KNOWLEDGE MANAGEMENT CHALLENGES IN NEW BUSINESS DEVELOPMENT - TRANSITION OF THE ENERGY SYSTEM

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ABSTRACT
The empirical study, this paper is based upon, aimed to identify and describe knowledge management challenges, throughout the new business development process. This paper reports findings from the study, as well as the framework used for analysing the knowledge management challenges, which can be applied to other case studies for comparison. Six interviews and 2 full-day workshops, gathering the perspectives of 76 people from an energy-utilities company forms the empirical background of the study. Six categories of knowledge management challenges were identified and, within each, central issues were extracted and changes throughout the new business development process investigated. Significant differences from the early to the late stages of this process were identified, including; shift from personal to codified knowledge transfer and need for supporting integration of knowledge from diverse domains better in the early phases. Furthermore, two new roles of the early phase, besides instigating projects, were found. This study contributes to the development of support tools for knowledge management in industry and to research with a deeper understanding of the new business development process.

Keywords: Knowledge Management, New Business Development, Innovation, Empirical Study

1 INTRODUCTION
Knowledge, especially about new technologies and markets, plays a very significant role in the design of the future energy systems and universities; technological research institutes; governments and companies are all engaging in development of technologies, products and services for this future system. Thus, the management of new knowledge from these and other sources; is a key concern. Through describing the specific *knowledge management* (KM) challenges faced during *new business development* (NBD), the aims for developing supporting tools to support the transformation of the energy system can be further clarified and the new business development process itself be further understood.
The approach of this paper is to describe the KM challenges faced in practice by NBD professionals in industry. An empirical study of the product and service design process was set up with an energy utilities company, and the outcome is discussed in this paper.
In the following two sections; new business development processes and knowledge management is discussed, with the aim of providing a frame for answering the research question:

How do the KM challenges change throughout the NBD process, in the context of designing products and services for the future energy system?

1.1 New business development processes
New business development (NBD) processes are concerned with growing the company, through recognising and utilising opportunities arising in the environment of the company. In this way, there are great overlaps between *corporate innovation processes* and *new business development processes*.[1]The term NBD processes will be used throughout this paper, however theories formally assigned to both areas will be drawn upon.

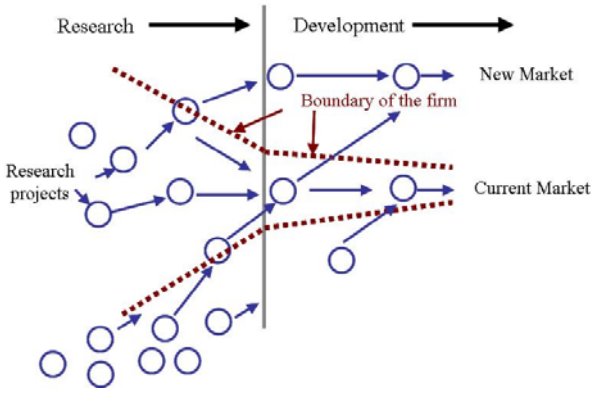

Figure 1: The open innovation funnel [2]

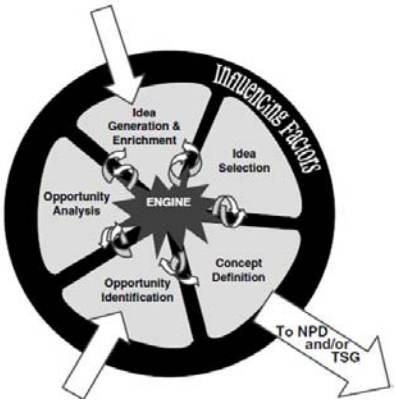

Figure 2: The fuzzy front end of innovation [3]

