining and integrating his/her knowledge, where the individual can argue in a constructive manner during a dialogue and a discussion, where the individual is able to paraphrase his/her personal knowledge (Briggs and Tang, 2011). These actions describe the observed situations in the working concept of 'connection', where the individuals understand one another, where the individual needs to, i.e., 'tune in' to understand the real meaning of the presented information cf. the working concept description. In the situation where the individual can relate to others, s/he is knowledgeable of the theme which is discussed. Hence in this kind of situation the individual should be capable of evaluating and selecting information which is relevant in the context of, i.e., developing ideas and generating business models.

The last part of the SOLO taxonomy describes the 'extended abstract' level of knowledge, where the individual can synthesise the existing knowledge in a novel manner, i.e., cf. Table 2, where the individual can theorise, create, invent and make an original case out of his/her existing knowledge and based on newly presented information. It is argued that this level of knowledge represents the working concept of 'movement', where there is an experienced rapid understanding and where new combinations (breakthrough) are created, because the individual is not restricted by the individual state of knowledge to forecast original propositions (i.e., cf. Briggs and Tang, 2011) and cf. Illeris (2007) and Lauridsen's (2012) transformational learning definition. In sum, it is stressed that the SOLO taxonomy assists in explaining why the individual in the context of radical innovation experienced situations which led to the working concepts. Moreover, the taxonomy is applicable in explaining the reason for the emergence of the different working concepts, because of the description of the different levels of individual learning when constructing and reconstructing personal knowledge. Moreover, it is stressed that the focus on illusions is imperative in any innovation context, where the individual possible is basing his/her attitudes, etc., on unrightfully assumptions.

However, it is argued that there is a shortcoming in the SOLO taxonomy, when applied to explain the working concepts, because the taxonomy focuses only on the level of knowledge and the task the individual is capable of performing according to the personal knowledge, being theoretical (declarative) or practical (functional) (Briggs and

Tang, 2011). Thus, it is claimed that the SOLO taxonomy, as an analytical tool to analyse and explain empirical evidence from radical innovation does not generate fulfilling results and implications for this study, because it is too narrow in its range of explanation. Henceforth, to reduce the claimed shortcoming, the concept of knowledge typologies is introduced to explain an imperative aspect of personal knowledge construction and reconstruction, an addition more specific than Briggs and Tang's (2011) distinction between declarative and functional knowledge. Based on this argument, the 'IKC' framework is constructed, where knowledge typologies are integrated as a working hypothesis into the SOLO taxonomy.

4.2   Building theory – the IKC framework

Because the individual learner becomes more knowledgeable as s/he works actively with different types of information in radical innovation practice, cf. the SOLO taxonomy and the presented definition, it also implies that the individuals work continuously with different types of knowledge. The knowledge typologies applied in the IKC framework were originally created by Aristotle in the Nichomenian ethics and the same typologies were recently suggested by scholars Scharmer (2009) and Nonaka and Takeuchi (2011) because they facilitate the structuring and analysis of the knowledge in a systematic manner. It is however stressed that the typologies are acknowledged as fuzzy sets because they are intertwined in reality. The five knowledge typologies are as follows:

- *factual knowledge:* knowledge about facts (episteme)

- *process knowledge:* knowledge about how to reach a certain goal (techne)

- *practical knowledge:* knowledge about how things work when used (phronesis)

- *theoretical knowledge:* knowledge about how things act in theory (sophia)

- *tacit knowledge:* knowledge which cannot be described nor explained (nous).

Based on the descriptions of the different knowledge typologies above, the author presents the IKC framework as a working hypothesis (see Figure 2). The IKC framework integrates both knowledge typologies and knowledge taxonomies, which the author puts into supposition, can assist in bettering the understanding and the practical processing of radical innovation processes at an individual level.

Figure 2   IKC framework (see online version for colours)

The IKC framework is created to exemplify a more direct picture of the type of and the usability of the learning outcomes the individual has when working with personal knowledge construction and reconstruction in radical innovation practice. Moreover, it is the author's supposition that the IKC framework can assist practitioners in directing focus at important inquiries where new insights and information is needed to inspire the individual learning in constructing and/or reconstructing the personal knowledge to become more knowledgeable and thus move up the latter step by step towards the relational or the extended abstract levels of knowledge. The purpose of the IKC framework is to indicate a picture of the type of knowledge and the level of knowledge which is constructed by the individual in a particular situation. It is stressed, delimitation wise, that nothing is black and white in reality and that the cells in Figure 2 are (can be) intertwined; i.e., theoretical knowledge requires some sort of factual knowledge, etc.

4.3   Delimitation and suggested application

Because there is no knowledge constructed and thus no learning in the prestructural phase of the SOLO taxonomy (dead capital), it is not part of the IKC framework. As a compliment to this, because tacit knowledge cannot be described or explained (Polanyi, 1958; Drejer, 2000), it is likewise removed from the framework. It is henceforth stressed that the IKC framework represents a working hypothesis and it is stressed that it will serve as a tool in the context of, i.e., working in the context of radical innovation, because it assists in directing attention at knowledge about facts, processes, practical outcomes and theoretical suppositions, and the individual level of knowledge in these perspectives. The framework can thus be used to discover the individual persons 'illusions' (Rozenblit and Kiel, 2002) based on the level of knowledge in the left side of the framework, and it can be used to focus on the knowledge the individual person has regarding the different types on knowledge which is relevant according to the work situation in which the individual person needs to evaluate the personal knowledge. It is thus to be utilised as an auxiliary construction in radical innovation practice to explain situations of knowledge gaps, and where to direct focus to overcome these gaps, one step at the time when moving up the latter of the taxonomy. In short, the purpose in not to fill out the IKC framework with all the knowledge one have; it would not be possible. In the next section, the IKC framework is tested as part of the author's intervention at the case companies.

5   Testing the IKC framework in practice

As part of reaching the third goal of the study, the IKC framework was presented to the individuals in the five case companies, who were asked to comment and relate the IKC framework to their experiences concerning the work with radical innovation. The author's intervention at the case companies was completed as a seminar, where the author presented the IKC framework to the individuals who participated in the CIS projects, in order for them to discuss, reflect upon and comment the IKC framework as an auxiliary tool. Having stressed the operational usage of the IKC framework, all participants were asked to reflect upon the IKC framework and its application in relation to their experienced practice and then comment upon it at the seminar.

Generally, the IKC framework was well received and the participants demonstrated positive orientation towards it. For instance it was stated that the contextual thinking of

one's own knowledge was an interesting perspective which generated a lively discussion about the work with radical innovation in practice. The individuals stated that they were highly focused on the progression of their innovation projects and not their own personal knowledge while using this knowledge to develop their innovation projects in practice. This was experienced as an important paradox amongst the individuals, because the discussion about the ICK framework made them realise that they could have postponed judgement in certain situations during their projects, because they retrospectively had made decisions on illusions – an insight which they argued could have diminished the full potential of their projects. This finding supports Kerzner's (2009) project manager's dilemma of decision making.

Additionally, the participants stated that the practical work with idea generating and development was a constant process of being either confused or focused. They stated that the framework could assist them in understanding this confusion and that it could direct attention at the type and level of knowledge they experienced a lack of, when being confused. One person presented the example of a situation in his team, where he could not understand why it was not possible to combine two specific software-systems and operate them. When his team mate presented the underlying facts and arguments for his 'it is impossible' attitude, he failed to convince the person, who continued to be confused. They stated that this confusion could have been avoided by consulting the IKC framework, because then he would realise that the team mate was not knowledgeable enough to stand by his claims. As a compliment to this, other participants presented similar situations and conclusions regarding the usage of the IKC framework as a self-reflexive 'state-of-my-concrete-knowledge' to avoid illusionary arguments and decision making, and to avoid taking for granted that their first 'brilliant thought' should be the one to follow in order to search for the full potential of the innovation project. This feedback strengthens supposition that the IKC framework can assist in improving the operational level of working with individual knowledge in the context of radical innovation, because situational self-awareness in the context of personal knowledge is important to avoid the pitfall of working on illusions when developing radical innovation projects. This finding complements Rozenblit and Kiel's (2002) research.

Another perspective was presented at the intervention, where the utilisation of the IKC framework as a tool to seek for specific information was proposed as a possible benefit. In example, a person stressed that the framework could provide her with a focused direction, because she had experienced the radical innovation process as a constant questioning of: 'what do I know?', 'what do I not know?', 'what did I forget I knew?', and when she experienced a breakthrough in the process she added 'what did I not know that I did not know' [questions which are also imperative in the context of individual learning, cf. Kastberg et al. (2007)]. According to the participant, the IKC framework could assist her in exploring and searching for knowledge in a systematic manner if she was to contact external partners/consultants, because she would be able to specify what type(s) of knowledge she needed, i.e., practical, process and factual knowledge, and she would be able to explain what she was capable of according to her existing knowledge. This perception was moreover complemented by the other participants during the intervention.

The feedback given by the participants at the intervention strengthens the supposition that the IKC framework can assist in bettering the operational level of working with individual knowledge in the context of radical innovation, because it is easier to search for concrete insight/information as the description of the needed information becomes

more specific, and because the individuals stated that the IKC framework would help them in bettering the operational process when developing the projects based on their personal knowledge and the illusions haunting them when doing so. In the following the constructive criticism presented by the participants is presented and afterwards the implications of the study are demonstrated.

5.1 Constructive criticism

Even though the participants gave the framework positive feedback, they also stated that it needed to be strengthened and elaborated upon to reach a more applicable level of practical value. Below three general shortcomings are presented, which need to be developed further:

- When is one knowledgeable enough in order to proceed in the radical innovation process?

- How can a person evaluate if the 'achievable actions' are actually achieved by the person?

- When a breakthrough is created by recognising elements which the individual does not know that s/he does not know, how would this be related to the IKC framework?

6 Implications

6.1 Industrial implications

Because the study presented the existence of the usage of assumptions and not knowledge about facts to create and develop ideas in practice, it is stressed that the management of organisations and project managers working with innovation should question their taken-for-granted knowledge and evaluate not only their practical experiences, but also *how recent their experiences are*, when they base new arguments on these. This must be done by collaborating with and/or consulting experts, either from the organisation or external to the organisation, to base the innovative strivings on facts and not assumptions. In short, the work with innovation may not live up to its full potential if the project and its ideas are based on wrong facts or outdated experiences, i.e., in the context of what is possible and not possible regarding technology and software in general. Since the IKC framework is experienced as a beneficiary tool to apply in practice to question and remove these assumptions, it is stressed that more research on the operational level of radical innovation is needed, because it enhances the practitioners work with innovation, which can lead to an increase in pecuniary and learning outcomes – a need which is urgent in the current state of the global economy, where innovation is predicted to be the key enabler to financial growth.

6.2 Academic implications

The study claims knowledge to the under-researched individual level of aggregation in innovation studies (Crossan and Apaydin, 2010), where constructivist learning theory is utilised to explain common situations in radical innovation practices; in this study in the

context of the CIS framework developed by Brix and Jacobsen (in press). As a compliment to this, the construction of the IKC framework as an operational level theory represents a novel contribution to the literature, where focus is not only on explaining, but also on improving practice (cf. Huber, 2011). If researchers are willing to go beyond explaining, and start focusing on implications for improvement, an important step has been made to bridge theory and practice.

The study moreover demonstrates a paper setup for both theory-building and -testing in the context of action research which is a direct contribution to the literature. It is argued that the paper's setup is highly important to action researchers when they present their action research studies because – methodological wise – it is imperative to present the complete picture of the study and henceforth both theory building and testing (the intervention) when pursuing to claim new knowledge via this methodology. This setup is to be refined, and more suggestions for proposals are needed.

7   Conclusions

In this study five Lithuanian SMEs were followed in their strivings for creating radical innovation based on the 'creative idea solution' framework (Brix and Jakobsen, in press) where external innovation experts to the SMEs consulted and facilitated the participants in the process.

As a result, this theory-building and -testing study presents a working hypothesis coined the IKC framework; a framework which has been constructed to understand and improve IKC and reconstruction (learning) in the context of radical innovation projects. The indicated benefits and key findings of utilising the IKC framework as an auxiliary construction in the radical innovation projects represent indications which can reduce Kerzner's (2009) 'project managers dilemma of decision making'. This is argued because the participants stated that the IKC framework could indicate contextual self-awareness regarding their personal knowledge; a finding which can assist in reducing innovation projects in being developed based on the practitioners illusions (Rozenblit and Kiel, 2002) when working with idea generation, development and when creating business model(s) in practice.

As a compliment to this, the participants stated that the IKC framework could be utilised to enhance the process for consulting external experts and when searching databases regarding the need for specific information, because of the self-awareness of the lack of personal knowledge. Finally, it is supposed that the IKC framework can be appropriate to use in other development contexts, where the individual needs self-insight regarding his/her situational level and type of knowledge to make decisions or to search more specifically for external insights and information in the striving becoming more knowledgeable. Being in its embryonic state, the IKC framework needs more elaboration and it needs to take into consideration the presented shortcomings from the study. Therefore, the author calls for further research.

References

Billet, S. (2002) 'Workplace pedagogic practices: co-participation and learning', *British Journal of Educational Studies*, Vol. 50, No. 4, pp.457–481.

Brix, J. and Jakobsen, H.S. (in press) 'Corporate creativity – introducing the creative idea solution© framework', *International Journal of Innovation and Learning*.

Brix, J. and Lauridsen, K.M. (2012) 'Learning styles and organisational development in practice: an exploratory study of how learning styles and individual learning strategies can facilitate organisational development', *International Journal of Innovation and Learning*, Vol. 12, No. 2, pp.181–196.

Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive capacity: a new perspective on innovation and learning', *Administrative Science Quarterly*, Vol. 35, No. 1, pp.128–152.

Crossan, M.M. and Apaydin, M. (2010) 'A multi-dimensional framework of organizational vation: a systematic review of the literature', *Journal of Management Studies*, Vol. 47, No. 6, pp.1154–1191.

Crossan, M.M. et al. (1999) 'An organizational learning framework: from intuition to institution', *Academy of Management Review*, Vol. 24, No. 3, pp.522–537.

Drejer, A. (2000) 'Organisational learning and competence development', *The Learning Organization*, Vol. 7, No. 4, pp.206–220.

Eisenhardt, K.M. (1991) 'Better stories and better constructs: the case for rigor and comparative logic', *Academy of Management Review*, Vol. 16, No. 3, pp.620–627.

Eisenhardt, K.M. and Graebner, M.E. (2007) 'Theory building from cases: opportunities and challenges', *Academy of Management Journal*, Vol. 50, No. 1, pp.25–32.

Kanchana, R. et al. (2011) 'Interrelationships among knowledge management, organizational learning and innovation', *International Journal of Innovation and Learning*, Vol. 9, No. 2, pp.145–162.

Kim, D.A. (1993) 'The link between individual and organizational learning', *Sloan Management Review*, Fall, pp.37–50.

Krot, K. and Lewicka, D. (2011) 'Human side of innovation-individual and organisational environment-related aspects: the case of IBM', *International Journal of Innovation and Learning*, Vol. 9, No. 4, pp.352–371.

Lehesvirta, T. (2004) 'Learning processes in a work organization: from individual to collective and/or vice versa?', *Journal of Workplace Learning*, Vol. 16, Nos. 1–2, pp.92–100.

Levinthal, D.A. and March, J.G. (1993) 'The myopia of learning', *Strategic Management Journal*, Vol. 14, pp.95–112.

Leydesdorff, L. and Etzkowitz, H. (1998) 'The triple helix as a model for innovation studies', *Science and Public Policy*, Vol. 25, No. 3, pp.195–203.

Lundvall, B.A. (2007) 'Innovation system research – where it came from and where it might go', Working paper series, Aalborg University No. 2007-01 ISBN: 978-970-701-963-8.

March, J.G. (1990) 'Exploration and exploitation in organizational learning', *Organizational Science*, Vol. 2, No. 1, pp.71–87.

