How is value created and exchanged in different stages and different types of university-industry collaborations?

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Abstract

Through a longitudinal research project of university-industry collaborations comprising of 72 semi-structured interviews, this paper studies the creation and exchanging of value in a total of 38 university-industry collaborations. We distinguish between philanthropic, transactional and integrative type collaborations across a project stage model comprising the phases: contact, initialization, process and termination. Finally, we also take into account whether or not the collaborations involve companies and researchers, companies and students or all three agent-types. Initially we apply the framework of the business model canvas to analyze the value proposition from each of the three agent types. The results give important understandings of the transfer of knowledge and point towards problems of existing collaboration negating the value flow during the process. This is especially the case with student-company collaborations, but it is also evident in researcher-company collaborations. Both value creation and value exchange appear strongest in the initialization and process stages but often have their focus in the termination phase.

Key words

University-industry collaboration, value creation, value exchange, knowledge transfer

KASK:VIE VIDENSAMARBEJDE INNOVATION ENTREPRENØRSKAB

DEN EUROPÆISKE UNION Den Europæiske Fond for Regionaludvikling

Interreg IVA ÖRESUND – KATTEGAT – SKAGERRAK

Introduction

In an environment of increasing international competition, rapid technological change and globalization there has been a trend towards collaboration between organizations (Otley, 1994; Gulati & Gargiulo, 1999; Castells, 2000; Grabher, 2002; Batonda & Perry, 2003; Håkansson & Lind, 2004; Barnes *et al.*, 2006). At the same time governments are encouraging collaboration between universities and industry with the aim of promoting innovation and strengthening wealth creation (Barnes *et al.*, 2006; D'Este & Patel, 2007; Lundvall *et al.*, 2008). This has spurred a growing trend towards greater collaboration between universities and industry (Barnes *et al.*, 2002) and there has been a rise in commercial knowledge transfers from universities to practitioners (Siegel *et al.*, 2003).

From the perspective of the individual company university-industry collaborations have several potential benefits; technology and expertise, enhanced reputation and image, skill development, enrichment of corporate values and culture, technology testing and development, new perspectives, recruiting and retention, etc. (Austin, 1998; Kanter, 1999; Austin, 2000). From the perspective of the university and the scientists university-industry collaborations have the potential to provide funding, to provide insight in own research and to test application of theory (Lee, 2000, cf. Carayol, 2003 p. 890). In addition Siegel *et al.* (2003) find that scientists collaborating with companies often have a higher scholarly productivity.

But not all collaborations are alike and value is created and exchanged in different stages of the collaborative projects depending on the type of collaboration. Therefore, there is a need to further illuminate how and when value is created and exchanged in university-industry collaborations. Hence, the purpose of this paper is to build a model that captures the creation and exchange of value in U-I collaborations. Based on this model the paper seeks to build recommendations on how to manage these collaborations with the aim of optimizing value creation and exchange.

The paper applies a business model perspective with the aim of clearly illustrating how the parties affect each other's value propositions. Thus, we consider the parties to be each other's key partners. The business model approach applied in this paper is inspired by Osterwalder & Pigneur (2009), who define a business model as a description of the value a company offers its customers; the architecture of the firm and its network of partners for creating, marketing and delivering this value in order to generate profitable and sustainable revenue streams.

University scientists have in most studies represented the university side of the collaborations. However, this study, like Collinson & Quinn (2002), will also regard the students as representing the university. This means that both student-company collaborations and scientist-company collaborations are studied in order to put a broader perspective on the knowledge exchange between universities and industry.

