Three perspectives on managing front end innovation: process, knowledge and translation

Jensen, Anna Rose Vagn; Clausen, Christian; Gish, Liv

Published in:
International Journal of Innovation Management

Link to article, DOI:
[10.1142/S1363919618500603](https://doi.org/10.1142/S1363919618500603)

Publication date:
2018

Document Version
Early version, also known as pre-print

[Link back to DTU Orbit](#)

Citation (APA):
Jensen, A. R. V., Clausen, C., & Gish, L. (2018). Three perspectives on managing front end innovation: process, knowledge and translation. *International Journal of Innovation Management*, 22(7), [1850060].
<https://doi.org/10.1142/S1363919618500603>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

THREE PERSPECTIVES ON MANAGING FRONT END INNOVATION: PROCESS, KNOWLEDGE, AND TRANSLATION

Anna Rose Vagn Jensen, Liv Gish and Christian Clausen

Authors original manuscript.

A revised version is published in International Journal of Innovation Management (2018) 1850060 (32 pages) © World Scientific Publishing Europe Ltd. <https://doi.org/10.1142/S1363919618500603>.

A complete reference would be:

Anna Rose Vagn Jensen, Liv Gish and Christian Clausen 2018, Three Perspective on Managing Front End Innovation: Process, Knowledge, and Translation. *International Journal of Innovation Management*, e-published ahead of publication. DOI: 10.1142/S1363919618500603

Abstract

This paper presents three complementary perspectives on the management of front end innovation: a process model perspective, a knowledge perspective and a translational perspective. While the first two perspectives are well established in literature, we offer the translation perspective as a complementary perspective. The paper combines a literature review with an empirical examination of the application of these multiple perspectives across three cases of FEI management in mature product developing companies. While the process models represent the dominant, albeit rather simplistic perspective, they primarily serve as a reference point and communication device. Here, the knowledge perspective offers a supplementary perspective by filling the gaps left by the formal processes with informal cross boarder knowledge exchange. In comparison, the translation perspective is found to represent an emergent approach in managing FEI where process models, knowledge strategies and objects become integrated elements in more advanced navigational strategies for key players.

Keyword: Process models, knowledge sharing, translation process, front end innovation, case study

Introduction

Over the last decade, companies have become increasingly interested in understanding and organising the front end innovation (FEI) because of its potential for leveraging the innovative capability of the company. Through workshop dialogue and knowledge sharing with industry over the past ten years, we have experienced that practitioners in industry deal with a number of challenges when organising FEI. The key focus by management has been on understanding how the FEI works as a process that can be described as a number of activities and phases leading up to the delivering of concepts for the formal new product development (NPD) process. However, although the activities and phases seem logical and work as preferred management tools to assess progress and secure strategic alignment, the practitioners seldom experience these process models as being of help in exploring new ideas and opportunities in the early phases. The FEI thus continues to be an interesting topic, especially because of its complexity and interpretive flexibility, but also because FEI is

considered to be a critical part of the innovation process, as decisions made here have a significant impact in the later processes of product development, production and market launch. Schweitzer and Gabriel (2012) found that planning of the FEI together with clear and formalised procedures throughout technological predevelopment and market feasibility studies have a positive effect on efficiency. FEI therefore also has a substantial potential for optimisation if provided with clarity (Koen et al., 2002).

FEI has been widely treated in innovation literature (e.g. Smith and Reinertsen, 1998; Khurana and Rosenthal, 1998; Reid and de Brentani, 2004; Markham, 2013). Traditionally, FEI models have grown out of the work with NPD models, and therefore a vast amount of the contributions in literature evolve around understanding FEI as a process (e.g. Khurana and Rosenthal, 1998; Boeddrich, 2004; Koen et al., 2002). However, understanding FEI as a process, where formal structures and well-defined processes mitigate risk and improve overall efficiency and effectiveness of the process, does not explain nor offer strategies for individuals enacting certain organisational roles to stimulate creativity and flexibility and secure organisational support for ideas and concepts (Schön 1983; Howell, 2005). Thus, several authors have pointed at how FEI can be viewed as informal networking processes where the focus is on how to enable the flow of knowledge across boundaries, knowledge sharing and creation through social interactions between individuals. Cockayne (2004) has described FEI as loosely connected network processes taking place before a specific innovative concept is formed and accepted by the subsequent new product development (NPD) process.