Nonaka, I. and Takeuchi, H. (2011) 'The wise leader – how CEOs can learn practical wisdom to help them do what's right for their companies and society', *Harvard Business Review*, May, pp.58–67.

O'Connor, G.C. and McDermott, C.M. (2004) 'The human side of radical innovation', *Journal of Engineering and Technology Management*, Vol. 21, pp.11–30.

O'Connor, G.C. et al. (2008) *Grabbing Lightning – Building a Capability for Breakthrough Innovation*, Jossey-Bass, San Francisco.

Pastuszak, Z. et al. (2012) 'Establishing interrelationships among organisational learning, innovation and performance', *International Journal of Innovation and Learning*, Vol. 11, No. 2, pp.200–215.

Polanyi, M. (1958) *Personal Knowledge – Towards a Post-critical Philosophy*, Routledge, USA.

Raqshin, S. and Nirjar, A. (2012) 'Accruing individual potential for creativity and innovation in biotechnology firms', *International Journal of Innovation and Learning*, Vol. 11, No. 2, pp.162–181.

Reigeluth, C.M. (1979) 'In search of a better way to organize instruction: the elaboration theory', *Journal of Instructional Development*, Vol. 2, No. 3, pp.8–15.

Rozenblit, L. and Kiel, F. (2002) 'The misunderstood limits of folk science: an illusion of explanatory depth', *Cognitive Science*, Vol. 26, pp.521–562.

Bibliography

Argyris, C. and Schön, D.A. (1974) *Theory in Practice: Increasing Processional Effectiveness*, Jossey-Bass, Oxford, England.

Bloom, B. et al. (1956) *Taxonomy of Educational Objectives: The Classification of Educational Goals*, McKay, New York.

Briggs, J. and Tang, C. (2011) *Teaching for Quality Learning at University*, 4th ed., Mcgraw-Hill, England.

Christensen, C.M. (1997) *The Innovator's Dilemma – When New Technologies Cause Great Firms to Fail*, HBS Press, Boston.

Christensen, C.M. and Raynor, M.E. (2003) *The Innovator's Solution – Creating and Sustaining Successful Growth*, Harvard Business Review Press, Boston.

Dewey, J. (1997) *How We Think*, 1st ed. (1910), Dover Edition, Dover Publishers, New York.

Elkjaer, B. (2005) *Når læring går på arbejde: et pragmatisk blik på læring i arbejdslivet*, Samfundslitteratur, Denmark.

Huber, G.P. (2011) 'Organizations: theory, design, future', *The APA Handbook of Industrial and Organizational Psychology – Building and Developing the Organization*, Vol. 1, American Psychological Association, Washington, DC.

Illeris, K. (2007) *How We Learn: Learning and Non-learning in School and Beyond*, Routledge, New York.

Kastberg, P. et al. (2007) *Personlig knowledge management – Fra information til viden via læring*, Samfundslitteratur, Denmark.

Kerzner, H. (2009) *Project Management: A Systems Approach to Planning, Scheduling and Controlling*, 10th ed., John Wiley and Sons, Inc., New Jersey.

Kuhn, T. (1962) *The Structure of Scientific Revolutions*, The University of Chicago Press, Chicago.

Lauridsen, O. (2012) *Fokus på læring 3.0*, Akademisk Forlag, Copenhagen.

Leifer, R. et al. (2000) *Radical Innovation – How Mature Companies can Outsmart Upstarts*, Harvard Business School Press, Boston.

Merrill, M.D. (1994) *Instructional Design Theory*, Englewood Cliffs, New Jersey.

Mezirow, J. (2000) 'Learning to think like an adult: core conceptions and transformation', in Mezirow, J. et al. (Eds.): *Learning as Transformation: Critical Perspectives on a Theory in Progress*, Jossey-Bass, San Francisco.

Moon, J.A. (2004) *A Handbook of Reflective and Experiential Learning – Theory and Practice*, Routledge Falmer, New York.

Piaget, J. (1972) *Psychology and Epistemology: Towards a Theory of Knowledge*, Penguin Publishers, Harmondsworth.

Scharmer, O.C. (2009) *Theory U – Leading from the Future as it Emerges*, Berrett Kohler, England.

Schein, E.H. (2008) 'Clinical inquiry/research', in Rearson, P. and Bradbury, H. (2008): *Handbook of Action Research*, SAGE Publications, London.

Schön, D.A. (1983) *The Reflective Practitioner: How Professionals Think in Action*, Basic Books Inc., USA.

Schumpeter, J.A. (1943 [2010]) *Capitalism, Socialism and Democracy*, Routledge Classics, Oxon.

Tidd, J. and Bessant, J. (2009) *Managing Innovation – Integrating Technological, Market and Organizational Change*, John Wiley and Sons, Inc., West Sussex, England.

Trott, J. (2012) *Innovation Management and New Product Development*, 5th ed., Prentice Hall, England.

Yin, R.K. (2009) *Case Study Research – Design and Methods*, 4th ed., Sage Publications, London.

Third paper

Brix, J. and Lauridsen, O. (in press) Improving learning competencies in the context of radical innovation: a team perspective, *International Journal of Innovation and Learning***, Vol.xx No.yy**

See appendix 2 for co-author agreement

Improving learning competencies in the context of radical innovation: a team perspective

Jacob Brix*

Department of Business Communication,
School of Business and Social Sciences,
Aarhus University,
Fuglesangs Allé 29,
DK-8210 Aarhus V, Denmark

E-mail: jabk@asb.dk

*Corresponding author

Ole Lauridsen

Centre for Teaching and Learning,
School of Business and Social Sciences,
Aarhus University,
Fuglesangs Allé 4,
DK-8210 Aarhus V, Denmark

E-mail: ol@asb.dk

Abstract: This study widens the current state-of-the-art for improving teamwork in practice by enhancing personal and interpersonal learning competencies. The foundation for the study is obtained by conducting eight months of action research at five Lithuanian SMEs who followed Brix and Jakobsen's (2013) radical innovation method the 'Creative Idea Solution (CIS) framework'. As part of the authors' intervention, Lauridsen's (2012) updated version of the building excellence (BE) learning styles model (Dunn and Rundle, 2007) was implemented in the five innovation teams. The results represent important implications for organisations and teams in practice as well as they represent new insight to the innovation management literature and organisation science. Here, focus on improving organisational practice is starting to sprout and a scientific contribution is no longer the only imperative (Huber, 2011).

Keywords: radical innovation; learning styles; learning; action research; multiple case study; accelerating team effectiveness; improving innovation practice.

Reference to this paper should be made as follows: Brix, J. and Lauridsen, O. (in press) 'Improving learning competencies in the context of radical innovation: a team perspective', *Int. J. Innovation and Learning*, Vol. X, No. Y, pp.000–000.

Biographical notes: Jacob Brix is an Industrial PhD student at the Department of Business Communication at Aarhus University, School of Business and Social Sciences and he is employed at the Danish Technological Institute's Center for Ideas and Innovation. In 2012–2013, Jacob is Visiting Scholar at the Lally School of Management and Technology at Rensselaer Polytechnic Institute in Troy, New York.

Ole Lauridsen is Associate Professor at the Centre for Teaching and Learning at Aarhus University, School of Business and Social Sciences. The focus of his research is constructivism (learning) and learning styles in a professional setting. In addition, he is member of the Executive Board of the International Learning Styles Network (ILSN).

1   Introduction

The literature on exploring, describing, and explaining the team level of aggregation has exploded in research the last decades. For the most part, the goal of researching teams has been to explain how effectiveness and performance can be increased in practice and scholars have researched multiple perspectives. Woodcock (1979) and Tuckman (1965) made studies regarding development stages of teams, Belbin (1993) described different team roles, and Rietzschel et al. (2009) and Parjanen (2012) described and explain creativity in teams. Furthermore, Kanchana et al. (2011) and Kitazawa and Osada (2012) explain the importance of the team's knowledge management practices in the context of innovation projects. In this context, the importance of the individual person's knowledge in the social context of team learning was pinpointed by Wegner (1987) by introducing 'transactive memory systems' (TMS) to research. Here, intra-team knowledge regarding

'who knows what' was emphasised and explained to match the most qualified person (or group of persons) with a given task – also cf. Brandon and Hollingshead (2004). The TMS theory was recently further developed and rethought by Huber and Lewis (2010) into the concept of 'cross-understanding'. This development includes perspectives regarding intra-team beliefs and assumptions, sensitivity to different issues, and personal preferences, which according to Huber and Lewis (2010) need to be taken into consideration as relevant meta-knowledge to increase team effectiveness. The move from TMS theory towards cross-understanding will be imperative: it explains a more complex picture of the collective climate in which people work in practice because it integrates personal biases to explain the actions and attitudes of team members, productive as well as counter-productive, cf. Huber and Lewis (2010).

1.1   Purpose of the research

Because the literature cf. Argote (1999), Wegner (1987) and Huber and Lewis (2010) is highly developed in the perspective of enhancing effectiveness and productivity of existing teams via the increase of relevant meta knowledge about what team members know and why they act as they do, *the purpose of this paper is to widen these perspectives by delving into how different team members learn and thus how they become more knowledgeable when working with radical innovation in practice.*

This is not to state that the how of team learning is non-existing in the literature. For example, Edmondson (1999) investigated how psychological safety influences learning in teams, and Bresman (2010) studied how external learning activities could improve team learning in practice. Moreover, Gebert et al. (2010) studied how different action strategies could improve team practice in the context of fostering innovation.

Because research on how people learn effectively together in teams is in its embryonic state, scholars still call for further research to comprehend the *how* of team

learning. Thus, deeper understanding is needed to further increase the effectiveness and the quality of the outcome of teamwork, especially in the context of innovation projects where high demands for novel outcomes are needed and sought by creating teams of highly skilled people from different fields of expertise who need to collaborate, cf. Majchrzak et al. (2012).

In line with the purpose, the goal is to present how organisations can improve effectiveness and performance of teamwork in practice by increasing the team members' meta-knowledge regarding personal and collective learning competencies.

To assist in explaining and thus claiming knowledge in relation to the paper's purpose, Lauridsen's (2012) updated version of Rundle and Dunn's *Building Excellence* Learning Styles construct, hereafter BE (Dunn and Rundle, 2007; Rundle, 2010), is introduced as a framework for analysis in which specific results and indications regarding learning competencies to the team level of aggregation are presented.

1.2   Scientific contribution

Because the study seeks to understand, analyse and improve teamwork in practice within the context of creating radical innovation, the scientific contribution is claimed both to the innovation management literature and to organisation science. These literatures are seen as complementary entities since the results and implications can have great importance for managers and researchers when striving to improve the management of innovation in practice, cf. DeRue and Rosso (2012), Huber and Lewis (2010), Baruah and Paulus (2009), and Bresman (2010).

The cross-fertilisation of the literatures from present study is important because the desire for successful innovation and growth is larger than ever before in organisations due to the financial instability still haunting worldwide.

2   Presenting the cases

The study was made together with five Lithuanian SMEs in the period from April 2011 to November 2011. Table 1, inspired by Leifer et al. (2000), gives a brief overview of the five cases, the industries they are connected with, and the focus of their radical innovation projects. Due to confidential reasons the company names have been changed and the focuses of their radical innovation projects are more superficial than the ones utilised in practice.

The case SMEs were all different and did not have any conflicting interest in the process of cooperating with radical innovation. All SMEs operate in one or more sectors/industries, but the service sector is represented by all SMEs. This adds an extra unvarying element to the study because the focus of all the initiated projects were directed at radical innovation project in the context of developing new business models regarding services, cf. Jakobsen and Brix (2012).

Each SME had its own innovation team consisting of three-five persons responsible for creating progress in their projects. The setup was based on 'co-creation' amongst the five SMEs. In the co-creation setup there is a difference between the notion of groups and teams. Teams are referred to as the collection of individuals from each of the SMEs, whereas groups are referred to when individuals from the different SMEs cooperate.

Moreover, the groups were created by people both internal and external to the SMEs, and they were only gathered for up to two hours resulting in a very short group lifetime. In total, the innovation teams were assembled 11 times for meetings, workshops and seminars. When mixing the individuals from the innovation teams into groups during the process, it was done as random selection in order for the members to give each other inputs and insights to the ideas under development and to reduce 'functional fixedness' and 'Einstellung' (Eysenck and Keane, 2007), as well as the team members 'illusions' (Rozenblit and Kiel, 2002; Brix, in press).

Table 1   Overview of the case companies and their radical innovation focus

Company	Industry	RI project focus
LT-a	Service industry – B2B	ICT-based social platform for open innovation
LT-b	Service industry – B2B	Membership-based workshop facility [physical] that provides members with access to tools and equipment
LT-c	Service and direct sale industry – B2B and B2C	Web-based wellness platform
LT-d	Service and production industry – B2B	Robot 'skyscraper window cleaner'
LT-e	Service and information technology industry – B2B	Data processing application for small and medium-sized enterprises based on language technologies and semantic tools

Source: Inspired by Leifer et al. (2000)

3   Explaining the research context

In practice, the five SMEs followed the first two phases in Brix and Jakobsen's (2013) radical innovation model the 'Creative Idea Solution framework', hereafter referred to as CIS. In the first two phases, the SMEs initiate their radical innovation processes: they start by questioning their existing knowledge and assumptions regarding the subject/direction of the defined project, and then they generate and develop new ideas. Finally, they create business models based on these ideas (Jakobsen and Brix, 2012). Using CIS in all cases provides the study with a uniform context, which is imperative in multiple case study research to facilitate repeatability as well as creating transparency (Yin, 2009; Eisenhardt, 1991; Eisenhardt and Graebner, 2007). Four external innovation professionals to the SMEs facilitated the work in the randomly created groups and they advised the innovation teams in the eight-month period.

4   Explaining the method

The empirical evidence was collected as action research in the Lithuanian SMEs during the seminars and the workshops as well as the meetings. Thus, the context and the empirical evidence of the study represent an under-researched perspective, because most studies of teams are effectuated in laboratories and/or business school setups, and not in real life practice (Argote, 1999; Edmondson, 2002; Crossan and Apaydin, 2010). Hence,

the results from this multiple case study are highly needed to extend current state-of-the-art in the innovation management literature and in organisation science. Moreover, the collected evidence represents an ideal and powerful potential to understand the real effect of intervening organisational practices with complex theoretical frameworks (Eden and Huxham, 1996).

The applied action research methodology was Schein's (2008) 'educational intervention and facilitation', according to which the researcher is *licensed to observe what is going on but not licensed to influence the situation beyond what the client has contracted for* (Schein, 2008). In this study, license was given to intervene regarding the improvement of the work in the innovation teams. Operationally, observations, recordings, and personal insights were made the first two months of inquiry (April and May) and then the findings were related to the literature. Afterwards the intervention was planned and effectuated at a joint seminar for the participating individuals in mid-August. After the intervention, new observations were made, and to formally finalise the action research, a debriefing seminar was held after eight months of inquiry; here additional findings to the intervention and to other interventions not relevant to the purpose of this paper were presented and elaborated upon together with the participants resulting in the final data (Schein, 2008). These sources of empirical evidence are used to shed light on the paper's goal: which as above stated, is to present how organisations can improve the effectiveness and performance of teamwork in practice by increasing the team members' meta-knowledge regarding the personal and collective learning competencies.

Two critical parts of teamwork were emphasised as being relevant to the purpose and the goal of the research and thus the data collection. Consequently, to address an area of inquiry which remains unexplored in the literature, the initial data collection concerned questions of:

1   How do the innovation team members interact with one another?

2   How do the innovation team members behave during the meetings, seminars and workshops?

These questions are the base of the action research conducted. Hence, the content of the radical innovation projects *per se* was not in focus; rather the focus was the way in which the team members (and group members) collaborated in real life practice.