Chesbrough [2] has developed a model of the innovation funnel, which is shown in Figure 2. This model is made to emphasise the permeable boundary of the NBD process, where knowledge to an increasingly larger extent can pass freely in and out of companies, denoted *open innovation*. However, as Chesbrough's model starts with the existence of research projects, a model for where these projects come from is needed. Koens's [3] model of *the fuzzy front end* describes this very clearly, as an interaction between identifying opportunities, analysing and selecting between alternatives as seen in Figure 1. However, for the purpose of this paper, the two models have been integrated and simplified into the three phases seen in Figure 3: *Preject*, which are all activities going on before an actual project has been initiated, *Transition*, which describes the hand-over from preject to project, and where commitment to the project is established and finally; the *Project phase*, where the NBD project is executed.

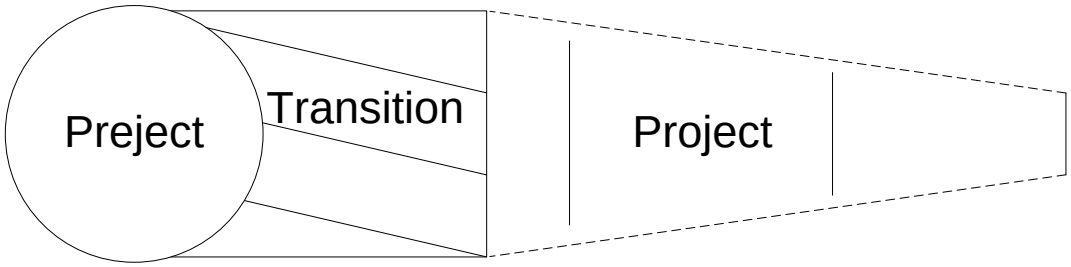

Figure 3: Reference model for the NBD process, adapted from Chesbrough and Koen

Tidd & Bessant [1] argues that knowledge plays a central part in the innovation funnel, as it converts uncertainty to risk, in the sense that the more we know about a given phenomenon, the more we can take a calculated decision about whether or not to proceed, thereby justifying a closer look at KM.

1.2 Knowledge management

The emphasis on KM within the NBD process aligns with current research on *innovation process definition* especially from the field of organisational behaviour [4-6] that recognise the central role of KM in innovation processes. Blackler [7] and Hansen [8] argues further, that KM in practice is closely related to the context in which it plays out, hence, it is expected that the KM challenges will differ from phase to phase and furthermore, this analysis can only be expected to be valid within a similar industrial context. Furthermore, the KM literature was use to construct the coding scheme presented later in Table 2.

2 RESEARCH METHODOLOGY

The aim of this study is to explore the KM challenges throughout a NBD process, including the early preject phase, which is seen to be only covered sparsely in current innovation literature.

Yin [9] differentiates between three types of empirical studies, being: 1) Exploratory, which covers questions like "what, "who, and where; 2) Descriptive, which covers research questions like "how many" and "how much" and, finally 3) Explanatory, which covers questions like "how" and "why".

The research question of this study is, based on yin's this distinction, clearly an explanatory study; investigating the operational links between the NBD process in practice and KM challenges.

For explanatory studies, Eisenhardt [10] and Blessing & Chakrabarti [11] argues that theory-building research using cases very often gives a particularly good answer to research questions addressing "how and why" in relatively unexplored areas so, therefore, this study has been designed as such.

2.1 Data Description

The study is based on data gathered through interviews and workshops with business developers in a large Danish energy-utilities company. What makes this company particularly interesting as case study is the fact that they are trying to radically transform the energy system; from 15% sustainable energy to 85% sustainable energy. This transformation introduces extra stress on the NBD personnel in the company, as they are forced to handle new types of knowledge, especially within the non-technical domains, which is both, new to the company, and so far, the behaviour of large socio-technical systems like this is very hard to make a reliable simulation of. Therefore, KM challenges are expected to be more apparent than during *business as usual*.