The collaboration matrix

Grabher (2002) points out the saying "a project, is a project, is a project" is oversimplified and cannot be used in a modern approach to how and why projects are successful. Furthermore, Batonda & Perry (2003) argue that every project goes through different stages. The purpose of this paper is, as mentioned in the introduction, to capture how value is created and exchanged in collaborations, and in the perspective of Batonda & Perry (2003) it is necessary, to view the value creation in the different stages of a project. In the context of this paper and in line with the guidelines of Batonda & Perry (2003), a project is presumed to go through four active stages and may enter an inactive stage. The four active stages are 'contact', 'initialization', 'process' and 'termination'. The contact stage is where the searching process takes place to find the proper company/person and initial contact is made. Following the contact stage, the project enters the initialization stage that encompasses how the project is started, exemplified by the match of expectations and the first physical meeting. The process stage is the ongoing project and elements like conceptualizing, ongoing planning and execution. The final active stage is the termination. At this point the project deadline is reached and the results are shared and evaluation takes place, and, if wanted, a renewal. The inactive stage is called dormant, where some projects can be found, due to change in the business or/and the project and thereby setting the project on standby. This inactive stage will not be part of the matrix.

To add another dimension, Collinson & Quinn (2002) argue, somewhat like Grabher (2002), that each collaboration project will have its own unique features. Austin (2000) adds that it makes sense to view collaborations through a continuum. Austin (2000) argues that relationships can evolve over time, so the continuum concerns the maturity of collaborations, and the benefits and challenges this involves. Combining these thoughts a collaboration matrix can be made, as shown below:

	Philanthropic	Transactional	Integrative
Contact			
Initialization			
Process			
Termination			

Austin (2000) defines some features for each stage in the collaboration continuum, so the characteristics of each collaboration project can be identified. The *Philanthropic* stage relationships are limited in terms of resources and interaction, and somewhat characterized by charitable giving and with expectations like a “thank you" note. The *Transactional* stage is characterized by a mutual exchange of benefits, and the benefits are consciously found and sought. The relationships in the *Integrative* stage are defined by higher levels of interaction and very few boundaries between the collaborating parties, and the feeling of two parties in the collaboration diminish and turn into a sense of community.

The thought of value being created in a collaboration process is also an area of interest to Austin (2000), which he describes through four value construct dimensions. *Value definition* is where the parties in the collaboration define what value is to the individual part but also in the collaboration, which is important in all stages of collaboration.

Value Creation is likewise important, but has different occurrence characteristics in the continuum. In the philanthropic stage it is mostly concerned with resource transfer, where the giver of resources gets a good feeling, like in the form of donations from companies to scientific research. From the transactional view the creation of value is defined as core competencies exchange, where special capabilities of a partner benefit the other partner and the collaboration. Finally in the integrative stage the value creation is identified as joint value creation, thus not only the partners gain from the value, but it benefits a joint service or product, which makes the product unique due to the existence of the collaboration.

Value balance is important in all collaboration, since most parties will feel stronger about the collaboration with a proper value balance and thereby mutual benefits. In the philanthropic stage this element is not so important as resources go only one way without much balance to be made. On the other hand it is very important in the transactional stage, so both parties gain advantages, as a

distorted balance may harm the collaboration. The same is present in the integrative stage but here it is easier to obtain the balance since the parties of the collaboration have the sense of community.

Value renewal is the point where the collaboration benefits may erode and thereby needs renewal. This is not much of a problem in the philanthropic stage, since most resources are exchanged only one way, and thereby there is little to erode. The transactional stage should recognize this issue, since factors could change the value in the collaboration, hence the need for renewal and new value definition, if the collaboration is to continue without tipping the value balance. In the integrative stage this renewal should be ongoing since the parties in the collaboration could be seen as one, and thereby activities and resource exchange should continuously evolve.

Analysis of U-I collaborations from a business model perspective

A requisite for investigating the creation and exchange of value in university-industry collaborations is a fundamental understanding of what constitutes value in such relationships. In this regard it is important to distinguish between what companies regard as value and what academia – scientists and students – regard as value. Thus, it is widely acknowledged that the parties have very different, and sometimes conflicting, motives for entering collaborations. In the following sections it is illustrated how different potential benefits relate to the business models of scientists, companies and students. Changes are primarily related to the input sides of the business models, and thereby the value propositions are naturally affected.