The first task of the action research was to observe and explore in order to find phenomena for how the individuals in the innovation teams and in the randomly created groups interacted as well as how they behaved individually. Here, the observed phenomena were described, framed, and analysed. The second task was to realise the intervention based on the analysis, and the third and final task was to evaluate outcomes of the intervention. Completing these three steps during the action research should according to Schein (2008) generate insights and results that can be used to improve organisational practice.

4.1   *Operational method for construction the working concepts*

The operational method utilised for identifying the phenomena and developing the working concepts was based on three steps: first, issues of relevance to the data collection focus (one of the two questions above) were observed; second, the relevant observations were described; and third, the observations were commented upon. By following the

steps when describing the phenomena and constructing the working concepts, the empirical evidence is presented in a transparent manner. This enhances the replicability of the study in future research, which is imperative in strengthening the outcomes of explorative research (Schein, 2008; Eisenhardt and Graebner, 2007; also cf. Eden and Huxham, 1996). However, it must be emphasised that the construction of the working concepts is based on the authors' experiences and interpretations of these observations. This, however, is a natural delimitation in the context of action research (Eden and Huxham, 1996; Schein, 2008).

5   Exploring the real life application of the CIS framework

Multiple phenomena were identified during the action research regarding the questions of how the innovation team members interact and how they individually behave in the CIS projects during teamwork. However, five general phenomena stood out in all five cases and were thus chosen as working concepts according to the operational method described above. These five working concepts are labelled: 'Rapid documenting', 'Fidgety', 'Reticence', 'Laidback attitude', and 'Non-aligned'. Each working concept is illustrated with a short 'case-description'.

1   Rapid documenting describes situations where the individuals write, draw (or take a picture with their cell/smartphone) of something that seems relevant to them during the workshops, meetings and seminars. The participants keep these notes/drawings/photos to themselves and do not make them public. There is no system as to how the individuals made the documentation, but it seems that it needs to be done quickly.

> Case: "Suddenly, out of the blue, one of the participants who has been calm during the first half hour of the idea development seminar grabs a pen and she starts writing and drawing on her paper for a minute – she keeps the pen in her hand and sits straight up, but after one more minute the pen is back on the table and she is once again calm."

This observation and situations alike were frequently observed in all cases. Therefore, this behaviour needs to be looked into, because it is obviously highly relevant in and for the individual learning process.

2   Fidgety represents situations where impatience is observed – especially in the context of seminars and meetings. During the seminars many participants were rocking back on their chair or they were shaking their legs – others were fiddling with their pens, doodling or constantly checking their phones. When attending meetings, some individuals pace the other participants when they seemingly feel things are moving too slow forward.

> Case: "Especially one participant is sending strong signals of impatience; he constantly changes position in his chair and his leg is moving up and down. Another person is pacing the team, she is trying to make progress in the agenda and it seems like she wishes the meeting could move much faster forward."

Undoubtedly, it is of paramount importance to analyse this impatience further to more thoroughly understand the behaviour and the signals the individuals send to one another e.g., during meetings.

3   Reticence is experienced when only a few individuals participate actively in dialogues and discussions during the workshops, often by referring to what has just been said (echoing) and by afterwards presenting a new input. In addition, when somebody who has not contributed via dialogue during the session suddenly starts to speak, it seems that the remaining group listen more carefully compared to when the really active individuals discussed.

> Case: "In the seven person group there are only three people discussing, but all of the participants contribute to the workshop by writing inputs down on the yellow stickers, even though they are not engaging in the dialogue (…) suddenly one of the silent participants starts to speak, and the three vocally active stops talking and starts listening to what she has to say."

This unequal participation needs to be looked into since a large potential possibly can be wasted by having around the half of the group not participating in the dialogue.

4   Laidback attitude has a certain affinity to the above mentioned reticence. This attitude is experienced by observing the body language of the participants when they work on their projects, both during the seminars, in the meetings, and when working in the workshops. Some individuals are relaxed regarding how they place themselves e.g., on the chair. During the progress in the projects this laidback attitude is observed to irritate some of the fellow participants: they roll their eyes, the look away with angry faces, but they do not comment upon it.

> Case: "In the seminar, many of the participants have placed themselves differently in their chairs, however not according to what would be recognized as 'ordinary concentrated posture'. Seven persons are slouching, it seems that four–five are daydreaming and two–three persons situate themselves in more cocky postures with their legs crossed and their arms over their heads holding the neck."

Because of the differently observed postures, both in the meetings and at the seminars, and especially because of the observed irritation, this phenomenon is interesting to analyze further since it removes focus in the process from developing the project and causes irritation instead.

5   Non-aligned represents situations where there is mutual misunderstanding between two or more individuals communicating. Even though the individuals speak the same language and are addressing the same subject, they are seemingly talking in different directions.

> Case: "During the meeting one person is talking about specific technological details regarding the project in focus and he moves the conversation more into detail. Suddenly another person ignores these details and she starts directing the conversation in more general terms regarding marketing and cash flow."

This general move in two different directions is interesting to analyse because it represents an experienced counterproductive element to the development of the idea in focus.

Below, the working concepts are related to the literature to analyse them and to develop an understanding of their implications for teamwork in radical innovation practices.

## 6 Relating the working concepts to the literature

As stated in the introduction, the literature has exploded regarding the team perspective in the organisation science literature, both regarding what people know (TMS theory) and why people act as they do to certain inputs (cross-understanding) (Wegner, 1987; Huber and Lewis, 2010). As a complement to this, Wenger (1998) proposed the theory of 'communities of practice' into research where focus is on learning as social participation regarding negotiating meaning, constructing discourses and fine-tuning amongst the community members, e.g., in an enterprise (Wenger, 1998). These theories have contributed immensely to the understanding of learning in practice and from practice, but their implications and results remain difficult to implement directly into teamwork for they represent fuzzy constructs and they do not offer concrete strategies for implementation.

To create a scientific contribution that both claims knowledge to the academic community via the investigation of a specific variable in the team context (Argote, 1999) and that represents implementable suggestions for improving teamwork in practice, this study taps into Brix and Lauridsen (2012) that integrated Rundle and Dunn's building excellence (BE) learning styles construct (Dunn and Rundle, 2007) to enhance individual learning competencies and to improve group/team collaboration and communication in organisational practice – that is the how of learning. The reason for these improvements, Brix and Lauridsen (2012) argue, emerge not least because the individuals start working (i.e., learning, see below) more strategically with their personal knowledge construction and reconstruction according to their individual learning styles, both when working (learning) alone and when working (learning) together in a team (Brix and Lauridsen, 2012). As a compliment to this, the argument for utilising BE to inform the working concepts derives from Lauridsen's (2012) definition of learning styles which especially treats the learning individual, both when working alone or together with others.

The original definition of learning styles according to Dunn and Dunn is *the way in which individuals begin to concentrate on, process, internalise, and retain new and difficult information* (Dunn and Dunn, 1999). Obviously, this definition is characterised by a behaviouristic approach to learning with its focus on merely taking in and retaining information. Of course the words 'process' and 'internalise' could give the impression of knowledge construction being part of the concept; however 'process' here refers to the individual's preferred way of having information presented [analytic (step by step) vs. global (concept first, details later)] and 'internalise' refers to the information absorption (sensory modalities). From a constructivist point of view, the authors' theoretical foundation, this approach is a crux as is its very linear understanding of learning. Hence, new research has made some fundamental changes to the definition and conception of learning styles which now form the basis for the work with learning styles in all professional settings: *Learning styles are the way in which individuals concentrate on new information, take in this information, processes it into knowledge and/or re-construct existing knowledge, store and retain this knowledge* (Lauridsen, 2012). These changes have no impact on the original construct *per se* – the factors of the Dunn and Dunn (1999) learning styles model remain unchallenged – but they lift the construct out of the outdated behaviouristic framework and into the constructivist concept that most of today's learning experts (ibid.). Based on the understanding of learning in general as the individual's way from taking in information to processing this information into knowledge (with the personal changes to the individual that this process implies), the new

approach emphasises that learning takes place in all possible human settings – not only in education, for we take in information and process it more or less round the clock. Thus learning is of paramount importance in a working setting, too. Based on these premises, selected variables from BE are utilised to analyse the five working concepts to further deepen the understanding of the experienced phenomena. Figure 1 presents the BE model.

Figure 1   The BE® model (see online version for colours)
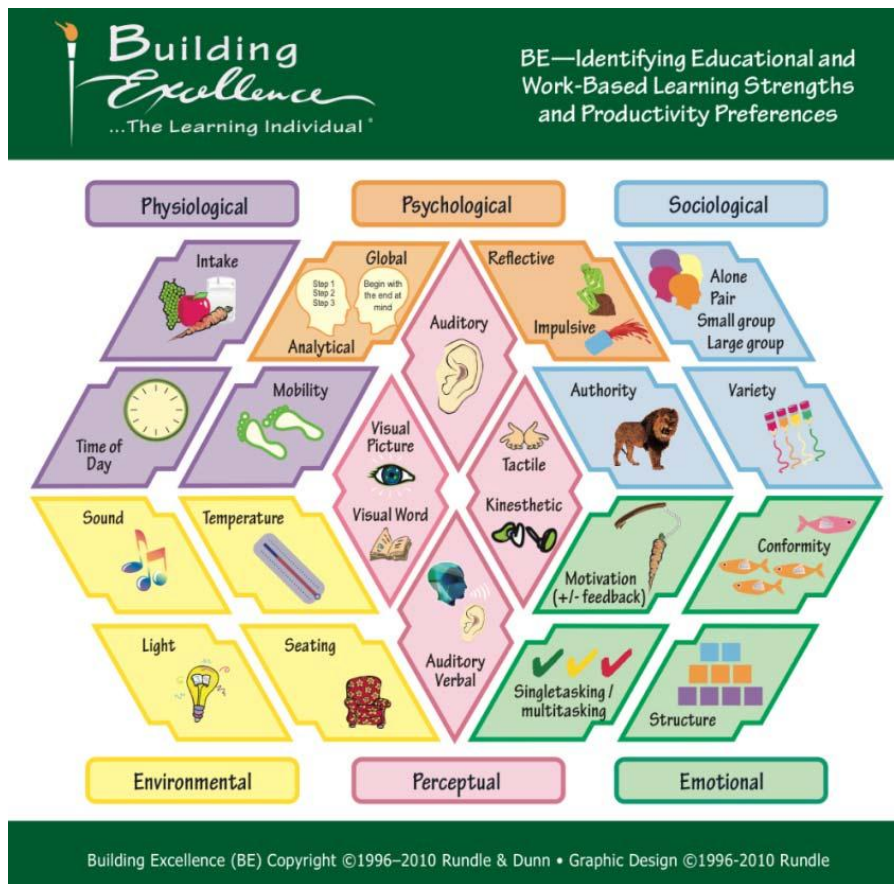
The BE model and survey are based on Dunn and Dunn's (1999) learning styles construct (e.g., Dunn and Griggs, 2007). The BE learning styles model operates with six strands of elements: the perceptual, the psychological, the physiological, the environmental, the emotional, and the social. The six strands contain 20 elements with altogether 28 variables that may influence individual adult learning. This may be a positive influence when an individual exploits his/her preferences, and negative when that is not the case (Dunn and Rundle, 2007). It should be stated that these elements have emerged on the basis of the Dunns' observations in classrooms. There might be further factors to take into consideration and some of the existing factors might be interrelated – further

research is needed and will follow. However, the model delivers a strong tool for pointing out important element of the individual's learning that is as focus of attention. For more information about BE, see http://www.learningstyles.net.

The integration of the BE learning styles construct into the research will furthermore claim knowledge to the call made by Brix and Lauridsen's (2012) work on implementing learning styles in a knowledge based organisation, in which it is put into supposition that individual work as well as teamwork will be enhanced based on implementing individual learning styles profiles and Team Mastery Profiles®; in the work with these, individual and collective learning competencies are discussed and the implications for having different – or the same – ways and preferences for working concentrated on new and difficult tasks are needed. The selected variables from the BE is utilised to inform the five working concepts.

6.1 Informing the working concepts via the BE model

By analysing and interpreting the working concepts with selected variables from the BE model, the following indications must be explained. The two strands 'sociological' and 'emotional' were altogether not taken into consideration since the implications of these strands cannot possibly be identified by mere observations. The working concepts below are analysed/informed by Dunn and Rundle (2007), Lauridsen (2012) and Brix and Lauridsen (2012). Separate references will not be made during the analysis.

The perceptual elements in the BE can be used to analyse the working concept rapid documenting. Presumably, there is a strong element of tactual/kinesthetic preferences behind the drawing, doodling, etc. Furthermore, rapid documenting might reflect a need for picture/graphic support (visual picture) and/or a need for reading (visual text). Thus, the strong need of many participants to utilise their motor skills, large and small, as well as their outspoken tendency to use pictures or texts when taking in information can explain why the individuals in the CIS projects opted the rapid documenting concept.

In addition, the working concept fidgety can partly be explained by these perceptual variables. Instead of thinking negatively about people rocking their chairs, shaking their pens or tapping their phones, etc. these apparent impatience can be explained by the need to use the motor skills when processing information into personal knowledge. Another perspective relevant to fidgety is the perspective of pacing the fellow team mates. Here, the dichotomy 'reflective' vs. 'impulsive' can undoubtedly be taken into consideration: the reflective person's input to the discussing is more often than not bypassed by an impulsive individual who reacts immediately and in contrast to the reflective person does not need to check and recheck his/her contribution.

The working concept reticence could easily be addressed by the Ringelmann effect or the perspective of social loafing according to which the individual effort is reduced as the size of the group/team increases (Hogg and Vaughan, 2008). However, by addressing the working concept with the BE model, other perspectives emerge. As mentioned before, the differences between being impulsive and reflexive can be large, especially when the two types work together. For example, having an impulsive person pacing a reflective person makes the reflective person stall. When reflective persons are asked a question, it can take a little while before they feel ready to answer the question – and if an impulsive person rephrases the question, then the reflective persons will start thinking all over, believing that a new question has been asked. Hence, instead of dealing with the symptom of e.g., social loafing, the BE model explains how reticence to some extend can

be untangled, resulting in an increase in the intra team/group collaboration. The echoing above can furthermore be seen as a need for verbalising i.e., taking in and processing information by talking loud, that is to oneself.

The working concept laidback attitude can be explained by the environmental strand in the BE model that addresses the individual needs for the concrete work environment. According to BE model bodily stress has a negative impact on concentration; therefore it is important that the individual is formally or informally seated according to his/her bodily needs. Also sound (music, phones ringing, people talking), light (need for strong light, need for dimmed light), and high/low temperature play a role in this respect.

The working concepts non-aligned can to a large extent be explained on the basis of the variables 'analytic', 'global' and 'integrated'. The BE model explains that individuals have different way to make sense of information: some people prefer to have all the details in place, before they can start to understand the whole (analytical); other people need to have the general overview in place, before they can grasp the details (global). In addition, the integrated learner go both ways, which results in these groups of people often are referred to as interpreters, since they understand both ways of processing information, and since they understand how to translate something presented in an analytic manner into a global context, and vice versa. The best way to work with information processing according to the BE and common knowledge on how the brain operates, is to start globally by speaking of the general meaning of e.g., the product under development, and when having clarified this, by moving into details. This, BE argues, will increase the mutual understanding of the participants who work together.

All together, the analysis of the working concepts on the basis of BE shows that the construct delivers an easily manageable key to interpret the behaviour and attitudes of people in a learning/working context. In other words, behaviours as the above described will, due to culture and tradition, often be misinterpreted by group and team members in working practice and this can lead to stress and unfocused cooperation. The use of BE, however, makes it possible to shed another and more correct light on peoples' behaviour: thus an intervention is needed.

7 The intervention

7.1 Introducing the BE learning styles model in practice

The team members from all the SMEs were assembled mid-August to participate in the intervention. Beforehand, they had completed individual learning styles profiles at http://www.learningstyles.net. The intervention was divided into two parts: a team training session and a team building workshop.