The company is structured as a concern, where 4 business units handles diverse technical areas such as: exploration and production of oil, production of electricity, sales and distribution of electricity to private and wholesale markets, and, finally, trade with oil, gas, coal and electricity on Nordic and European markets. Data for this study has been collected at the *group R&D* level, which is a part of the executive support group, reaching across all 4 business units. The participants in the study are all employees specifically dedicated to fostering the corporate innovation, and, thereby, the transition of the energy system. 6 interviews, between 1 and 1½ hour duration, were situated and carried out in the company. *All Interviews* were undertaken in a semi-structured manner, with questions in the following categories: 1) Personal Networks and their function 2) The interviewees understanding of innovation, knowledge and decision making (DM) 3) Personal narratives on knowledge flow and DM 4) Experience with Methods & Tools for DM and KM. In addition to interviews, 2 workshops were carried out. First one had 20 participants and lasted 7 hours. The second workshop had 50 participants and lasted 6 hours. *The first workshop* treated 3 topics: 1) Structure and accessibility of knowledge from different domains 2) identification and activation of sources of knowledge and 3) Requirements for selecting the better KM methods. *The second workshop* treated one topic: Ideas for enhancing innovation, stimulated by a presentation of innovation theories and 2 brainstorm methods. This way, there are three angles on the data: Preject, Project and R&D operations, representing viewpoints of 76 People.

Table 1: Overview of Data Used in the Study
[DG = Distributed Generation]

Data Source	Purpose	Methods Used	Participants
R&D Operations	Gaining insight into current issues with the innovation process, as perceived by the department as a whole. Furthermore, the "operations view" provided insight into department level management of NBD prejects and projects	2 Workshops	Top Management Senior Management Business developers Specialists
DG Preject DG Project	Understanding the specific KM challenges involved with running projects and preject activities that aims to radically transform the energy system and include knowledge from multiple domains	6 Interviews	6 Different Business Developers, involved in both Preject and Project, within DG.

2.2 Coding scheme

Data from the interviews was transcribed and separated into speech bursts, before it was coded according to the coding scheme presented in Table 2. From the workshops, the material produced during the workshops was collected, transcribed and coded according to the same coding scheme.

Development of the coding scheme in Table 2 was driven by the data, but infused with knowledge from literature whenever a new topic emerged. This was seen a more expedient approach than the completely data driven coding used in grounded theory [12] as literature is very rich on explanations of local phenomena, but as no literature so far has described the full picture, the predefined coding schemes common in e.g. psychology [13] , didn't exist. The coding scheme is constructed as a syntactical morphology, meaning that by picking one code from each category, it is possible to construct a meaningful sentence, postulating something about the data set.

Table 2: The Coding Scheme for Knowledge Management Challenges in New Business Development

Category	Definition	Codes		References
NBD Phase [Noun]	Reference-category, describing which phase in the NBD process data relates to. See *Introduction* for more details on this particular division of the NBD Process	• Preject • Transition	• Project	[3] [2] [1]
Exploitation of Knowledge [Verb]	A group of activities concerned mainly with transferring existing knowledge, through teaching, mixing teams, capturing information in databases etc. This is the main concern in the majority of KM literature [14]	• Concentration • Dissemination • Externalising	• Collecting • Codified Dissemination • Personal Dissemination	[15] [5] [16]
Exploration of Knowledge [Verb]	A group of activities aimed directly at managing *new* knowledge: how to create it, how to identify it, and how to integrate different knowledge from different domains in order to put it to use.	• Reflection • Monitoring	• Experimenting • Integrating	[15] [17] [3]
Barriers for Knowledge Transfer [Noun]	Identified types of issues with transferring knowledge, both encompassing situations where the transfer is directly from person to person, but also where knowledge is explicated into reports, guidelines, databases, emails etc. as part of the transfer. Transfer of tacit, implicit and explicit knowledge-types all appear within this category.	• Pre-conception of knowledge quality • Ease of Access • Deliberate restricted access • Mediation • Cause for interaction	• Common frame of understanding • Accessibility of source • Knowledge Level Distance • Interpretation difference	[5] [18] [4]
Novelty of Knowledge [Adverb]	Novelty level of the particular knowledge that is handled by the business developers. The scale ranges from knowledge completely new to the world, down to common knowledge that is reused in a different context.	• New to World • New to Firm • New to Org. Unit	• Partly Known / Adapted • Existing	[1] [19]
Knowledge Domain [Noun]	This category defines the object of the above knowledge management activities, being a classification of managed knowledge, based on what the knowledge is *about*. The classification is an extension to distinguishing between market and technology, which is quite frequently used in management literature	• Business model and processes • Development funding • Internal alliance creation • External alliance creation • Regulatory environment	• Insights into user's world • Dynamics of the market • Technical characteristics • Synergies with energy system • Energy resource reliance • All Domains	[20] [14] [14]
Knowledge Retainment Strategy [Verb]	Describes the strategy followed in order to purposefully keep or discard the knowledge in use. The categorisation ranges from consulting external sources and not deliberately trying to retain any knowledge, to the internal creation of knowledge in the company, where all knowledge is possible to retain within the company.	• Spread and Keep • Create internally, keep	• Get externally, keep • Consult external source	[21] [14][18] [5]