Lee (2000) has identified a range of reasons for both scientists and companies to collaborate. He states that university-industry collaborations provide scientists with a number of opportunities. For instance he points out that industry collaboration gives scientists access to external funding and research data. Furthermore, the scientists are provided with knowledge about application of research and business opportunities. In the following sections we apply Osterwalder & Pigneur's (2009) business model canvas to analyze the value propositions of university-industry collaborations from the perspectives of each overall agent.

The value proposition of the scientist

Below we illustrate how these benefits relate to a potential business model of a researcher. The business model below is based on the assumption that the primary objective of a researcher is to

gain scientific reputation, e.g. by publishing contributions to scientific journals. This assumption is in line with for example Bruneel *et al.* (2010, p. 859) and Siegel *et al.* (2004, p. 118).

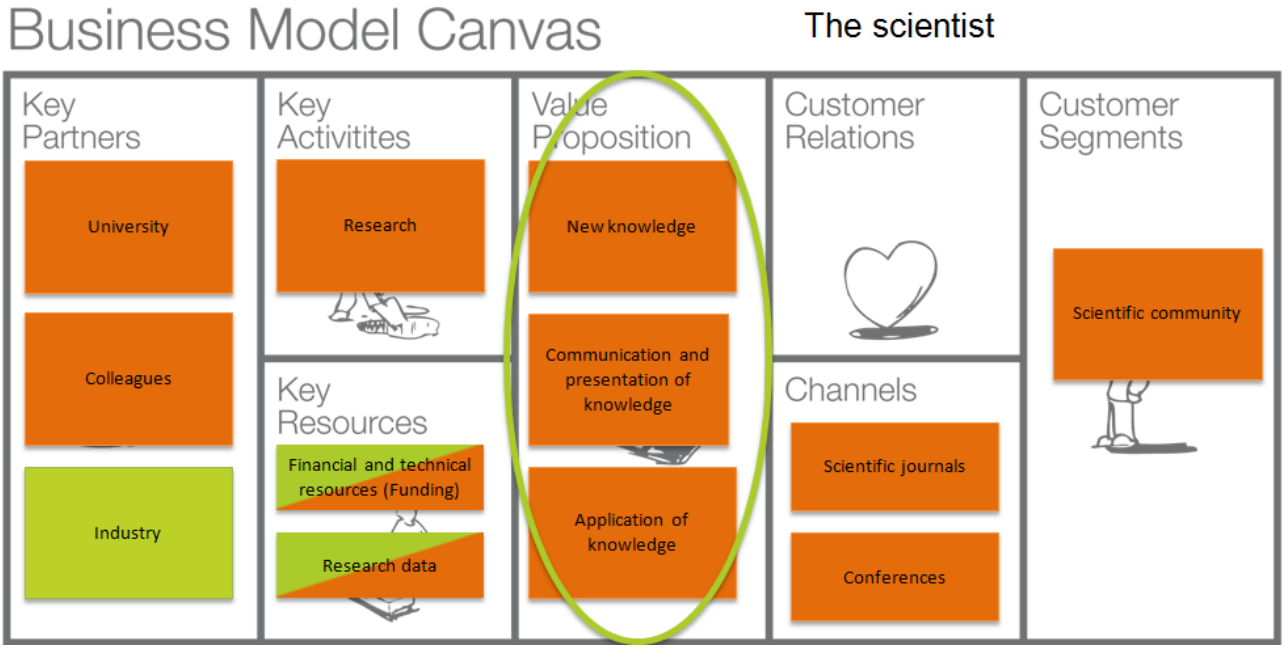

Figure 1: The Scientist Business Model Canvas

The elements of a traditional business model are pictured in orange color, whereas the elements that are affected by a U-I collaboration are pictured in green. The value proposition is naturally affected by the nature of the elements of input. It is seen that industry appears as a key partner that contributes to the scientist's key resources. For example, companies have the potential to contribute with both financial and technical funding of research projects. Furthermore, a company can give the scientist access to research data that can form the value proposition, e.g. in the form of new knowledge, in a certain direction making it more interesting to the scientist's "customers" and thereby enhancing her/his reputation.