The team training session was set up as a seminar where the team members were introduced to BE and its strategies. After the introduction to BE and Q and A's, the five teams were asked to complete team learning profiles (Team Mastery Profiles®) at the following team building workshop. Here the team members discussed the importance of the individual members' profiles to the rest of the team, both regarding preferred and non-preferred elements of BE. Furthermore, the team members discussed how the individual learning preferences and non-preferences could affect the teamwork in practice regarding cooperation, communication and interaction in general. The end product of the

workshop was a team learning profile of which all the team members from each team got a copy.

8   Results and perspectives

The results and perspectives are divided into short term and long term outcomes. The reason for dividing into short- and long-term is to understand the effect of the intervention. It is interesting to evaluate the short term effect because of the novelty of the intervention, but to obtain a long term perspective, the authors waited two months to question the participants about their experience with and their perceptions of the value of the intervention. This strategy was purposely chosen to secure a certain time lag between the introduction as well as the implementation of the intervention, and the time to reflect on the impact of the intervention, which is imperative when evaluating real changes in effect (Guest, 2011).

8.1   Observed behavioural changes (short term outcomes)

After the intervention, the participants frequently referred to learning styles, and most of them started to exploit their individual strengths more strategically, which should increase their concentration and thus their learning outcome. Following bullets sum up the general observations:

x   more individuals than before had started to take pictures with their phones; they started to make drawings e.g., mind-maps jottings, etc. to accommodate perceptual strengths

x   they had started to use small breaks to speak to one another and walk around, instead of calling a colleague to get updates from the firm, etc. to accommodate perceptual strengths

x   they started to situate themselves more strategically in the different rooms, so their environmental strengths regarding sound, light, temperature and seating were accommodated

x   they had started to consider ways of communicating during meetings – analytic vs. global presentation of information and they had started to wait longer (or at least be aware of) reflective team members to accommodate psychological elements.

The feedback from the evaluation of the intervention is presented, both the positive and the constructive criticism, which needs to be elaborated upon in further studies.

8.2   Feedback after the action research (long term outcomes)

According to the participants, the intervention had resulted in several positive experiences. First of all the general questioning of the way in which people work concentrated was highly stressed by the participants, because they found that they could work more concentrated and especially more efficient when they followed their individual learning styles strengths and not only the tradition and norms existing in the organisation culture in which they worked. Moreover, the perspective on having

individual preferences and non-preferences and understanding how other people might work concentrated – especially in the innovation team, did remove much of the before experienced bickering, which sometimes influenced the cooperation in general. One of the participants stressed that:

> "I have found that there is not one correct way for all people to be concentrated when working, rather, there is my way of working concentrated and your way of working concentrated, and the insights and implementation of learning styles in our team has assisted in removing this assumption!"

This perspective corresponds the findings by Brix and Lauridsen (2012) that stress the importance of intra- and interpersonal insights regarding learning strengths and weaknesses in the context of working with complex information. As a complement to this, the participants stated that they worked more effectively after creating the Team Mastery Profile® in the team workshop, the reason being that they had agreed to work according to their learning styles preferences, both when working alone and when working together. One project manager stated that:

> "After the august session [introductory session] the work in the team has been running more smoothly and we feel that everything is going better, both regarding the quality and the quantity of work which is created, and this is especially because of the perspectives from the [learning styles] session!" and he continued:

> "When I look into the past, I suddenly understand why some situations escalated without a reason, simply because we took for granted how to work. Now I can see the potential in knowing one another's strengths and weaknesses when working together and I have found that the bickering often occurred because of differences in preferences, when thinking of the learning styles!"

Another project manager stated that he definitely agreed to the comments, and he continued:

> "When talking with the team during the creation of the team profile, it made me realize that I as a team manager must not expect my colleagues to work exactly as I do (...) of course a deadline is a deadline, no doubt about that, but if one or two of my colleagues work more concentrated and efficient in the late evening and at night instead of early morning, then it is in the team's interest that they are allowed to do so!"

Finally, a participant stated that:

> "The learning styles gave us some new words to use when planning meetings and when planning to work together in the team. By having this new set of words, we can exploit the full learning potential of most of the team members while having a mutual understanding for why some concentrate in other settings and by having other types of behaviour than one self!"

It is clear from the feedback that the participants had worked under taken-for-granted assumptions about how to work concentrated, regarding both the development of the radical innovation projects and their daily work tasks. The indications from the research strongly demonstrate that there is a large potential to be harvested by allowing the individuals to fully understand their personal learning styles preferences and non-preferences. Moreover, creating a Team Mastery Profile®, where mutual understanding of the team members' preferences and non-preferences are discussed and interpreted, with the aim to reach a higher meta-level of knowledge regarding the team is

found to be least equally rewarding to the team – especially in times of insecurity in the developing stages of teams, where frustration and disagreements are frequent, cf. Tuckman (1965). Consequently, the five Lithuanian innovation teams found themselves to work more efficiently and they thus found that the intervention had improved their work with radical innovation in practice. Below the constructive critique is presented before the conclusion and implications.

Constructive criticism: at the final seminar some participants stated that they had built up a solid knowledge of learning styles both as to the theoretical background and as to the strategies, but that they somehow had forgotten to bring this knowledge. Below the constructive critique of the intervention is divided into two themes and the consequences for the participants are described.

Organisational culture: a shortcoming uttered by the participants addressed the organisational culture of their companies namely that the strategies from the individual profiles could conflict with the (unwritten) rules of how to behave when working alone and with others – the traditional working culture, that is. This culture was widely used as an excuse for why some of the actions presented in the strategies were not implemented. Thus, issues of informal seating were highly discussed, but it was made clear by the participants that the need for informal seating did not correspond to the rules of the company – especially in front of customers. Moreover, issues of dimming the light in the office, working in a quiet environment (e.g., from home) can potentially be interpreted negatively by fellow colleagues in the companies, if a common understanding for why the individuals behave and interact as they do is not present. Thus, the individuals stated that the intervention was very good for themselves and especially the team. However, when returning to the daily work, where all the other colleagues had not taken the BE survey and had not made a Team Mastery Profile®, there could emerge situations of misunderstandings and bickering. Hence, it was suggested is that BE should be a complete integration of the (part of) the organisation in order for everyone to understand why people behave as they do when working concentrated.

Incorrect profiles: some of the participants felt that they had similar profiles. However, when discussing their individual learning styles preferences and non-preferences, they found that their individual profile print-out did not match them. This gap between the individual assumptions and the individual profile outcome emerges because the online profile was completed before the participants were presented to BE and the discourse connected with it. This pinpoints a problem to which a solution still has not been found: making one's participants take the profile before the introduction often facilitates their understanding of the concept as such – through the perusal of the profile and the strategies, quite a few will have a thorough grasp of the concept, and on the whole many will be familiar with basic terms gives them a feeling. Others, however, need a certain amount of pre-understanding in order for them to give obliging answers to the questionnaire – just to mention one example: many adults do not know that they have a kinaesthetic preference simply because they never had the opportunity to find this potential due to the traditional learning and working culture. Thus, this critique needs thorough research – which is planned – but therefore, in the future, if a more correct picture is needed of the individuals profile-wise, it is suggested that a new set-up will start by introducing the individuals to the learning styles construction and then complete the online survey.

9 Conclusions and implications

9.1 Industrial conclusion and implications

This study claims that implementing Lauridsen's (2012) updated version of Dunn and Rundle (2007) BE learning styles construct into innovation practice increases team effectiveness and it improves collaboration and communication in general, because the team members understand exactly how to work concentrated alone and how to work concentrated together with others. The claim is based on the fact that the team members from the five Lithuanian case SMEs experienced a general improvement in their teamwork after they were introduced to the BE model and the Team Mastery Profile® in the context of their radical innovation projects. It is however imperative that the top management communicates clear about the consequences of implementing the BE learning styles construct in practice. This should be done to gain full understanding and acceptance of 'different ways of working to achieve to common goal' in the (part of the) organisation, where the innovation team is developing their projects, to avoid misunderstandings and bickering from fellow colleagues and managers.

9.2 Academic conclusion and implications

This study claims knowledge to the innovation management literature and organisation science by utilising learning styles to widen the perspectives on how people learn in teams and how they become more knowledgeable when working with radical innovation in practice – here in the context of Brix and Jakobsen's (2013) 'Creative Idea Solution' framework. Moreover, the study presents findings which strengthens the research by Brix and Lauridsen (2012) and Lauridsen (2012) on the value and effect of integrating the BE model into teams in organisations in practice, and findings which expand the area of implementation from a school setting towards the industry (Dunn and Rundle, 2007). Finally, the findings contribute with specific indications on increasing the effectiveness and performance of teams, and it demonstrates how action research can assist in improving organisational practice – a new imperative emerging in the organisation science literature (Huber, 2011; Bresman, 2010; Gebert et al., 2010). Still, all together, the research on integrating the BE model in organisational practice in the context of innovation projects is only represented by six case studies in total – all completed on a national level, and therefore the authors call for further research, e.g., in global innovation teams, to convince the industry as well as academia that there is a vast potential in working with learning styles outside the classroom.

References

Argote, L. (1999) *Organisational Learning: Creating, Retaining and Transferring Knowledge*, Springer, New York.

Baruah, J. and Paulus, P.B. (2009) 'Enhancing group creativity: the search for synergy', *Research on Managing Groups and Teams*, Vol. 12, pp.29–56.

Belbin, R.M. (1993) *Team Roles at Work*, Butterworth-Heinemann, Oxford.

Brandon, D.P. and Hollingshead, A.B. (2004) 'Transactive memory systems in organisations: matching tasks, expertise, and people', *Organisation Science*, Vol. 15, No. 6 pp.633–644.

Bresman, H. (2010) 'External learning activities and team performance: a multimethod field study', *Organization Science*, Vol. 21, No. 1, pp.81–96.

Brix, J. (in press) 'Improving individual knowledge construction and re-construction in the context of radical innovation', *International Journal of Innovation and Learning*.

Brix, J. and Jakobsen, H.S. (2013) 'Corporate creativity: introducing the Creative Idea Solution© framework', *International Journal of Innovation and Learning*, Vol. 13, No. 4, pp.388–405.

Brix, J. and Lauridsen, K.M. (2012) 'Learning styles and organisational development in practice: an exploratory study of how learning styles and individual learning strategies can facilitate organisational development', *International Journal of Innovation and Learning*, Vol. 12, No. 2, pp.181–196.

Crossan, M.M. and Apaydin, M. (2010) 'A multi-dimensional framework of organisational innovation: a systematic review of the literature', *Journal of Management Studies*, Vol. 47, No. 6, pp.1154–1191.

DeRue, D.S. and Rosso, B.D. (2012) 'Toward a theory of rapid creativity in teams', *Research on Managing Groups and Teams*, Vol. 12, pp.195–228.

Dunn, R. and Griggs, S.A. (2007) *Synthesis of the Dunn and Dunn Learning-Style Model Research: Who, What, When, Where and So What?*, St. John's University, New York.

Dunn, R. and Dunn, K. (1999) *The Complete Guide to the Learning Styles in Service System*, Allyn & Bacon, Boston.

Dunn, R. and Rundle, S. (2007) *Bound for Success*, PCI Limited, USA.

Eden, C. and Huxham, C. (1996) 'Action research for management research', *British Journal of Management*, Vol. 7, No. 1, pp.75–86.

Edmondson, A. (1999) 'Psychological safety and learning behavior in work teams', *Administrative Science Quarterly*, Vol. 44, No. 2 pp.350–383.

Edmondson, A. (2002) 'The local and variegated nature of learning in organisations: a group-level perspective', *Organisation Science*, Vol. 13, No. 2 pp.128–146.

Eisenhardt, K.M. (1991) 'Better stories and better constructs: the case for rigor and comparative logic', *Academy of Management Review*, Vol. 16, No. 3, pp.620–627.

Eisenhardt, K.M. and Graebner, M.E. (2007) 'Theory building from cases: opportunities and challenges', *Academy of Management Journal*, Vol. 50, No. 1 pp.25–32.

Eysenck, M.W. and Keane, M.T. (2007) *Cognitive Psychology – A Student's Handbook*, Psychology Press, USA.

Gebert, D. et al. (2010) 'Fostering team innovation: why is it important to combine opposing action strategies?', *Organisation Science*, Vol. 21, No. 3, pp.593–608.

Guest, D.E. (2011) 'Human resource management and performance: still searching for some answers', *Human Resource Management Journal*, Vol. 21, No. 1, pp.3–13.

Hogg, M.A. and Vaughan, G.M. (2008) *Social Psychology*, 5th ed., Pearson Prentice Hall, England.

Huber, G.P. (2011) *Organisation: Theory, Design, Future*, in The APA Handbook of Industrial and Organisational Psychology, Volume 1 – *Building and Developing the Organisation*, American Psychological Association, Washington DC.

Huber, G.P. and Lewis, K. (2010) 'Cross-understanding: implications for group cognition and performance', *Academy of Management Review*, Vol. 35, No. 1, pp.6–26.

Jakobsen, H.S. and Brix, J. (2012) 'The 'vertical innovation process': constructing sustainable business models in practice', *Proceedings of the 5th ISPIM Innovation Symposium*, Seoul, Korea December: ISBN: 978-952-265-317-8.

Kanchana, R. et al. (2011) 'Interrelationships among knowledge management, organisational learning and innovation', *International Journal of Innovation and Learning*, Vol. 9, No. 2, pp.145–162.

Kitazawa, K. and Osada, H. (2012) 'Innovation by small group activity and organisational learning', *International Journal of Innovation and Learning*, Vol. 11, No. 3, pp.233–249.

Lauridsen, O. (2012) *Fokus på læring 3.0*, Akademisk Forlag, Copenhagen.

Leifer, R. et al. (2000) *Radical Innovation – How Mature Companies can Outsmart Upstarts,* Harvard Business School Press, Boston.

Majchrzak, A. et al. (2012) 'Transcending knowledge differences in cross-functional teams', *Organisation Science*, Vol. 23, No. 4, pp.951–970.

Parjanen, S. (2012) 'Innovation sessions as sources of new ideas', *International Journal of Innovation and Learning*, Vol. 11, No. 4, pp.352–368.

Rietzschel, E.F. et al. (2009) 'What are we talking about, when we talk about creativity? Group creativity as a multifaceted, multistage phenomenon', *Research on Managing Groups and Teams*, Vol. 12, pp.1–27.

Rozenblit, L. and Kiel, F. (2002) 'The misunderstood limits of folk science: an illusion of explanatory depth', *Cognitive Science*, Vol. 26, No. 5, pp.521–562.

Rundle, S. (2010) *Building Excellence (BE) – The Learning Individual Research Manual*, Performance Concepts International, USA.

Schein, E.H. (2008) *Clinical Inquiry/Research*, in Rearson, P. and Bradbury, H. (2008) *Handbook of Action Research*, Sage Publication, London.

Tuckman, B.W. (1965) 'Development sequence in small groups', *Psychological Bulletin*, Vol. 63, pp.384–399.

Wegner, D.M. (1987) *Transactive Memory: A Contemporary Analysis of the Group Mind*, in Mullen, B. and Goethals, G.R. (Eds.): *Theories of Group Behavior*, Springer-Verlag, New York.

Wenger, E. (1998) *Communities of Practice: Learning, Meaning and Identity*, Cambridge University Press, Cambridge.

Woodcock, M. (1979) *Team Development Manual*, Aldershot, Gowerm, USA.

Yin, R.K. (2009) *Case Study Research – Design and Methods*, 4th ed., Sage Publications, London.