Table 3: Findings from the analysis aggregated in overview form.
Numbers next to codes are given in *percentage of total cross-tabulation (e.g. Preject + Exploitation of knowledge)*

Categories	Preject	%	Transition	%	Project	%
Exploitation of Knowledge	Dissemination	21,3	Dissemination	49,9	Dissemination	30,3
	Collecting	27,6	Collecting	12,7	Externalising	48,5
	Personal Dissemination	24,5	Externalising	13,1		
	Concentration	13,5	Concentration	11,2		
	Total (explanatory power)	86,9	Total (explanatory power)	86,9	Total (explanatory power)	78,8
Exploration of Knowledge	Integrating	37,7	Integrating	60,5	Monitoring	48,7
	Experimenting	18,7	Reflection	22,7	Reflection	29,2
	Monitoring	30,8				
	Total (explanatory power)	87,2	Total (explanatory power)	83,2	Total (explanatory power)	77,9
Barrier for Knowledge Transfer	Common Frame of Understanding	19,3	Common Frame of Understanding	47,8	Common Frame of Understanding	50,6
	Accessibility of Source	14,5	Accessibility of Source	7,7	Accessibility of Source	13,7
	Cause for Interaction	20,3	Cause for Interaction	18,3	Deliberate Restricted Access	13,7
	Mediation	25,1	Mediation	8,2		
	Pre-conception of knowledge quality	7,8				
	Total (explanatory power):	87,0	Total (explanatory power)	82,0	Total (explanatory power)	78,0
Novelty of Knowledge	New to World	25,7	Existing	16,4	Existing	42,6
	New to Firm	27,0	Partly Known / Adapted	28,6	Partly Known / Adapted	37,5
	New to Org. Unit	31,0	New to Org. Unit	42,9		
	Total (explanatory power)	83,7	Total (explanatory power)	87,9	Total (explanatory power)	80,1
Knowledge Domain	All Domains	41,7	All Domains	24,0	All Domains	22,8
	Business Model and Processes	32,6	Business Model and Processes	32,0	Business Model and Processes	67,8
	Internal Alliance Creation	8,9	Internal Alliance Creation	20,6		
	Total (explanatory power)	83,2	Total (explanatory power)	76,6	Total (explanatory power)	90,6
Knowledge Retainment Strategy	Create internally	50,2	Create internally	46,4	Create internally	32,2
	Spread and keep	21,7	Spread and keep	53,5	Spread and keep	57,8
	Consult external	13,5				
	Total (explanatory power)	85,4	Total (explanatory power)	99,9	Total (explanatory power)	90,0
	Total Preject [%]	**75,50**	**Total Transition [%]**	**15,68**	**Total Project [%]**	**8,82**