The value proposition of the company

Additionally, Lee (2000) lists a number of reasons for companies to engage with the university. These reasons can feasibly be reduced to 4 main categories: 'Recruitment', 'Research & Development', 'Knowledge resources', 'Network and contacts'. Furthermore, collaboration with non-profit organizations may improve companies' reputation and image (Austin, 1998; Kanter, 1999). Below these potential benefits are placed in order to illustrate how they may impact a

potential business model of a company. The business model is based on the assumption that the primary objective of the company is to serve its customers in order to make a financial gain.

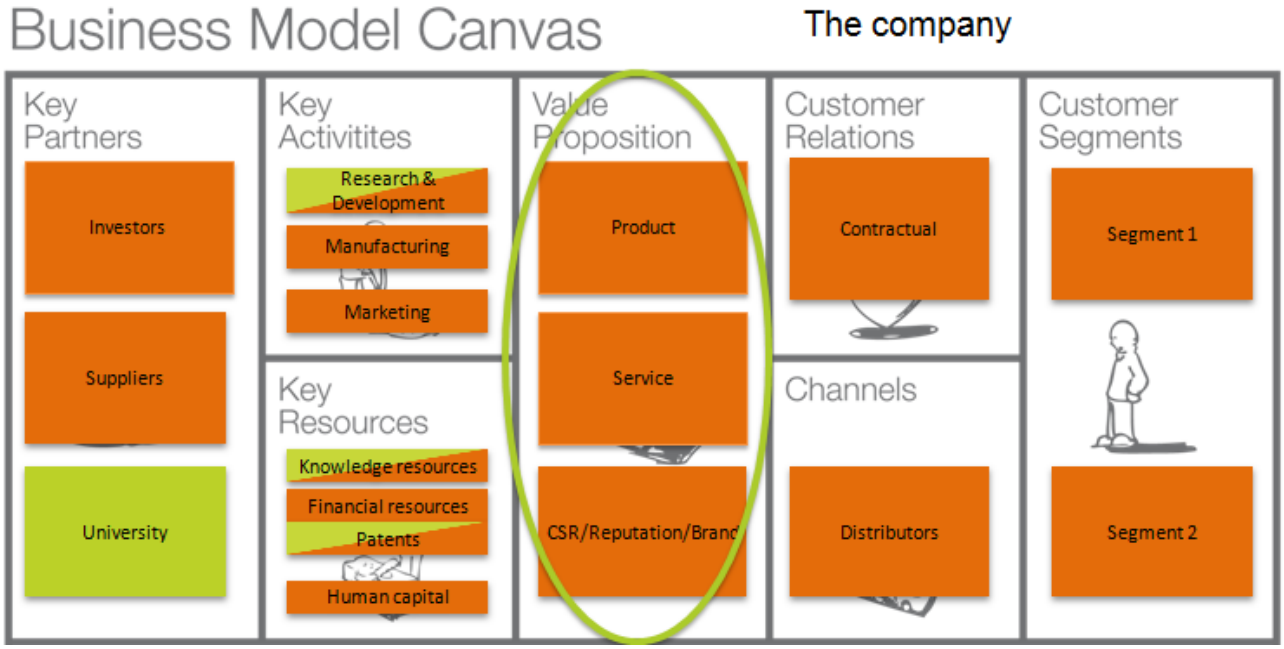

Figure 2: The Company Business Model Canvas

Again the potential business model of a company that does not collaborate with students or scientists is pictured in orange and the changes that appear if collaboration is established are pictured in green. It is seen that the university then appears as a key partner that has the potential to affect both the key activities and the key resources. For example university scientists can participate in research and development activities and provide knowledge resources. Thereby, the company's value proposition is affected.