Fourth paper

Brix, J. (in review) Exploring a radical innovation project as source of change in organizational routines, *Organization Science – special issue on Routine Dynamics,* **Vol.xx No. yy**

Exploring a radical innovation project as source of change in organizational routines

By: Jacob Brix,
　　　Industrial PhD student,
　　　Aarhus University,
　　　School of Business and Social Sciences,
　　　Department of Business Communication &
　　　Interdisciplinary Center for Organizational Architecture (ICOA)

Abstract:

The purpose of the study is to explore a radical innovation project as source of change in organizational routines, and the goal to demonstrate that the scope and impact of investing in high uncertainty projects is much further reaching than would be indicated by traditional performance measures on innovation data as defined by the OECD (2005). To enable this, a bold setup for identifying changes in organizational routines was developed by defining 28 ostensive routine (abstract pattern) variables by utilizing theory from organization design literature to facilitate the data collection and analysis on performative routines (specific actions). As result, seven propositions were established that claim knowledge to the existing literature as well as they facilitate organizations in practice to further understand the unnoticed, however positive performance effects (change of routines) that emerge during such a project. The propositions were claimed based on an eight-month participatory action research study in five departments/institutions in a Danish municipality.

Introduction

Do old habits die-hard? – Maybe not! Present study demonstrates that it could be time to create a new adage, at least within organization science: old habits die easily…

Since organizations exist in ever-changing and turbulent environments (Huber 2004, Burke 2011) and the need for radical innovation (defined below) is becoming the new managerial fad, the premise of this study is to identify the unnoticed and unanticipated developments and changes in routines that emerge within an organization during and immediately after such future investments. Normally, innovation research on the organizational level of analysis is conducted by focusing on 'hard' technological measures and tangible outcomes as described in the Oslo Manual (OECD 2005), where results such as new product development (Trott 2012), optimization of business processes (Harry and Schroeder 2006), and more recently business model innovation (Osterwalder and Pigneur 2010) has got the scholarly attention. This important, however myopically directed focus on the hard measures has exploded in the last decades (Crossan and Apaydin 2010) and consequently innovation research itself has been criticized as being too routinized (Anderson, Drue and Nijstad 2004). To avoid the pitfall of contributing to the routinization of innovation research, this study seeks to stretch the existing research frontier by identifying and exploring changes in the 'non-technological' innovation measures, which according to Schmidt and Rammer (2007) can be to adopt, integrate new elements and/or even re-organize the routines driving operations and generating innovations in organizations. Schmidt and Rammer (2007) argue that these changes in routines within organizations are essential to explore if new insights are to be found and when new knowledge is to be claimed to understand the full picture of innovation and thus manage it successfully in practice (ibid.). By complementing Feldman (2000) and Feldman and Pentland's (2003) view of organizational routines as being dynamic and subject to change over time, ***the purpose of this study is to explore a radical innovation project as source of change in organizational routines to discover and explain the immediate development and changes that emerge as unanticipated, however beneficial side-effects beyond the planned innovation assignment.*** The goal of the study is to determine if the indirect changes in

routines (the non-technological innovations) deriving from the proactive work may be of more importance and of higher value to the organization than preliminary assumed. Such results would reinforce the assertion that investment in radical innovation projects with high uncertainty is not necessary 'valueless' if/when the initiated project should not reach the expected outcome(s). The indications deriving from this study will thus demonstrate that the scope and impact from investing in radical innovation projects is much further reaching than performance outcomes traditionally conceived as well as the implications will provide R&D managers, innovation consultants etc. with more ammunition to persuade top-managers, Board of Directors, City Councils and other decision makers in investing in the high uncertainty projects. A need that is highly present in the aftermaths of the financial instability still haunting the larger part of the globe where short-termism has not proven beneficial for a larger part of the deceased organizations.

Explaining radical innovation

When consulting the innovation management literature it is evident that research on radical innovation has been down emphasized when comparing it to the efforts made towards understanding and explaining how incremental innovation come about (cf. Crossan and Apaydin 2010). In the last decade however, the picture started to change: Leifer et al. (2000) put radical innovation on the world map by describing how established firms could move beyond the 1980'ies efforts of quality management and incremental innovation, to secure corporate survival by rethinking their business. Since Leifer et al.'s (2000) seminal work, it seems that radical innovation efforts in organizational practice are starting to sprout and that the scholarly interest is increasing (O'Connor et al. 2008). Radical innovation is, however, a phenomenon we still know precisely little about. The increased tendency to work on projects that seek radical innovation outcomes can be explained by the previously mentioned rapid and disruptive changes in the nature of organizations and their context (Huber 2011), where there are new competitive and external business conditions (Bettis and Hitt 1995), global and complex competition (D´Aveni, Canger and Doyle 1995), new markets (Prahalad and

Hammond 2002) or new and innovative organizational forms that take advantage of the new conditions (Hamel 2003, Burton, Obel and DeSanctis 2010). In light of these formidable challenges, radical innovation is claimed to be the key for existing organizations to survive cf. Christensen (1997), Daft, Murphy and Willmott (2010) and O'Connor et al. (2008), and therefore it is imperative to contribute to this growing pool of knowledge, both for the academic community and the organizational practitioners. This particular study applies Brix and Jakobsen's (2013) definition of radical innovation: a 'paradigm stretching' activity in which the foundation for a product, process, business model, etc. is rethought leading to significant positive change; for example resulting in 'new performance features' and 'reduction of costs' greater than 30 percent (also cf. Leifer et al. 2000). In addition, radical innovation can also represent a new business platform to the company. By having defined radical innovation, the next section treats the research process and its context.

Studying organizational routines via action research

There are multiple scholars calling for empirical studies on organizational routines, e.g. Becker et al. (2005), Farjoun (2010) and Pentland (2011). I argue that the indications and insights created in this study act as response to these calls, since the results were developed via a participatory action research approach (Rearson and Bradbury 2008) founded in a longitudinal single case study with an embedded design (Yin 2009). My delving into a single case is based on the argument that an in-depth understanding of a singular entity can serve with imperative indications for the discovery of new insight cf. Yin (2009) and Eisenhardt (1991) – in this context a new way of understanding investment in radical innovation as the source of changes in organizational routines. I used Edgar H. Schein's (2008) 'Educational Intervention and Facilitation' (EIF) action research methodology. This approach represents a data collecting process in which the researcher is "licensed to observe what is going on but not licensed to influence the situation beyond what the client has contracted for" (Schein 2008 p.190). In practice, I was allowed to intervene when issues of change in the context of the project emerged – a mandate that made the approach to study routines *actively and*

participatory in contrast to e.g. ethnographically that is a *passive observatory* research approach (Hammersley and Atkinson 1995). The power of the EIF approach is that it could assist me in uncovering causal phenomena that lied deeper in the levels of group and organizational dynamics (as well as routines); furthermore, it could lead to insights that may never have occurred to me through surveying or interview data only (Schein 2008).

I got access to the case organization as a source of data collection by getting permission to follow a private consultancy's real life radical innovation project from its start to its end (see more below). The advantage of following the particular private consultancy was clear: they used a systematic radical innovation framework in practice, which (cf. Yin 2009, Eisenhardt and Graebner 2007) further assists in strengthening the repeatability of the study for future purposes. The consultancy applied Brix and Jakobsen's (2013) radical innovation method called the 'Creative Idea Solution© framework', where the case organization followed the 'Focus-' and the 'Preject phases'. In short, during my action research the case organization was guided from focusing their innovation project, to creating an idea- and concept portfolio of recognized and developed opportunities, towards the creation of different outlines for new business models cf. Jakobsen and Brix's (2012) 'Vertical Innovation Process'. For more information about the systematic radical innovation method the 'Creative Idea Solution©' framework, please see Brix and Jakobsen (2013) and for 'the Vertical Innovation Process', see Jakobsen and Brix (2012).

The organization

The case organization that invited me to participate in their upcoming project was a Division for Education Management (hereafter DEM), which is part of a Danish Municipality (public institution). Part of the DEM's purpose is to offer education as well as before and after school activities to children and adolescents from ages 4 - 16. To be able to carry out this assignment, the DEM runs 13 schools in the municipality, where most of them have institutions with before and after school offerings. The purpose of the initiated radical innovation project was "to propose new ways of learning through child caretaking in the

before and after school setting" (modified purpose due to mutual agreement with the municipality). The radical innovation project was completed by an innovation team consisting of five persons from the DEM, including two managers from different institutions, one senior consultant from a parallel department in the division, one senior consultant from the administration and a project manager from the DEM management department. To follow the progress of the radical innovation project and to evaluate work completed by the innovation team, the DEM management and the City Council had appointed a steering committee, including senior managers from the top-level administration in the municipality. Since five individuals from five different departments/institutions in the DEM constituted the innovation team, the unit of analysis for this action research was the routines in each of these departments, resulting in a single case study with an embedded case design constituted of five areas of inquiry (Yin 2009).

The action research process

The EIF action research process had a six month time duration from August 2012 to January 2013. During this period I followed and collaborated with the project team, while being guided and advised by the innovation experts from the consultancy using the 'Creative Idea Solution[©]' framework (Brix and Jakobsen 2013). As demonstrated in figure 1, the team was creating progress from the Focus phase towards the Preject phase, where workshops concerning the creation of inputs as well as opportunity recognition were completed.

Figure 1: Timeline for the project
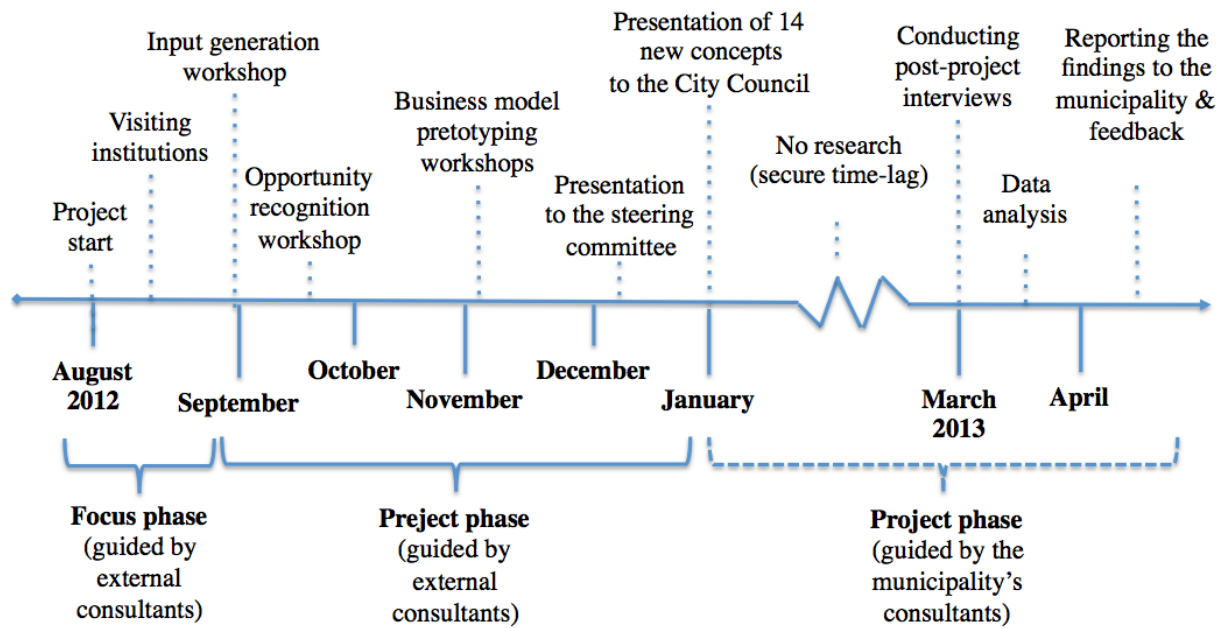
After this, the team developed the recognized opportunities, and finally, they reached the goal of the project by creating and presenting different outlines for business models according to Jakobsen and Brix's (2012) 'Vertical Innovation Process'. In total, the innovation team presented 14 different business model outlines of more or less radical nature to the Municipality's City Council in January 2013.

Based on in depth insights from the longitudinal action research, I attended a vast amount of different meetings and workshops where I collected a large portion of data. Data included pictures, video and audio clips, field jottings and interview notes. The access to this data gave me deep insight about the changes of *individual habits* for participating team members and it gave me in depth knowledge, which could be used to challenge the team members in the post-project interviews, where focus was to be directed at the *collective routines* in their respective departments/institutions. I conducted the post-project interviews in March 2013, which consisted of two half's: a semi-structured and a structured approach. The interviews were conducted after two and a half months of time lag according to Guest's (2011) recommendations. The purpose of the time lag was to determine the dynamic, changes and impacts of completing the first two phases of the radical innovation project in the DEM.

Below the next section will describe how the interview guide was developed, highly inspired by the organization design literature.

Discovering changes in routines via an organization design perspective

Because organizational routines are dynamic generative systems that emerge and evolve over time cf. Pentland, Hærem and Hillison (2011) they should for analytical reasons be divided into two key aspects, being: 'ostensive routines' and 'performative routines' (also cf. Latour, 1986, Pentland and Feldman, 2005). Ostensive routines are defined as "the abstract patterns that participants use to guide, account for and refer to specific performances of a routine", and performative routines are defined as "the actual performances by specific people, at specific times, in specific places" (Pentland and Feldman, 2005 p.795). In addition, Pentland and Feldman (2005) argue that 'artifacts', being physical manifestations of organizational routines, such as rules, standard operating procedures, etc. can influence organizational routines and *vise versa*.

To realize the discovery of the dynamic changes in organizational routines in the five departments/institutions, I consulted the organization design literature. This choice was made since the organizational design literature could provide the study with a comprehensive framework, as an artifact, to focus the data collection and - analysis by creating a structured interview guide regarding the ostensive and performative aspects of organizational routines on a pre- and post-project basis for analysis.

To enable the data collection, I selected Burton, Obel and DeSanctis's (2010) step-by-step approach towards a generic organization design framework based on two arguments. First, because of their dynamic view on routines, where the iteration of reflection, adjusting and working is a basic foundation for knowledge construction and hence learning (constructivist / information processing view). Secondly, because Burton, Obel and DeSanctis's (2010) approach is applicable to all types of organizations and it encompasses all aspects of a contemporary organization, both public and private, from the operational level towards the

tactical and finally the strategic level of analysis. Both perspectives correspond the methodological choices in the study.

Methodological-speaking, the utilization of the generic framework as inspiration for this study facilitates repeatability for the purpose of future research, which strengthens the argument for applying it, cf. Eisenhardt and Graebner (2007). Moreover, the reason for applying an organization design perspective is that such research has demonstrated beneficial for creating implications for real life practices, and not only organization science theory (Liedtka and Parmar, 2012). Therefore, striving to use the bold framework could create a new foundation for the analysis of the dynamic of organizational routines in practice. This can be an imperative contribution in search for new empirical-based knowledge, because it can be used to construct new theory that will help to further understand and assist in managing the complexity of contemporary organizations, cf. Miles (2012) and Alberts (2012).

I used the step-by-step approach to inspire the structured part of the data collection with a bold framework for defining *generic ostensive aspects* (abstract pattern) of the organizational routines used to reach the goal of the specific departments, institutions, etc. The boldness of the framework is evident, since Pentland and Feldman (2005) argue that the distinction of the ostensive and performative routines in practice would be like isolating the Gulf Stream from the Atlantic Ocean. However, the argument for applying the bold framework is based on Pentland and Feldman's (2005) own argument that follows: "the ostensive aspects of routines in organizations should not be conceptualized as a single, unified entity" (p.797) and that there can exist multiple variations in the abstract pattern of describing how/why different performative routines can reach the same intended goal with results that are alike. Hence, the generic definitions of the ostensive aspects of the organizational routines below in table 1 are argued to correspond Pentland and Feldman's (2005) description of the nature of ostensive routines. Therefore, the organizational design framework is utilized to specify the different levels of aggregation where generative actions are to be completed via performative routines, which as remainder, are the specific actions used to reach the goal of the ostensive routine.