3 FINDINGS

In this section, the identified KM challenges are presented, as well as an adaptation of the New Business Development model that better fits the findings from this study.
Interviews and the two different workshops were analysed separately, in three different analyses, using the same coding scheme. Table 3 shows the cross-tabulated and aggregated results, in matrix form, with numbers next to codes being calculated *as percentage of category total* i.e. In the top left corner, the code *integration* accounts for 37,7% of the total hits in both *Exploration* and *Preject*. Inside each of the 18 squares, the most significant codes are displayed. Each field has an explanatory power of at least 75% i.e. it explains at least 75% of the total dataset with the displayed codes. In cases where more codes are close to having the same value, all of them are included. In total, there is a little more than 1400 coded elements (workshop suggestions and speech-bursts from interviews) behind the numbers.

3.1 Exploitation of Knowledge

Efficient exploitation of knowledge is one of the cornerstones in KM theory. [14] The analysed case is no exception; however, there is clearly a much more diverse focus on different exploitation activities in the preject and transition phase, than in the project phase. From the explanations in the interviews, it was found that the exploitation activities are high on the agenda in the company, as they see KM as almost similar to knowledge sharing. Knowing that they have challenges with handling new knowledge, they try to solve it though and exploitation approach, which, so far has turned out rather efficient in the project phase, but very inefficient in the preject phase. This finding is very consistent with [15] whom suggests that focus on exploitation activities in radical new innovation, especially where new ideas are conceived, is often overemphasised, whereas focus on strengthening the exploration activities should be more emphasised.
Another indication of the different needs in preject compared to project, is the strong focus on codified knowledge sharing [8] in the project phase and the just as strong focus on personal knowledge sharing [8] in the preject phase. It appears to be quite important in the preject phase, that the knowledge sharing they *do* have is made face to face, avoiding reports, databases etc. thus maintaining the ability to quickly adapt to new situations and fast changing political agendas.

3.2 Exploration of Knowledge

As mentioned above, this category is shown by [15] to be central in especially the early phases of innovative work. However, in this case the there was very low explicit focus on these activities; they were driven by need more than actual deliberate action. Again in this category, clear changes throughout the NBD process are seen, where the knowledge-creating activity *experimenting* only is seen in the preject phase. Specifically, the challenge is to experiment with large socio-technical networks, which are very hard simulate and very hard to create demonstrations of, as they are often intangible. The importance of experimenting is stressed by the interviewees, as the only way to truly generate new knowledge and insight into technologies as well as market.
Later on, in the project phase; it appears more central to follow what others are doing through *monitoring*, which is further supported by frequent statements from the interviews, where the participants describes the project execution as “putting your nose in the track and running” – It is interesting to compare this to the concept of path dependency [ref], which is most frequently applied to a whole organisation, but the above numbers indicate that the preject work seeks to break paths and find new business directions, whereas the project work is deliberately path dependant: They run in the direction they are started in, while monitoring what others are doing. Exactly *who these* others are will be touched upon in the end of this section *across categories.*
The code *integrating* is a whole different issue – It appears only in preject and transition and seems to be comparably more important in transition. However, it is actually two different challenges that hide behind the numbers: In the preject phase, the integration challenge relates to integrating knowledge from several different, often new, domains of knowledge. In the transition phase, the integration challenge is distinctively between the truth of the company and the new truth that comes with a radically new project idea.

3.3 Barrier for Knowledge Transfer

A surprising finding in this category, is that *common frame of understanding* goes across all categories, but, even though integration between knowledge domains was seen to be a challenge in preject phase, the focus on common frame of understanding is weighed much lower here, than in the subsequent phases. The explanation for this, rather odd, phenomena lies in the *mediation* which scores very high in the same preject phase, compared to other next phases. The preject work is, by nature, very multidisciplinary and the involved actors are aware of this. Therefore, though they would wish for a *common frame of understanding*, they know that it is very unlikely to happen, and instead focuses on the more action oriented "mediation"- In the absence of the common frame, a good translation is the next best thing. However, for the transition and the project phases, the strongest focus is on the frame itself, as they perceive it as possible to generate, through continuous organisational learning.