The ability to manage knowledge in innovation processes is considered key to innovation capability and performance (e.g. Tidd and Bessant, 2009; Adams et al. 2006). Nonetheless, when provided with either a process or a knowledge perspective, managing FEI appears as a continuous conflict between systematisation/exploitation and creativity/exploration (Verworn and Herstatt, 1999; Benner and Tushman, 2003). However, important aspects of FEI may not be recognised nor explained with the process or knowledge perspective. Thus, a third perspective would stress the network formation processes not just as knowledge processes between social actors, but also as socio-material interactions in FEI. In the translation perspective, human and non-human actors join forces in the conceptualisation of new concepts. Akrich et al. (2002) describes innovation in the making as a very complex task that entails the mutual translation of relevant actors as well as material objects and product concepts. In line with Akrich et al. (2002), we have earlier suggested that the successful effort of FEI can be viewed as an actor network going through a translation process (reference omitted due to blind review).

With this paper, we would like to draw attention to the multiple perspectives on FEI. We take our point of departure in the tensions between the offered process models and their limited support for practitioners facing challenges of navigating the complexities of FEI and ask: What are the different perspectives offered on managing FEI and to what extent do they compete or supplement each other in practice? We answer these questions by providing an overview of three perspectives we have identified in literature and illustrate them through three cases. The perspectives are: 1) a process perspective, 2) a knowledge perspective, and 3) a translation perspective. The first perspective accommodates FEI challenges through well-defined processes and formal structures such as extending the Stage Gate model (Cooper 2008) into FEI. The second perspective underpins the necessity of knowledge sharing and creation and builds on literature discussing the formal and informal knowledge aspects of innovation in organisations (Takeuchi and Nonaka, 1986). The third perspective seeks to provide a conceptual vocabulary to a third approach that is not well described in the innovation literature yet is increasingly acknowledged (Akrich et al., 2002; Garud et al., 2013). This perspective is able to describe the dynamics of FEI acknowledging and emphasising the

relational interaction between human actors and non-human actors such as process models. The translation perspective builds on actor-network theory (Callon, 1986b). To better understand the implications of the three perspectives, we exemplify them with three industry cases. The cases have been collected from three large Danish industrial companies through qualitative research methods.

Literature review: Three perspectives on FEI

The process perspective: From linear NPD models to iterative FEI models

As outlined in the introduction, the process perspective represented by the process models is a dominant perspective in the innovation literature. Process models were first applied in new product development (NPD) to standardise the product development and diffusion effort and improve overall efficiency and effectiveness of the process (Cooper, 2008). Later on, the process perspective has also made its entry in FEI. One could argue that many of the FEI models are merely an extension of the NPD process upstream. Decades ago, as a reaction to the linear NPD process models, Takeuchi and Nonaka (1986) suggested the new product development game as an alternative or supplemental view to the NPD process: *'Under the old approach, a product development process moved like a relay race, with one group of functional specialists passing the baton to the next group.'* (Takeuchi and Nonaka, 1986). Nonaka and Takeuchi identified a challenge of dividing the process into sequential steps and suggested instead to view the product development process as a rugby game with stages overlapping each other significantly. Later on, discussants have suggested similar alternative models in FEI that take into account the more iterative nature of innovation processes in sharing knowledge and interactions between individuals (e.g. Koen et al., 2002; Reid and de Brentani, 2004).

In the pursuit of improving efficiency and effectiveness of innovation activities, researchers began focusing on the early phases of the NPD process in the 1990s, arguing that the most significant benefits can be achieved here (Khurana and Rosenthal, 1998), and that many of the NPD practices do not apply to the early phases of the innovation process (Koen et al, 2002). The early phases are both referred to as Front End Innovation (FEI) and as Fuzzy Front End (FFE). Similar to the Stage Gate model, process models have been developed for FEI. Khurana and Rosenthal (1997) have, for example, proposed a FEI model consisting of three pre-phases before entering the NPD process. In pre-phase zero, a preliminary opportunity is identified, in phase zero the product concept and definition is developed, and in phase one, the company assesses the business and technical feasibility of the product and plans the NPD project. Different suggestions of how to organise FEI have been proposed, many of them illustrated as linear processes. However, Koen et al (2002) argue that a sequential process would not work for FEI, and thus developed a non-sequential relationship model called the New Concept Development (NCD) model. The NCD is circular in shape. In the center of the NCD model is a so-called engine is placed comprising leadership, culture and business strategy. Around the engine five activities are pictured: Opportunity identification, opportunity analysis, idea generation and enrichment, idea selection and concept definition. In addition, in the final layer of the model, the influencing factors such as organisational capabilities, the outside world etc. appear. Even though the Concept Development Model is presented as circular and iterative, it still represents a process perspective. In his Total Front End Framework for Innovation, Trotter (2011) combines a process model perspective with non-process factors such as customer input, innovation teams and culture. Process input and actors thus seem less black-boxed than in previous suggested models.