The O.D. framework inspired the structured interview guide, which was used for the post

project interviews (further developed below)

Table 1: Organization Design: defining generic ostensive aspects of organizational

routines

Strategic Level	Ostensive routines	Defining the ostensive routine
Goal(s)	Efficiency	Focus on inputs, use of resources and costs
	Effectiveness	Focus on outputs, products/services and revenues
Operationalization of goals	Exploration	The degree of search, variation, risk-taking and innovation
	Exploitation	The degree of refinement, efficiency, selection and implementation
Environment	Complexity	The number of factors in the environment and their interdependency
	Unpredictability	The degree of understanding (or ignorance) of the environment and the nature of the factors

Tactical level	Ostensive routines	Defining the ostensive routine
Configuration	Functional	The degree to which work is divided by specialized activities
	User oriented	The degree to which work is divided by products/costumer names
Organizational Complexity	Vertical differentiation	The depth of the hierarchy
	Horizontal differentiation	The degree of tasks specialization across the hierarchy
Knowledge exchange	ICT-infused	The degree to which the organization is reliable of ICT equipment and software to manage knowledge
	Virtualization	The degree of boundary-spanning and "reach" used as basis of knowledge exchange
Task design	Repetitiveness	The degree of standardization of execution of tasks
	Divisibility	The degree to which a subtask need coordination
People	Number of people	The number of people in the unit of analysis
	Professionalization	The collective skill level and the capabilities to solve work tasks
Leadership style	Uncertainty avoidance	The degree to which top-management shuns to take action or make choices that involve major risk
	Preference for delegation	The degree to which top management encourages lower-level managers or other employees to make decisions
Organizational climate	Tension	The degree to which there is a sense of stress or psychological 'edge' in the work atmosphere
	Readiness for change	The degree to which people in the organization are likely to shift direction or adjust work habits to meet new, unanticipated challenges

Operational level	Ostensive routines	Defining the ostensive routine
Coordination and control	Formalization	The degree to which the organization specifies rules and/or codes of conduct to govern how work is done
	Decentralization	The degree to which responsibility for coordination and control lies in the sub-units and at the individual managers
Information systems	Amount of information	The overall volume of data and information that must be collected, processed and stored on a regular basis
	Tacitness of information	The degree to which it is difficult to codify and transfer information in an understandable manner
Incentives	Target of incentives	The degree to which individual or group/team performance is rewarded
	Basis of evaluation	The degree to which it is behavior and/or results that are rewarded

Inspired by Burton, Obel and DeSanctis (2010)

Table 1 is divided into a 'strategic, tactical and operational level' of analysis, containing of 14 levels of analysis in total. The 'ostensive routines' represent two complementing features of each of the 14 levels of analysis – leading to 28 different measures in total, which are all defined individually in the right side column. By having defined the 28 measures, table 1 enables the identification on an organization level of analysis, where the ostensive aspect of routine dynamics can be identified to understand routines as dynamic and generative phenomena. By having identified the 28 ostensive routines of the organizational routines, it facilitates in asking *how* the specific abstract pattern was completed, and thereby in getting answers of pre- and post-project *performative character* (specific actions). Hence, the *change of* or *influence on* the performative routines pre- vs. post-project makes it possible to identify and analyze the dynamic of the organizational routines as a collected entity, and it can thus assist in claiming knowledge to the purpose of the study.

Applied method

I created a structured interview guide by using the information in table 1 and I used this guide to ask the individuals in the team to evaluate the way their department/institution would focus their work efforts (their performative aspects) in relation to the 28 ostensive measures. This critical questioning and evaluation was made firstly by asking the individuals to rate the routines in their department (not their individual/personal habits), on a pre-project basis, and then afterwards on a post-innovation project basis. This rating was made on a closed scale

ranging form 1-5 including half-measures. The analysis determines how a radical innovation

project, in this case Brix and Jakobsen's (2013) approach, as source of change can influence

organizational routines by: 1) changing them, 2) affirming their correctness, or 3) not

influencing them. To increase repeatability of the study further, and to clarify the analytical

process, the two examples below will demonstrate how a change (+/-) is registered in the data

set; and how a routine is clarified as being correct (√) according to the existing situation of the

institution/department within the DEM.

Picture 1: Example from post project interview: change
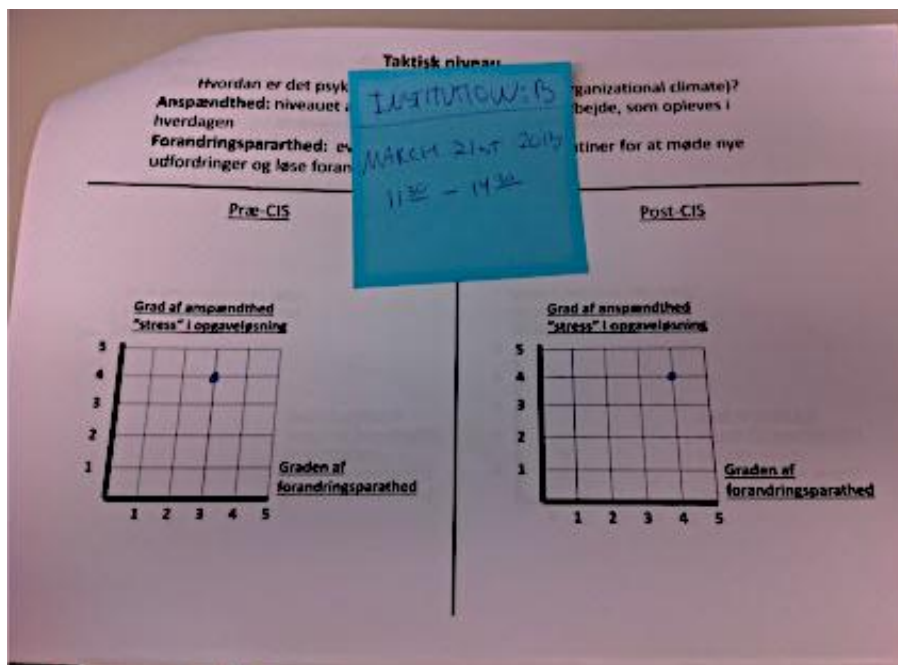
Picture from interview data (interviews made in Danish) – Institution B

Picture 1 demonstrates the documentation used to identify a change in organizational routine

by asking a question to the innovation team member from institution B, who is the manager of

that specific institution. The question relates to the tactical level of analysis where it is the

'organization climate' there is in question and where the two measures cf. the organization

design framework are 'tension' and 'readiness to change'. The left side of the scheme

represents the level of 'tension' and the right side the 'readiness to change'. The quote below

demonstrates the answer the I got from the manager, when asking for the reason for a change

in routine in relation to 'readiness to change' – see picture 1: pre-project estimated to a 3 on readiness to changes and post-project estimation the number has increased to a 4. The manager stressed the reason for the identified change by stating that:

"*There is no doubt that my personal readiness to change has exploded* [because of the project]*, and I am sure and aware that this readiness to change that I demonstrate is influential to the staff – <u>no one is rolling their eyeballs anymore</u> when new ways of working or new initiatives are suggested, simply because they <u>have been positively surprised with some of the ideas</u> we worked on in the project. Now the staff is <u>much more moldable to future changes</u>, since they see the potential in at least some of the new ideas we presented based on the project!"*

Since the structured interview was created as a critical inquiry, I would not accept a change in routine claimed by the respondent if s/he could not give a concrete example (a performative example) of the change in routine in relation to the claim. The underscored statements above represents such claims, since concrete examples were stressed to have occurred during the radical innovation project (in the following analysis, the core statements used to claim the changes or affirmations will be underscored in the same way). The arguments used to substantiate the acceptance of change in the level of analysis "readiness to change" are therefore based on the respondent's three claims: 1) 'decrease of eyeball rolling', 2) 'positively surprised with some of the ideas', and 3) 'more moldable to future changes'.

Picture 2: Example from post project interview: affirmation of correct routine
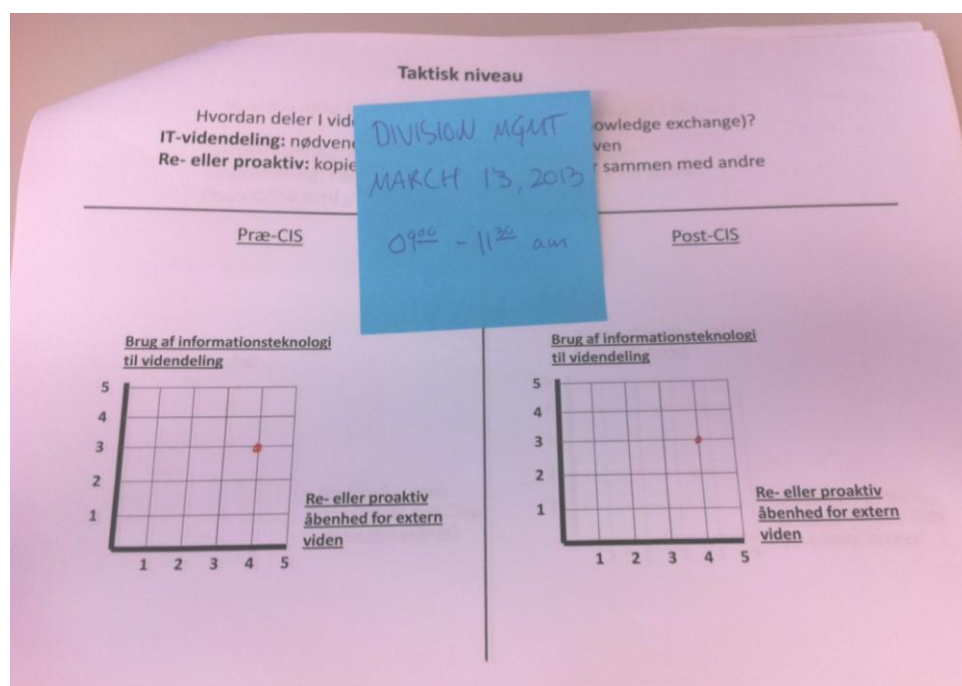
Picture from interview data (interviews made in Danish) – Division Management

Picture 2 demonstrates how a performative routine was documented as being relevant and in line with the current reality of the department. The radical innovation project had not *per se* changed any performative aspects in relation to the specific ostensive level of analysis – here: tactical level of analysis in relation to 'knowledge exchange', where 'ICT infusion' and 'Virtualization' represent the abstract measures. During the post project interview the respondent claimed that:

"During the project we were confirmed that <u>we are on the right track when we explore and create new opportunities with external partners.</u> There is a certain value in cooperating with people external to the municipality, because of the critical questioning by these people, who are not biased by the culture etc. Interviewer*: could you give me a concrete example?* Respondent*: (...) yes, before our project, some of the <u>managers from different institutions tried to collaborate to find new radical ways of restructuring some parts of a work task</u> [classified]<u>, but the suggestions they presented to the division management were not, by us at least, considered radical.</u> So when we had the external consultants come in and help us, <u>we finally got the 14 new quite radical concepts,</u> which we presented to the City Council – so I guess that is a good example!"*

In the interview the respondent demonstrated two aspects that made them aware that their exiting performative routines regarding knowledge exchange, hereunder 'virtualization', still were appropriate. The first was 'the managers attempt to create radical innovation unsuccessfully', and the second was 'the 14 new more or less radical concepts that were developed in collaboration with external partners'. Even though there is no change of perspective in the routine, which can be seen in picture 2, the respondent found it highly valuable to the department (here division management) that they got confirmed in the appropriateness of the actions they undertake in reaching the abstract goal they have in relation to 'knowledge exchange'.

It is important to stress that the purpose of the structured interview on a pre- and post-project basis is to *explore and identify* areas of change and influence, and not to document the degree of change. The degree of change will be interesting to study in future research, but it is not the core purpose of this study. Therefore, since the measures presented in table 1 are soft and difficult to define via hard variables for why a given performative routine on a pre- and post-project basis should be 3, 3.5 or 2, etc., it is important to stress and clarify for analytical purposes that a *change* in the defined routine measures will be represented in the analysis via a (+) for adding to a routine, a (-) for reducing a routine, a (√) for affirmation of the correctness of the exiting routinized practice, and a (-blank-) for no influence on the routine in question.

I interviewed the five innovation team members and I typed the results of the structured part of the interview into table 2 (strategic level routines), table 3 (tactical level routines) and table 4 (operational level routines) as well as I used the statements made in the semi-structured part of the post-project interview to critically question the claims made by the respondents during the structured part of the interview.

Results – radical innovation as source of change in organizational routines

The results are divided into three sections where the influence of the radical innovation project as source of change is divided into: 1) strategic level, 2) tactical level, and 3) operational level of analysis. After each level of analysis, focus will be directed at theory development, where the results seek to indicate 'simple theory' cf. Whetten (1989) where a description and an explanation of the phenomena are presented. Finally, the limitations of the new proposed theories/propositions are discussed.

The analysis is based on the total-assembled data from the EIF action research process, where key focus of the changes/effects in the institutions/departments is based on the structured part of the post-project interviews. First the results for the strategic level are presented, where the level of analysis (the what) and the influence on this level (the how) are presented, and finally where statements from the interviews are utilized to demonstrate the 'why'. Hence, the presentation of the results can contribute to the discussion of theory development later in the section cf. Whetten's (1989) recommendations. As a limitation, only the most affected levels of analysis are treated in the study, where at least four out of the five of the participating institutions/departments must have been affected. The remaining levels of analysis are not treated here, since the concrete influence of the radical innovation project cf. Brix and Jakobsen's (2013) approach has not demonstrated its effect across the larger part of the DEM's institutions/departments.

Table 2 – Radical innovation as source of change to strategic level routines

Strategic level	Ostensive routines	Inst. A	Inst. B	Admin.	Par. Dep.	Div. Mgmt
Goal(s)	Efficiency	√	√	√		+
	Effectiveness	√	√	√	+	
Operationalization of goals	Exploration	+	+	√	+	+
	Exploitation	+	√	√	+	+
Environment	Complexity	-		-	-	√
	Unpredictability					

Legend: + = more than before the project;
- = less than before the project;
√ = confirmed that behavior/routine is correct via the project;
(-blank-) = non-influenced

The analysis establishes that the larger parts of the performative routines in the participating institutions/departments were assured to appropriate in relation to the prioritization of efficiency and effectiveness. Interestingly, this confirmation of being on the 'right track' was of a high value to the managers leading these institution/departments. For example, one of the managers stated: *"I found that our institution was on the right track based on the project, because the <u>preliminary results and the insights we got from the 'challenge of assumptions' really made it clear to me that the purpose of a future institution is not only caretaking, but indeed also learning activities broadly speaking!"* Action researcher: *"So you got confirmed that the way you lead your staff before the project was in the correct direction?"* Manager Institution: *"Yes<u>, I was most certainly confirmed</u>!"* Moreover, the radical innovation project gave the Division Management new tools and new systematic methods to optimize the future work with innovation in relation to improving the usage of internal resources (efficiency) as well as the Parallel Department could use the same tools and systematics to make new initiatives in the context of existing and future development/innovation projects more specific, and thus more implementable (effectiveness). To back up this argument, the manager in the administration said: *We have started to focus much more on the outcomes of the resources we use on development projects, and <u>the systematic process we have been through in our innovation process really made it clear to us that following such a systematic to make progress was better than not having a clear guideline for the next step in different projects</u>. We had tried controlled processes before, but not as systematic as this one, and <u>our experiences have therefore acknowledged the need for strict management of such projects, since it facilitates us in reaching the goal</u>!"* In relation to these strategic priorities the performative routines in the institution/departments on exploration and exploitation were also influenced by the innovation project. Here, the concrete methods to critically search for new knowledge and to challenge assumptions influenced the routines in the participating institution/departments as well, since the involved institution/departments had started to search and explore for new knowledge other places than pre-project and that this exploration was improved as well as the results of the exploration was utilized more directly into the daily

practice, e.g. to improve a particular internal process or to start up new initiatives. A concrete example to demonstrate this claim is presented by the institution manager: "*After having completed the innovation project <u>we have started to be much more focused on exploring to get insight and we have learned new methods, which can help us in reaching our goals</u>. Also, it has been excellent to experience that all the things we worked with six months ago are now more or less directly implementable to meet the pressure from our external environment (the new school reform) and <u>we feel that we are ready to change, instead of before, where we would have been much more critical and skeptical of the changes forced from outside</u>!*"

Finally, the analysis determines that the participating institutions were less influential by changes or new demands in the external environment, since the learning that occurred during the completion of the radical innovation project could make the institution/departments react promptly to the change (here the legislation of a new reform in the school perspective). This is argued via following statement: "*Based on the experience of participating in the project my staff and I feel much more ready to face the future and whatever changes that may emerge from external forces. <u>By having worked with the whole perspective of rethinking our tasks and the outcome of our tasks in solving our goals, we are now much more used to having the thoughts of a different looking future than today, and the thoughts are actually not as scary as they would have been one year ago pre project</u>!*" Here it is presented that the DEM was because of the radical innovation project five to six months in front, knowledge wise, of other Municipalities that had not worked on a project with the magnitude or rethinking learning in the before and after school activities.