The value proposition of the student

Collinson & Quinn (2002) has identified a range of reasons for students and companies to collaborate. They state that university-industry collaborations provide students with a number of opportunities. Those potential benefits can be "acquiring new work practice and theoretical knowledge", "learning how to assess business needs", "increase in project quality if project objectives clearly defined". These benefits are used as inspiration to the figure below of a student's business model canvas and the following explanation.

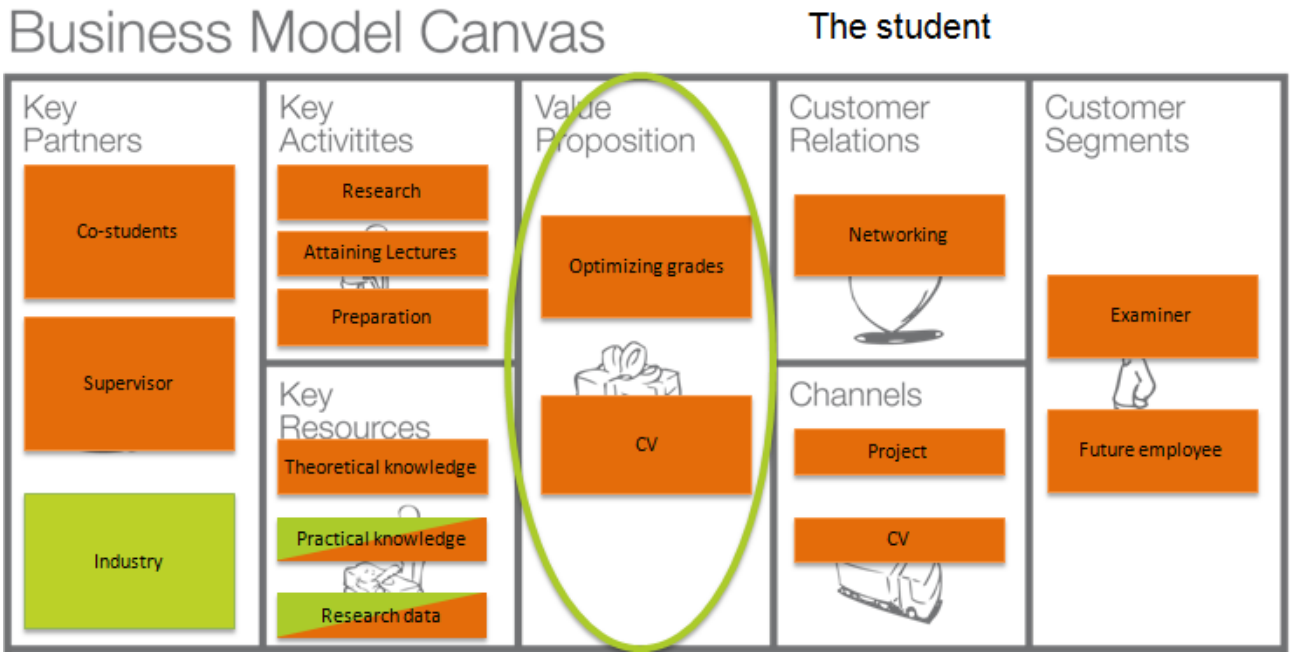

Figure 3: The Student Business Model Canvas

The basis assumption of the student's business model, illustrated above with the business model canvas, is that the students strive to get the best grades possible and improve their CV, so the probability of a career/employment is higher upon graduation. Again the potential business model of a student that does not collaborate with a company is pictured in orange and the changes that appear if collaboration is established are pictured in green. Collaboration between a student and a company/industry will make the industry a key partner, where the student can attain key resources like practical knowledge and research data that can be operationalized through a project. This project and the experience is assumed to benefit the student's value proposition, where the experience can be addressed in the CV, and possibly be a factor in getting better grades. These could in turn be favorable for the student's purpose; getting a career/employment.