Cause for interaction starts relatively high, and then wears off throughout the phases. This challenge is related to the exploratory role of the preject activities, as the people monitor the world around the company closely, mainly directed by "cause of the interaction", being ideas for discussion, conferences within their respective field etc.

3.4 Novelty of Knowledge

This category looks very much as one would expect from a traditional closed innovation model [1]: High focus on radically new types of knowledge in the preject phase, with new to world, new to firm and new to organisational unit making up 84 % of the KM challenge-focus. From transition and into the project, there is no longer focus on new types of knowledge, but to work with existing and partly known knowledge, mainly infused in a waterfall manner from the preceding preject phase. However, this picture seems a bit odd, when compared to the fact that the case company are promoting open innovation [22] where focus should be the exact opposite, namely integration of new to the firm knowledge all along the lifespan of projects and close alliances with external partners. The explanation given in the interviews is that the leaders of the innovation department sees open innovation as a viable and unavoidable path for developing the future energy systems, as no one company can change the full system alone, as it covers an immense amount of business areas, where only a few of them are of interest to an energy utilities company. However, there is a great amount of inertia in a company this size and there is very little practically applicable methods at the time for actually *doing* and *managing* open innovation when arriving to the project phase, thus the transition is harder.

In the transition phase, there seems to be a an opening, at least to *new to organisational unit* knowledge, however, behind this number lies the explanation that the knowledge that is new to the unit in fact is the knowledge that comes from the preject phase, and only to a very limited extend, knowledge from the external world

3.5 Knowledge Domain

In the preject phase, there is a strong emphasis on *all domains* which does not mean that all the domains are equally important, but that the interaction *between* the domains is of special importance. This supports very well the discussion above; that the integration mediation and experimenting between knowledge domains are of larger importance than any one of the domains in isolation. However, this picture is disturbed a bit by the *Business model and Processes* domain, which is very central across all phases. This owe to twp primary reasons: firstly, as the company struggles with expedient methods for open innovation in an energy system in transformation, they are very cautious about *how* to develop project ideas. Secondly, as the importance of *internal alliance creation* also suggest, the internal sale of the developed project idea is a central challenge, but requires intimate knowledge about the many *development methods* and *business models* followed by the receiving business units. If a project is based on an unfamiliar development method, or is opposed to the business model of the receiving business unit, it will be very hard for them to engage in the transition and take over the project.

3.6 Knowledge Retainment Strategy

The last category deals with how knowledge is retained within the company, which to some extend relates back to the prior discussion on path dependency. A high level of self-create knowledge and absorption makes the company more path dependant, as the competencies needed to create and absorb complex knowledge are the same competencies that will make the company follow a specific technological path [21] Earlier, it was argued that the there was a high degree of path dependency in the projects, while the preject activities are more able to follow, and even create, new paths.

When looking at the numbers, the *spread and keep* starts at 22 % and rises downstream ending with a little short of 60% in the project phase. At the same time, *create internally* has the opposite curve, moving from 50% in the preject phase, down 32% in the project phase. Together with *consult external* appearing only in the preject, the numbers support the earlier statement about path dependency; however, it doesn't create the impression of a completely agile company, with high degree of internal creation. The main challenge here is a classic one: to balance the company's path dependency, with the agility. However, a third argument arises from the interviews to explain the high degree of internal creation of knowledge in the supposedly agile front end: the front end doesn't just execute a strategy, it is actually active in the creation of the R&D strategies and this way it creates paths that other companies follow. This is an addition to the agility / absorption discussion in the way that a strong normative path can be laid out for others to follow, but this approach of course presupposes a large amount of control over market and technologies within the energy system.