Building simple theory on the strategic level

The analysis of the pre- and post-project results on a strategic level of analysis reveal that a radical innovation project cf. Brix and Jakobsen (2013) can act as source of change on organizational routines in practice. This is argued, since the indications on the strategic level of analysis represent strong tendencies towards the influence on three important levels of aggregation in the organizational framework used to collect data for the purpose of this study.

These influenced routines are: 1) verification of organizational goals, 2) improvement of exploration and exploitation initiatives, and 3) reduction of external complexity (uncertainty). Based on this identification, three propositions are developed to guide future research:

Proposition 1: managers can test the appropriateness of their performative routines in relation to efficiency and effectiveness by initiating and completing a radical innovation process. This proposition is developed on the premise that the in-depth questioning and challenge of assumptions cf. the respondents can assist in removing false illusions and/or verifying the current actions and directions. As a complement to this, there is evidence in the anaysis indicating that the tools used in the CIS framework can improve the manner the performative routines of reaching efficiency and effectiveness are sought and prioritized to reach the goal of the organization/sub-department.

Proposition 2: managers can improve the performative routines for exploration and exploitation by completing a radical innovation project.
The second proposition is developed on the premise that the concrete methods and tools utilized to construct new knowledge and to develop it cf. the respondents was new to the DEM. Moreover, the areas of inquiry in search for new knowledge went beyond the pre-project boundaries of the institutions/departments.

Proposition 3: uncertainty from the external environment (complexity) is decreased during a radical innovation project.
The third proposition is developed on the premise that the proactive search for a different future cf. the respondents changed the mind-set of the employees and the management in the institutions/departments, making them realize that status quo cannot be maintained in practice, and because they found it more fruitful to create their own future proactively instead of responding reactively to external impetus. These propositions represent the indications on the strategic level of analysis. Below the tactical level of analysis is presented.

Table 3 – Radical innovation as source of change to tactical level routines

Tactical level	Ostensive routines	Inst. A	Inst. B	Admin.	Par. Dep.	Div. Mgmt
Configuration	Functional			√		+
	User oriented					
Organizational Complexity	Vertical differentiation					
	Horizontal differentiation					
Knowledge exchange	ICT-infused	+	√			
	Virtualization	+	√	√	+	√
Task design	Standardized					
	Divisibility					
People	Number of people					
	Professionalization		√	√		
Leadership style	Risk avoidance	√	-		√	
	Delegation of responsibility	+				
Organizational climate	Tension					
	Readiness for change	+	+	+	√	√

Legend: + = more than before the project;
 - = less than before the project;
 √ = confirmed that behavior/routine is correct via the project;
 (-blank-) = non-influenced

The routines in the institutions/departments were especially affected on three concrete tactical levels of analysis, being "knowledge exchange", "leadership style" and "organizational climate". In relation to "knowledge exchange", hereunder "virtualization", the participating institutions/departments have started to work more professionally with knowledge creation and – management as well as improving the process of decision making, because they during the project experienced the value of collaborating with people with high expertise, both internally and externally to the DEM, when challenging assumptions and developing new ideas. The argument for these changes across the participating institutions/departments were argued e.g. because of the "positive and provocative disturbances" that were created by challenging the underlying assumptions driving the routines. See for example the statement from the manager in Institution A: "*Before, I did try to challenge the way in which we worked in our institutions in the municipality, but it never really made any significant changes – perhaps because we all were alike and that we all were from the same division and thus we*

were influenced by similar ways of thinking, etc. So our participation in the innovation project with external consultants as project leaders was a real eye-opener, since they were not colored by our ways of thinking!" The same line of argumentation was made by the project member from the Parallel Department, arguing that: "*The project created a healthy disturbance in our department, because we had never been used to work so long time in a pre-ject phase – that is, we are more used to make quick decisions here in the Municipality, but the method and the collaboration with the external consultants gave us some very thoroughly prepared concepts and it is quite certain that we will collaborate more with external consultants in the future, simply because of this healthy provocative disturbance!"* As a complement to the change in relation to external knowledge search, the administration got confirmed in their current focus of offering professional education to their staff across the DEM, because of the increasing demand for specialization. In relation to the tactical level of analysis "organizational climate", hereunder "readiness to change" the participating institutions/departments experience an increase in the search for new ways of working by the staff and the increase of mandate given from the management to initiate the new exploration. The manager in Institution A claimed: "*The project has affected the institution in such way that the readiness to change has increased since we have learned to see the potential in exploring new ways of working, instead of being reactive to the changes that occur in the future. Right now the culture in our institution has changed to be more searching for new things and also to try to integrate the new things (...) we are not self-satisfied as much as before – normally we did not have to change anything, because everything was nice, the parents were happy and the children kept coming. But now, we are ready to offer an even better service to the children and the parents, and the self-satisfaction has been made lower, since the inspiration that occurs in the context of searching for new insight!"* In line with this argument, the project manager from the Department Management said: "*On the immediate notice, there is a clear result in the 'readiness to change' now after the project compared to before we initiated the innovation project – before the leaders were more reactive and now, they are more ready to change. Still, the ones who are most ready to change are the managers*

who participated in the innovation team, then the managers who participated in the workshops, etc. But on a general scale, most of the managers are more ready to change. And this immediate result is excellent, because in the future there will be additional changes, and the requirement for change-preparedness will be even higher!" Hence, the increase in readiness to change has boosted the desire for change from previously being reactive and counter-change towards the sprouting desire to seek changes proactively to co-create rather than adjust to the future needs.

Building simple theory on the tactical level

The analysis of the pre- and post-project results on a tactical level of analysis likewise reveal that a radical innovation project cf. Brix and Jakobsen (2013) can act as source of change on organizational routines in practice. This is argued, since the indications on the tactical level of analysis represent strong tendencies towards two highly influenced levels of aggregation in the organization design framework. These influenced routines are 1) the usage and co-creation of knowledge from/with external sources and partners, and 2) increase of readiness for change.

Proposition 4: the performative routines used to search for and constructing new knowledge with external partners (virtualization) are improved during a radical innovation project.

This proposition is developed on the premise that the concrete experience as well as the tools and methods utilized in the CIS framework assisted the respondents in refining the performative routines in creating applicable results of direct value to the institutions/departments.

Proposition 5: the employees and management's 'readiness to change' is increased during a radical innovation project.

This proposition is developed on the premise that the respondents claimed that the readiness for change in their institutions was increased towards a more open and proactive approach compared to pre-project attitudes. Moreover, the new insights in the departments/institutions demonstrate that pro-activeness assists in molding the future. These two propositions

represent the indications on the tactical level of analysis. Below the operational level of analysis is presented.

Table 2 – Radical innovation as source of change to operational level routines

Operational level	Ostensive routines	Inst. A	Inst. B	Admin.	Par. Dep.	Div. Mgmt
Coordination and control	Formalization					
	Decentralization					+
Information systems	Amount of information					
	Tacitness of information	+	+		+	+
Incentives	Target of incentives					
	Basis of evaluation	-	-	-		-

Legend: + = more than before the project;
- = less than before the project;
√ = confirmed that behavior/routine is correct via the project;
(-blank-) = non-influenced

The changes that occurred to the organizational routines on the operational level in the participating institutions/departments were centered on two key aspects: first, the level "information systems", hereunder "tacitness of information", and secondly, "Incentives", hereunder the "basis of evaluation". Because of the professionalization of the work with knowledge generation and management had been improved so had the "tacitness of the information" increased in the institutions/departments. For example, the 14 radical new the concepts had made it more difficult to explain the background and the estimated outcomes for the project teams to the projects stakeholders, as well as the change in performative routines regarding expert knowledge search and integration had challenged the hitherto way of working, since the new knowledge had to be translated into a genre relevant to the different stakeholders. For example, the manager from Institution A claimed that: "*The complexity of our communication has been increased since we are starting to work with more goal-oriented activities than before and we have prioritized a more professional approach to solving our tasks compared to before. And both my colleagues and I will do the best to deliver excellent value to the children – and to the parents, since they are the actual customers!*" The manager in Institution B made a complementing argument, saying: "*The project has made some of the*

information we need to communicate <u>more complex because insights from other knowledge</u>

<u>arenas have been integrated to the ideas and already into our daily live</u> here at the institution.

The 14 ideas we proposed in the innovation team had to be made more "understandable" for

our staff, and also for other stakeholders, and this has been a complex situation. <u>We have to</u>

<u>translate some of the things so they can be understood for the staff</u>!" The project manager

from the Division Management stated that: *"We have via our experiences in the project found*

<u>that it is important to communicate at all levels about new initiatives, and not only to the City</u>

<u>Council or to the inhabitants in the municipality. If we want to make sure that the things we</u>

<u>develop do not get misinterpreted by people afraid of change,</u> on all levels that is, then we

need to accept that it is quite complex to share this kind of information to different types of

people who has different backgrounds and who are or could be affected differently by the

implementation of such initiatives!"

Finally, the managers in the institutions as well as in the Division Management had changed

their performative routines regarding the basis of evaluation in the context of incentives and

the project manager got acknowledged that the way in which the Division Management give

incentives to it's employees were fitting to promote the desired behavior. This argument was

made clear, because the managers stated that they had started to positively reinforce their staff

based on their behavior rather than only on the results of their behavior. In example, the

project manager from the Division Management said; "*We will begin to focus more the on the*

acknowledgment of good behaviour and not only good results, simply because if <u>we desire</u>

<u>ideas beyond the usual, then we need to foster experimenting behaviour from our employees!</u>"

This line of argument was also claimed by the manager in Institution B, stating that: "*I now*

find myself more focused on rewarding behavior than results, because <u>I realized via the</u>

<u>project that you can learn many things with the right behavior</u> (...) therefore I find the focus

on behavior more important than before (the radical innovation project)!"

Building simple theory on the operational level

As with the strategic and tactical level of analysis, the analysis of the pre- and post-project results on a operational level of analysis also reveal that a radical innovation project cf. Brix and Jakobsen (2013) can act as source of change on organizational routines in practice. This is argued, since the indications on the strategic level of analysis represent strong tendencies towards the influence on two highly influenced levels of analysis. These factors are: 1) increased tacitness of information, and 2) basis of evaluation.

Proposition 6: the tacitness of information that needs to be communicated to the projects stakeholders (and understood by them) increases during a radical innovation.

This proposition is developed because the new knowledge that was constructed via the project was cf. the respondents different to the knowledge communicated ordinarily in the institutions/departments on a pre-project basis.

Proposition 7: the basis of incentives is moved from a result-oriented evaluation towards a more behavior-oriented evaluation during a radical innovation project.

This proposition is developed since the managers participating in the innovation team realized and thus claimed that the value of a proactive and knowledge-seeking behavior of their employees, where results are not immediately noticeable, is of key importance to foster radical innovation instead of a result-oriented feedback that fosters short-termism.

Discussion and implications

Organizational perspectives

By referring to the goal of the study, the findings and the developed propositions establish that the scope and impact of investing in a radical innovation project, in this study cf. Brix and Jakobsen's (2013) CIS framework, is further reaching than performance measures traditionally conceived, e.g. by referring to the Oslo Manual (OECD 2005). Hence, the key implication in an organizational perspective is that the myopic focus on technological measurements of innovation projects should be broadened when monitoring and evaluating these projects in practice. This is argued, since this study determines that a large and hitherto

unnoticed element has been left out of the consciousness of management thinking, being the non-technological innovations emerging unnoticed across the entire organization as a radical innovation project evolves – here referred to as the change and/or the approval of the organizational routines used to govern everyday activities and innovation efforts. It can thus boldly be claimed that even though a radical innovation project might fail concerning the intended purpose, the multiple emerging changes and/or verification of organizational routines optimize the organization's focus and performance in such way that success on an organizational level of analysis is evident. This is argued since six concrete propositions including performative routines were influenced in a positive manner in the five participating institutions/departments.

Finally, even though many of the performative routines used to fulfill the ostensive routines have been improved/confirmed as being appropriate on both a strategic, tactical and operational level of analysis, the increase of new insight and knowledge makes it more difficult for the organizational members to create a common understanding amongst the project's stakeholders, since the information that needs to be shared is different from what is ordinarily communicated internally and externally. Therefore the documented increase in 'tacitness of information' is the single disadvantage found in the development of the seven propositions that potentially can inhibit the success in the organizations, if appropriate actions are not taken.

Academic perspectives

The EIF action research approach cf. Schein (2008) represents a novel approach to study organizational routines with the discovery, the explanation and the development of the seven new propositions. These propositions claim knowledge to the purpose of the study, which as a remainder, is to explore a radical innovation project as source of development and change in organizational routines (here also referred to non-technological innovation).

Hence, because 7 specific propositions are developed determining the influence or change across an organizational design framework in multiple divisions/departments, this study

contribute with a new embryonic research agenda that provides novel indications to research on the dynamic of routines in the context of innovation management. In addition, new knowledge is claimed by the propositions to Schmidt and Rammer's (2007) research on non-technological innovation, where focus is on changing and restructuring organizational routines in general in relation to innovation projects. Likewise, the study stresses that non-technological innovations occur faster and more dynamically than the emergence of the intended goal of the initiated radical innovation project – an indication that claims new insight to Mothe and Nguyen Thi's (2010) research on the link between technological and non-technological innovation. In addition, the findings support Feldman (2000), Pentland and Feldman (2005) and Pentland, Hærem and Hillison's (2011) research on the dynamic nature of organizational routines, since the influenced routines are not only verified and changed; they are also developed to induce future changes via proactive exploration and search for new insight. Method-wise the overall findings contribute to Brix and Jakobsen's (2013) call for further empirical research to increase the understanding of the value of working with radical innovation in practice, since the radical innovation framework's systematic and concrete methods acted as a transformational experience (McGrath 2001) for the innovation team and the institutions/departments they were affiliated with. Finally, the longitudinal case study applied with the organization design framework was found beneficial in collecting and analyzing data in relation to non-technological innovation/organizational routines. Therefore, it is argued that the organizational design framework can be applicable as basic foundation for further research cf. Annex 2 in OECD's (2005) Oslo Manual, where the OECD calls for further research on the non-technological innovation at an organizational level of analysis. Still, further research is needed to shed light on the developed propositions, both in relation to size of the organization, if differences exist between public and/or privately owned institutions, and if there are differences between local, national and international oriented organizations.

Limitations

The findings utilized to determine the changes in organizational routines (the non-technological innovations) are based on a single longitudinal case study with an embedded case-design (Yin 2009) constituted of five institutions/departments in the DEM. Therefore, the development of the 7 propositions are of indicative nature and not generalizable for all organizations, as well as the degree of change and/or influence of the radical innovation project as source of change has not been treated in this study. There will be a need for further research to explore if these are general tendencies across other public institutions, if the effect on national organizations is different from international ones, as well as the effect differ when comparing large versus small and medium-sized enterprises. In addition, the organizational design framework used to collect and analyze the data has not prevailed pre- or post-project misfits (Burton, Obel and DeSanctis (2010) in the case institutions organization design – it is not the purpose or the focus of the end result of the initiated project. For that purpose, the original step-by-step approach must be utilized (ibid.). The strengths of the study, although being bold in nature, is the high level of replicability, since the overall data has been collected in the context of a research-oriented innovation framework (Brix and Jakobsen 2013), the semi structured as well as the structured interview data has been collected by the organizational design framework, and the analysis of data has been demonstrated in practice in the section 'applied method'. Hence, the study has presented a clearly articulated story with a transparent and replicable research design, and therefore it is argued that it can serve as an imperative foundation for further research on radical innovation as source of change on organizational routines (non-technological innovation), both on an organizational level of analysis, and in relation to innovation policy on both regional, national and international level of analysis.