As can be seen, companies, university scientists and students have very different motives for collaborating and according to Barnes *et al.* (2002) the benefits of university-industry collaborations are often not realized. This is in line with Bruneel *et al.* (2010) that argue that the motives of the different parties are often conflicting and that these conflicting motives challenge the effectiveness of collaborative projects.

Often the value of the potential benefits is exchanged or delivered in different stages of the collaboration. For example benefits related to CSR – such as an improvement of a company's

reputation – are often gained as soon as the collaboration has been initiated. On the other hand benefits related to knowledge resources are often not delivered before the termination stage of a project. This can in some cases be perceived as problematic. Some potential conflicts can be illustrated by structuring some of the potential benefits according to the collaboration matrix.

	Philanthropic	Transactional	Integrative
Contact	Company brand benefits from CSR effort		
Initialization			
Process	Students get experience and are provided with access to empirical data	Researchers gain access to empirical data	
Termination		The results (knowledge resources) of the research project are handed over to the company	

Table 1: An example of value exchange in UIC's

In the table above the potential challenges are illustrated in relation to an example of the student-company collaboration in the philanthropic stage. Here the companies often gain their expected value, in the form of CSR, already shortly after the contact stage and therefore perhaps lack incentives to allocate resources to the project beyond this stage. In the same manner, the students sometimes gain their benefits, in the form of research data and experience, early in the project, meaning that no one of the parties have real incentives to facilitate any further value creation.

In the same table it is also illustrated how challenges may arise in the transactional stage. Hence, the scientists build most of their value in the process stage, while the companies' potential value is often not realized before the termination stage. This highlights the challenge of keeping the scientists motivated beyond the process stage and providing them with incentives to deliver value properly in the termination stage in order to balance the exchange of value.

Method

Data collection

The empirical foundations of this paper are 72 semi-structured interviews conducted over the period 2011 to 2012. Each interview ranged from between 60 minutes to 90 minutes. We aimed at identifying university-industry collaborations that covered projects between companies and researchers on the one hand, and companies and students on the other. Identifying company/researcher collaborations was done with the help of Aalborg University's contracting unit official database, whilst the identification of company/student collaborations was done by active search and contact with the various departments at the university. The respondents were selected so as to give a balanced insight into different types of collaboration, different stages of collaboration, and different project sizes.

The form of interviewing chosen was based on the principle of dialogue between the interviewer and the respondent (Kvale, 1996) and has some similarities with the type of interview that Yin (1994, p. 84) calls "focused interviews". The interview guide is divided into sections from the stage model and questions about these, added by follow-up questions. The emphasis in the interview is not to strictly follow the guide, but let the respondent talk freely, naturally still making sure to address all main topics. To secure that the needed data was collected there were at least 2 interviewers present at each interview, one talking and ensuring a good interaction with the respondent, and one taking notes and securing that all main topics were covered, this approach is also suggested by Yin (1994). The interviews probed into five themes, which reflect the purpose of the paper, and these in turn therefore constituted the main sections of the interview guide:

1. Introductory questions concerning the respondent and his/her organisation
2. Questions addressing the different phases of a collaboration/
    a. Contact phase
    b. Initiating the collaboration
    c. Project phase: conceptualizing, planning, executing
    d. Completion phase: concluding, evaluating renewing
3. The overall cooperation of the relationship

During the interview process we made use of asking for extensive amounts of examples and stories as reflexive-type questions much in the manner described by Kreiner & Mouritsen (2005). In this way we aimed at forcing the respondents to explain what really goes on during their workday and also to stimulate them to provide details and thoughts that were more detailed than we otherwise would expect to get.