3.7 Across New Business Development Phases

As it was mentioned in both *novelty of knowledge* and *exploration of knowledge* there is evidence in the study, that even though the company aims for open innovation, it can be very hard to actually incorporate it in practice. What is furthermore seen is that the problem of openness seems to increase throughout the process. Returning for a bit to *monitoring* knowledge, from the *exploration* category, the interviewees explain that monitoring in the project phase is very different from monitoring in the preject phase: In the former, the team is looking for solutions to challenges they are facing in the project right now, and in general, they monitor *internally* in the company for these solutions. In the latter, the preject phase, the team is actively looking outside the company's boundaries for inspiration and complementary knowledge that can leverage their own. To improve this situation, more openness is needed in later stages of the project, especially because of the often very long lead-times within this industry, where the world changes a lot from a project is started till it finishes years later. The Challenge is thus to maintain openness, while still working efficiently on the project.

Another finding across the categories is that, contrary to believe in practice and the majority of literature, the main purpose of the preject is more diverse than being the instigator of new ground-breaking projects. Instigation is an important role, however, it was seen that both a great deal of *new process knowledge* and *new strategic knowledge* is created in the preject activities. There is traditionally not a great deal of focus on these side-effects though they were seen to be quite central to the overall management of the NBD process, and in cases where projects fail, they become the primary positive outcome, constituting organisational learning through revised strategies, tools and general assumptions about markets and technologies.

4 CONCLUSIONS & IMPLICATIONS

This paper has described a case study carried out in the energy utilities sector, and explained KM challenges identified throughout the New Business Development process.

The literature review disclosed a gap regarding KM challenges and how these change throughout the New Business Development Process, which has been addressed in this paper. Furthermore, the data-driven literature review disclosed the 6 categories: Exploitation of knowledge, exploration of knowledge, barrier for knowledge transfer, novelty of knowledge, knowledge domain and, finally, knowledge retainment strategy as the key areas of interest to understand these KM challenges.

6 interviews and 2 workshops were analysed with a coding scheme based on these categories, representing the view of, in total, 76 people involved in business development; either as business developers, technology specialists, project managers or senior managers. As such, results of the study represent the viewpoints of these people, which all belong to the same company, however the viewpoints represent equally three different angles, being preject activities, project activities and R&D operations.

Large differences between KM challenges in the three New Business Development phases were identified, indicating that support for KM needs to allow for these differences to persist. Specifically, the differences identified were:

- Emphasis on personalisation as means for knowledge transfer in preject, where codification is more relevant in the project phase.
- Support for exploration in the early phases, especially in relation to integrating knowledge from diverse domains and enabling experiments with non-tangible complex products to create new knowledge for use in projects, R&D Strategies and general knowledge of the company

- Enable the projects to monitor not only internal solutions to current problems, but also scanning outside the company for inspiration and leveraging of open innovation
- A need for establishing a common frame of understanding, or at least, better mediation between team members with different domain-backgrounds is seen to be increasingly important; when dealing with high diversity of knowledge domains in complex systems.

The preject phase was discovered to have at least two more functions, than instigating new projects based on absorption and creation of knowledge, which is the prevalent description in literature, as well as in the currently studied practise. These two functions are: 1) to generate strategic knowledge i.e. R&D Visions and Strategies, based on in depth knowledge about the socio-technical energy system, created through the direct work with developing new products and services for the system. 2) to create a general body of process, product and market knowledge, to make accessible for the running projects. This knowledge was seen to be created through the role as *first mover* in terms of new development methods as well as new markets and new technologies, in the company.

For research, the contribution is to address the gap in literature identified with empirically grounded insights, which in the future are planned to be expanded with more cases studies, as well as more data from this first case study.
For Industry, this study creates the foundation of further development of KM support tools, specifically aimed at supporting each phase in the innovation process in the best possible way.

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