Conclusion

By offering a data rich story and transparent analysis, this study provides evidence of how the initiation and completion of a radical innovation project act as source of change in organizational routines in practice.

The contribution to the organization routines literature is threefold. First, a bold setup of identifying generic ostensive routines via an organization design framework is developed, which is sought to claim new knowledge to scholars arguing that this task would be like isolating the Gulf Stream from the Atlantic Ocean (Pentland and Feldman 2005). Secondly, the application of the analytical framework enabled the development of seven propositions that can be used to understand how organizational routines are affected by working with radical innovation in practice, as well as they can guide further research. Six of the developed propositions determined either verification or optimization/recreation of the performative routines used to carry through daily operations and the work with innovation. On the other hand, one proposition demonstrated a downside, being the increase of the 'tacitness of information' that needs to be communicated in an understandable manner to both internal and external stakeholders. These propositions put emphasis on the dynamic view of organizational routines cf. Feldman (2000), Feldman and Pentland (2003) and Pentland, Hærem and Hillison (2011) to foster rich opportunity to collect empirical primary data to claim new knowledge to the highly important – but often neglected – unit of analysis; the routines driving the operations and innovations in contemporary organizations (Pentland and Feldman 2005). Thirdly, the study demonstrated that the realization of these effects of the performative routines used to carry out the ostensive routines was not consciously recognized by the members in the innovation team before they participated in the structured part of the post-project interviews, where the interviewer compared the pre-project answers with the post-project answers regarding performative routines within the five institutions/departments. Hence, positive changes occurred unnoticed in relation to optimization of the internal work processes – changes that were highly appreciated and surprising to the innovation team

members, when realized. More research is needed to investigate this phenomenon, since it further can assist in explaining the dynamics of organizational routines.

The contribution to the innovation management literature is fourfold. First, the description and explanation of the emergence and development of non-technological innovation (the changes of organizational routines) claim new knowledge to Schmidt and Rammer's (2007) research, since the study determines that non-technological changes do occur, and indications were presented for explaining the concrete changes that occur during and immediately after the completion of a radical innovation project. Secondly, in line with this, the findings explain a link in relation to a time perspective between technological and non-technological innovation cf. Mothe and Nguyen Thi (2010), where the non-technological innovation emerges (unnoticed) during the radical innovation project, and therefore before the intended outcome of the initiated project. Thirdly, the development of the seven propositions unveil that the scope and impact from investing in a radical innovation project following Brix and Jacobsen's 2013 'Creative Idea Solution© framework' is further reaching than traditionally conceived performance outcomes, and that investing in such a high uncertainty project is not necessarily valueless even though the intended goal of an initiated project might not be reached – this contributes to Brix and Jakobsen's (2013) research method prescribing radical innovation in organizations. Fourthly, the analytical framework of ostensive routines inspired by organization science scholars (Burton, Obel and DeSanctis (2010) has demonstrated to be an appropriate tool to collect and analyze data to understand the under-researched phenomena of non-technological innovation – a need that highly requested by the OECD (2005). The framework is in its embryonic state and further research is needed to understand and explain the full potential of it.

As a final remark, this study indicates that the new adage proposed in the introduction – old habits die easily – is finding its way into the routines literature, since it is the collection of individual habits that drive performative routines and thus operations and innovation in practice.

References

Alberts, D.S. 2012. Rethinking organizational design for complex endeavors, *Journal of Organization Design* **1**(1) 14-17

Anderson, N., Drue, C.K.W., and Nijstad, B.A. 2004. The routinization of innovation research: a constructively critical review of the state-of-the-science *Journal of Organizational Behavior* **25** 147-173

Becker, M.C. et al. 2005. Applying organizational routines in understanding organizational change *Industrial and Corporate Change* **14**(5) 775-791

Bettis, R.A. and Hitt, M.A. 1995. The new competitive landscape, *Strategic Management Journal* **16** 7-19

Brix, J. and Jakobsen, H.S. 2013. Corporate Creativity – Introducing the Creative Idea Solution[©] framework, *International Journal of Innovation and Learning* **13**(4) 388-405

Burke, W.W. 2011. *Organization change, theory and practice*, 3rd edition Sage Publications, USA

Burton, R., Obel, B. and DeSanctis, 2010. *Organizational Design: A step-by-step approach*, 2nd edition, Cambridge University Press, Cambridge

Christensen, C. 1997. *The innovator's dilemma: When new technologies cause great firms to fail*, Harvard Business School Press, Boston

Crossan, M.M. and Apaydin, M. 2010. A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the literature, *Journal of Management Studies* **47**(6) 1154-1191

Daft, R.L., Murphy, J. and Willmott, H. 2010. *Organization theory and design*, 10th edition, Cengage Learning, England

D´Aveni, R.A., Canger, J.M. and Doyle, J.J. 1995. Coping with hypercompetition: Utilizing the new 7s's framework, *The Academy of Management Executive* **9**(3) 45-60

Ettlie, J.E., Bridges, W.P. and O'Keefe, R.D. 1984. Organization Strategy and Structural Differences for Radical Versus Incremental Innovation, *Management Science* **30**(6) 682-695

Eisenhardt, K.M. 1991. Better Stories and Better Constructs: The case for rigor and comparative logic, *Academy of Management Review* **16**(3) 620-627

Eisenhardt, K.M. and Graebner, M.E. 2007. Theory Building from Cases: Opportunities and Challenges, *Academy of Management Journal* **50**(1) 25-32

Farjoun, M. 2010. Beyond dualism: stability and change as a duality, *Academy of Management Review* **35**(2) 202-225

Feldman, M.S. 2000. Organizational Routines as a Source of Continuous Change, *Organization Science* **11**(6) 611-629

Feldman, M.S. and Pentland, B.T. 2003. Reconceptualizing organizational routines as source of flexibility and change Administrative Science Quarterly **48**(1)

Feldman, M.S. and Rafaeli, A. 2002. Organizational routines as sources of connections and understanding, *Journal of Management Studies* **39**(3) 309-331

Guest, D.E. 2010. Human resource management and performance: still searching for some answers, *Human Resource Management Journal* **21**(1) 3-13

Hamel, G. 2003. *Leading the revolution: How to thrive in turbulent times by making innovation a way of life*, Harvard Business School Press, Boston

Hammersley, M. and Atkinson, P. 1995. *Ethnography: principles in practice*, 3rd edition, Routledge, New York

Harry, M.J. and Schroeder, R. 2006. *Six Sigma: The breakthrough management strategy revolutionizing the world's top corporations*, Doubleday, USA

Huber, G.P. 2004. *The Necessary Nature of Future Firms*, Sage Publications, California

Huber, G.P. 2011. *Organizations: Theory, Design, Future*. In. The APA Handbook of Industrial and Organizational Psychology – Building and Developing the Organization, vol.1, American Psychological Association, Washington DC

Jakobsen, H.S. and Brix, J. 2012. The 'Vertical Innovation Process': constructing sustainable business models in practice *International Society for Professional Innovation Management: Innovation Symposium, Seoul, December* Conference Proceeding

Leifer, R. et al. 2000. *Radical innovation: how mature companies can outsmart upstarts*, Harvard Business School Press, Boston

Liedtka, J.M. and Parmar, B.L. 2012. Moving design from metaphor to management practices, *Journal of Organization Design* **1**(3) 51-57

McGrath, R.G. 2001. Exploratory learning, innovative capacity, and managerial oversight, Academy of Management Journal **44**(1) 118-131

Miles, R.E. 2012. The centrality of organization design, *Journal of Organizational Design* **1**(1) 12-13

Mothe, C. and Nguyen Thi, T.U. 2010. The link between non-technological innovations and technological innovation, *European Journal of Innovation Management* **13**(3) 313-332

O'Connor, G.C. et al. 2008. *Grapping Lightning: Building a capability for breakthrough innovation*, Jossey-Brass, San Francisco

OECD 2005. *The Oslo Manual: Proposed guidelines for collecting and interpreting technological innovation data*, Organisation for Economic Co-operation and Development, European Commission, Brussels

Pentland, B.T. and Feldman, M.S. 2005. Organizational routines as a unit of analysis, *Industrial and Corporate Change* **14**(5) 793-815

Pentland, B.T. 2011. The foundation is solid, if you know where to look: comment on Feling and Foss, *Journal of Industrial Economics* **7**(2) 279-293

Pentland, B.T., Hærem, T. and Hillison, D. 2011. The (N)Ever-Changing World: Stability and Change in Organizational Routines, *Organization Science* **22**(6) 1369-1383

Prahalad, C.K. and Hammond, A. 2002. Serving the world's poor, profitably, *Harvard Business Review*, September, pp.4-11

Rearson, P. and Bradbury, H. 2008. *Handbook of action research*, SAGE Publications, London

Sathe, V. 2003. *Corporate Entrepreneurship: Top managers and new business creation*, Cambridge University Press, Cambridge

Schein, E.H. 2008. *Clinical inquiry/research.* In. Rearson, P. and Bradbury, H. (2008) *Handbook of action research*, SAGE Publications, London

Schmidt, T. and Rammer, C. 2007. Non-technological and Technological Innovation: Strange Bedfellows?, *ZEW Discussion Papers* **07**(52), http://hdl.handle.net/10419/24623

Trott, P. 2012. *Innovation management and new product development*, 5th edition, Prentice Hall, England

Whetten, D.A. 1989. What constitutes a Theoretical Contribution?, *The Academy of Management Review* **14**(4) 490-49

Yin, R.K. 2009. *Case study research – Design and Methods*, 4th edition, Sage Publications, London

Radical innovation in and for the future – research and organizational implications

"Now when you've almost completed your doctoral dissertation about innovation

management, what would you recommend me to do in my organization?"

The question above is not in any way unique – I have been presenting my work in many organizations, in seminars and at many network meetings for business professionals. There is always somebody interested in innovation asking this question and therefore, since people in the industry and in public institutions find it relevant, I have dedicated this part of the section to summarize four key elements that can be substantiated by my research.

First: if you want to work with radical innovation, you need to understand the consequences of this decision. Since radical innovation projects are of high uncertainty, it will take you many man-hours to reduce this uncertainty, because the team working on the project needs to learn many new things that are both difficult to find and to understand. In short, you will most likely not be able to create invoices on your innovative strivings the first 6 – 18 months of the project because the members in your team will still find themselves in a learning process.

Second: when working with high uncertainty projects you must not be in doubt about what to do and you must know how to create progress. Therefore, if you want to work professionally with innovation, you need to apply a systematic framework, create a schedule and not compromise by accepting short-termism. The key message here is that the work with innovation must never be based on random events without clear goals and direction.

Third: when recognizing opportunities and developing ideas one must critically examine the arguments and the knowledge used to make decisions or to create progress during idea development. During the study it became evident that many people reduced the potential of

the ideas they were developing. This was because they 1) took for granted what they knew, or 2) they thought that their experiences were enough to base decision upon – which was often not the case, because these experiences were outdated, e.g. regarding what was possible in the context of new technology or software, in the context of legislation, etc.

Fourth: do not hesitate to start up a radical innovation project. Working systematically with high uncertainty projects most likely creates new insights that can act directly as incremental innovation to the organization. These incremental innovations can both be optimization of the organizational routines, as well as improved production processes and products.

The emerging driving forces of radical innovation

I dedicate this section to a broader perspective on future research on radical innovation. During the last three years of practical experience I have observed some new tendencies/anomalies that are starting to sprout. These tendencies are presented as three bold suppositions, which I have entitled *the 'driving forces' of radical innovation*. Together with the implications presented in the papers, the tendencies/anomalies I have defined below should be treated in future research:

1) Organizations that focus on new business models *including* technology are increasingly becoming the driving force of radical innovation compared to organizations focusing *only* on technological innovation!

2) Organizations that focus on exploiting (new) legislation in their business model(s) are more likely to create radical innovation compared to organizations that do not take legislation into their business model(s)!

3) Technologically driven organizations that focus on identifying *multiple areas of application* of the *function* of their technology are more likely to create radical innovation than companies focusing only on the immediate usage of it! (Moving beyond the 'one technology – one product' increases the possibility to enter new unforeseen markets.).

I look forward to shed light on these propositions in the near future and to keep broadening the current understanding of radical innovation, both in research and practice. I invite all interested scholars and practitioners to join me in my effort, so we can help organizations prosper and hereby create new jobs.

Appendix 1: co-author agreement first paper

Aarhus University, School of Business and Social Sciences, Department of Business Communication & Danish Technological Institute, Center for Technology Partnership

Co-Author agreement

This co-author agreement concerns the paper:

Brix, J. and Jakobsen, H.S. (in press) Corporate Creativity – Introducing the Creative Idea Solution framework, *International Journal of Innovation and Learning,* **Vol.xx No.yy**

Industrial PhD student, Jacob Brix, is the lead author of the paper and he is the main contributor of the scientific quality as well as he is responsible for pinpointing the overall scientific contribution.

Senior innovation consultant, Henning Sejer Jakobsen, is the creator of the CIS framework presented in the paper, and he is responsible for accessing data as well as co-collecting data for the paper. Moreover, Henning Sejer Jakobsen has assisted in revising the paper into the final submission, and he also assisted in the final approval of the responses to the double blind review committee.

In short, the author team, with Jacob Brix as lead, has used the suggestions from Tjosvold (2008) as well as we have followed the suggested guidelines of the COPE Report 2003 to secure ethical authorship.
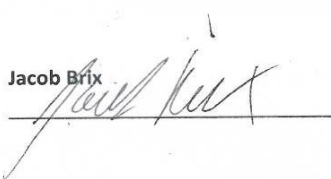
Sources:

Albert, T. and Wager, E. (2003) The COPE Report - how to handle authorship disputes: a guide for new researchers, *Committed on Publication Ethics*

Tjosvold, D. (2008) Constructive Controversy for Management Education: Developing Committed, Open-minded Researchers, *Academy of Management Learning & Education*, Vol.7 No.1 pp.73-85

Aarhus, date: D. 01 M. 02 Y: 2013

Jacob Brix

Henning Sejer Jakobsen

Appendix 2: co-author agreement third paper

Aarhus University, School of Business and Social Sciences, Department of
Business Communication & Center for Teaching and Learning

Co-author agreement

To Whom It May Concern:

This co-author agreement concerns the paper:

Brix, J. and Lauridsen, O. (in press) Improving learning competencies in the
context of radical innovation: a team perspective, *International Journal of
Innovation and Learning*, Vol.xx No.yy PP.000

Industrial PhD student, Jacob Brix, is the lead author of the paper and he has
been responsible for the data access as well as data collection following the
method described in the paper.

Associate Professor Ole Lauridsen is responsible for the section concerning
the introduction of the Building Excellence (BE) learning styles construct.

Both authors have equally contributed to the analysis and the conclusions as
well as implications of the paper.

Therefore the author team has used the suggestions from Tjosvold (2008) as
well as we have followed the suggested guidelines of the COPE Report
(Albert and Wager, 2003) to secure ethical authorship.

Sources:

Albert, T. and Wager, E. (2003) *The COPE Report – how to handle authorship
disputes: a guide for new researchers*, Committee on Publication Ethics

Tjosvold, D. (2008) Constructive controversy for management education:
Developing Committed Open-minded Researchers, Academy of Management
Learning & Education, Vol.7 No.1 pp.73-85

Aarhus, date: D. 24 M. 06 Y. 2013

_____
Jacob Brix

_____
Ole Lauridsen