Analyzing the data

Immediately after finishing each interview the interviewer wrote a brief resume of the main points according to the three themes of the interview guide. Here we aimed at noting down exceptional examples or particularly interesting points being made. The interviews were transcribed in their full length and we applied a structural coding approach in the analysis of them along the lines of Krippendorff's (1980) recommendations. This coding tree was based on the full interview guide. After coding the interviews, a list containing the drivers of project management, project success and project management success considered critical by the interviewed respondents was prepared. The data-analysis was initiated by searching for patterns in the subsection of the case study database that was specifically focused on the codes for this paper. From this a set of working hypotheses was generated and they were supported through analytical generalization.

Empirical analysis of value propositions

The analysis divides the data according to the collaboration matrix. The first step is to divide the studied collaboration into researcher-company collaborations and student-company collaborations. The next step is to divide these into philanthropic, transactional and integrative collaborations through the Austin framework proposed in the theoretical section. For the sake of our analysis we note the following about this latter step:

1. If there is a skewed value balance, where it is primarily just one part that gains value from the project, the collaboration should be considered philanthropic. E.g. in many student projects, the firms state that they benefit very little, if any at all, from the project, hence it should be considered philanthropic, where the firm at most gains CSR from the UIC. This is also the case where the company only makes a donation to a researcher or department.

2. If both parties (company and student/researcher) have a proper value balance, meaning that both are simultaneously gaining value from the project, it is likely that transactional collaboration is taking place. This is for example the case where both parties state that they have gained benefits from the collaboration and have gained value through knowledge access or transfer, resource reduction, new models and so on.
3. If both parties gain value and there are only few boundaries between the partners in the collaboration it may be considered integrative. E.g. if a scientist works over a period with a company and has free access to all information and data from the company, and walks around the company as a "normal employee" it could be considered integrative.

Knowledge transfer across the different UIC's

The data is analyzed according to the structure of collaboration set out above in order to illustrate how, where and when value is created in the university-industry collaborations along the four stages, and placed into the matrix defined in table 1. Hence, each type of UIC studied here will be depicted in their own separate table. This will make it possible to analyze which stages of the respective UIC phases that are most critical from a value creation point of view, and also when and how the value transfer is taking place, if it is taking place at all.

Throughout our interviews we got many viewpoints on collaboration success including the perceived ability of the projects to build and/or transfer knowledge between the collaborating partners. The data also illustrates that knowledge transfer takes many varying forms and takes place at many different phases of the university-industry collaboration. One respondent commented on this in relation to having a student-trainee in-house for a semester that:

> "One of the advantages of having him (the student) here is that the methods that have been developed during the period, i.e. the models, theories and frameworks, and that have been applied have become known here in the department to the other employees. This is a real knowledge transfer and not some thick report at the end, which is not a usable tool. The transfer is through his being here and the interaction that goes on".

This idea of knowledge transfer being something that is a part of the process is also accentuated by a company in relation to a more traditional student-project, acknowledging the value-added in being confronted with the perspective of theory every once in a while:

> ”The report could’ve been divided into two (Ed.: a theoretical report and a practical report), but it is not, and we don’t have the best experiences with those reports. However, we have many good experiences with the dialogue that goes on during the process. The students ask the most annoying questions and they keep probing at some aspects where they challenge us on issues that we normally consider ourselves to be quite content with because we argue that ok, the theory might say that, but that’s not how it works here. It’s quite a healthy exercise really”

As such, the notion that knowledge transfer takes place at the end of a project may not be entirely correct. Another respondent specifically criticizes the termination phase of the researcher-company collaboration for being a part of the process where focus is lacking:

> ”The finishing phases of this project became a bit messy, perhaps a bit too messy. This was because there was no formalized way of finishing the project. There are of course the papers that were written, which constitute some kind of an overview. However, I would’ve liked to have some sort of review of the whole project and the process we’ve been through, where we could have sat down altogether and discuss whether the goals and objectives were reached. Maybe also talk about what went wrong and things like that. We never made any evaluation and I miss that”.

One of the reasons for the problematic aspects of knowledge transfer in the termination phase is that the partners here tend to be moving onwards and into new projects, are delayed or are simply getting fed up with the project. Another important issue when projects reach their final stages is the misalignment that might be present between universities and companies because universities traditionally do not think along the lines of commercialization and creating growth or jobs:

> ”The university enters into projects like this, but it isn’t their specific goal to ask how they can give these five case companies the opportunity to create growth and jobs. They (the researchers) enter into projects like this thinking about transferring theory to praxis, but behind that are only the goal of disseminating that knowledge and the process about the work we do here, in order to use it for research purposes”.

Exchange of value in student/company UIC's

In this section we attempt to synthesize into a table the value exchange we find in our interview data in relation to student/company UIC's. The student/company UIC's are placed in either the philanthropic or the transactional types of collaboration. There is a tendency for companies to think of bachelor level student collaboration as philanthropic and masters level and executive level as either philanthropic or transactional.

	Philanthropic	Transactional	Integrative
Contact	Company brand benefits from CSR effort to students	Students learn how to sell the contribution of a project	
Initialization	Students get access to corporate environment and learn about organization	Companies and students learn about each others' playing ground, goals and deadlines	
Process	Students get experience with seeing operations	Students are provided with access to empirical data	
Termination	The results of the project are handed over to the company	The results of the project are handed over to the company	

Table 2: Value exchange in student/company UIC's

Exchange of value in researcher/company UIC's

In this section we attempt to synthesize into a table the value exchange we find in our interview data in relation to researcher/company UIC's. The researcher/company UIC's vary considerably in size and length. Despite this, the table clearly illustrates that the different archetypes pose different types of value exchange. We can use this knowledge when we engage in a UIC to be better at aligning project objectives and to achieve a better understanding of how to create reciprocal value. Together with the Business Model Canvasses depicted in figures 1, 2 and 3, it is possible to analyze how one's proposed project – irrespective of one being a student, a researcher or a company – affects the other partners and their respective value propositions.

	Philanthropic	Transactional	Integrative
Contact	Company brand benefits from CSR effort of supporting the university	Quite often informal networks play a role in generating contact	Partners know each other in advance and this eases the friction of contact
Initialization		Partners are challenged and perhaps even forced to	Partners know each others' structures and differences
Process		Researchers gain access to empirical data and invoke reciprocal development through contact with each other	Partners achieve constant progression together and employ sub-contractors to embrace potential holes in the data-set
Termination	Company benefits from dissemination and marketing of the results in the public arena	The results (knowledge resources) of the research project are handed over to the company	

Table 3: Value exchange in researcher/company UIC's

Exchange of value in researcher/student/company UIC's

In line with the structure above, ideally this section should have attempted to synthesize the value exchange we find in our interview data in relation to researcher/student/company UIC's into a table like the previous two sections. However, our data on this archetype is insufficient for proper synthesis and conclusions. Despite this, some of the problems in addressing integrative solutions give rise to suggestions on coordinated activities such as the current Solution Hub proposal at Aalborg University or Lab-activities that integrate teaching and student projects to reaching overall corporate innovation objectives. The real obstacle to be overcome for companies that regularly give access to students and researchers is that students tend to start at the beginning every single semester and rarely play a value-added role for on-going projects between the same company and researchers. The most important question is therefore how to establish coordination and progression of such collaborations.

Concluding remarks

This paper illustrates that the value propositions of UIC's change across the different phases of the projects. This is the case for all three of our UIC-archetypes studied. We can use the insight from the analysis structure used in this paper when we engage in a UIC to become more knowledgeable at aligning project objectives and to obtain a better understanding of how to create reciprocal value. Together with the Business Model Canvasses depicted in figures 1, 2 and 3, it is possible to analyze how a proposed project – irrespective of one being a student, a researcher or a company – affects the other partners and their respective value propositions. Future research should look closer at the interaction between UIC-type, collaboration type and success/non-success and establishing best practices of alignment and value added according to each of the project phases.

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