The NPD and FEI process models are normative which mean they prescribe an ideal process for innovation and handling ideas, and primarily serve as a tool for management (Verworn and Herstatt, 2002). The main focus in the process models is the activity of transforming an initial input to a functioning output (Florén and Frishammar, 2012) and, in this sense, the models black boxes the work with ideas and does not offer a broader understanding of the interactions going on in the process. Another focal point of the process models is the time perspective, which is prevalent in going from one stage to another, moving an idea forward. A third aspect of the process models is the formal structure, which implies an organisation with functional structures and well-defined responsibilities for each stage in the process and a set of rational criteria for deciding whether or not to proceed. The journey of the idea appears to be well steered and the shift in actors involved from one stage to the next seems well defined. In this sense, the process models present themselves as effective project management tools. Although creativity is agreed to be a fundamental ingredient in innovation, the process models emphasise managerial decision making. Researchers have strived to reduce the fuzziness in FEI by developing process models (Schweitzer and Gabriel, 2012), although others oppose structure as destructive to creativity, while flexibility, ambiguity, and keeping a broad set of possible options open is vital for innovation success (Schweitzer and Gabriel, 2012). Gassmann et al. (2006) argue that the art of managing the fuzzy front end is not the art of dictating what everyone has to do at what time, nor is it the art of letting chaos reign. Therefore, FEI models have also been criticised for being overly abstract and general and not lending themselves to concrete actions for employees (Gaubinger and Rabl, 2014). Consequently, they do not work as an explanation of what is really taking place in innovation processes. While the process models contribute with an overview and a measure of progress in the NPD, they tend to treat the work with ideas in FEI as merely objects that have to be pushed forward or rejected in the process, leaving actors and agency black-boxed.

The knowledge perspective: From exploitative knowledge management to explorative knowledge creation

The knowledge perspective can be viewed as an alternative to the process perspective. Whereas the process perspective focuses on controlling activities and exploitation, the knowledge perspective illuminates the creative, informal and explorative aspects of innovation. Innovation concerns creating new possibilities through combining different sets of knowledge, e.g. knowledge of technical solutions, marked trends, and user needs. Innovation thus combines differing knowledge pieces into a configuration (Tidd and Bessant, 2009) and the conceptualisation of products and services draws on many different pools of knowledge. In relation to FEI, knowledge management is especially associated with scanning and searching the environment to discover new opportunities. A very common approach in searching for new ideas is the idea suggestion system, where employees can submit their ideas (van Dijk and van den Ende, 2002). Sometimes companies also open up to suggestions from outside the organisation, also known as open innovation (Chesbrough, 2003). A newer tendency in the same vein is idea competitions (Ebner et al., 2009). The underpinning idea of these approaches is to circulate, capture or store the ideas so they can be retrieved at a later stage when needed. The challenge, however, seems that the ideas are revisited infrequently. Other approaches in FEI to open up for new opportunities include the organisation of workshops and seminars with internal specialists or external experts who can create new knowledge in a particular area available for the rest of the organisation, e.g. for functional departments or projects groups. This type of knowledge sharing is somewhat explorative in nature since you do not always know what you are looking for, and it is thus also difficult to predict the outcome.

Less formal and more self-organising setups for knowledge sharing across established thought worlds (Dougherty, 2008) also exist in organisations. Knowledge sharing through informal social relations is an unavoidable and integral part of innovation in organisations and takes place in order to overlap or integrate phases in the innovation processes or to fill knowledge gaps and create synergy. For instance, intrapreneurs, also known as idea champions (Schön, 1967; Mullins et al., 2008), perform early conceptualising activities such as promoting ideas through creating informal relations in the organisation. This perspective frequently focuses on the individual. A more collective focus on informal sharing of knowledge across the organisation is captured by the concept of communities of practice. Communities of practice (CoPs) consist of people who '*...share their learning experiences and knowledge in free-flowing, creative ways that foster new approaches to problems*' (Wenger and Snyder, 2000). CoPs have an ability to utilise informal processes of learning, knowledge creation and sharing and are thus a resource of innovation capabilities (e.g. Brown and Duguid, 1991; Pattinson and Preece, 2014). CoPs can be a place for sharing and creating knowledge both within specialisations, across functionalities and organisational boundaries, and between companies. In relation to FEI, it is relevant to utilise knowledge and expertise from different technical and market domains and CoPs can enable innovation through the combination and recreation of diverse knowledge (Nonaka and Toyama, 2003). Pérez-Avilés et al. (2015) even propose that time to market can be reduced by using an integrated CoP model instead of the conventional linear models.

In relation to CoPs, Cross and Prusak (2002) define roles such as central connectors, boundary spanners, brokers, and specialists. Moreover, in de Brentani and Reid's (2012) continuous work on roles in FEI of discontinuous innovation, roles are described to be central to the movement and success of innovations in companies. They describe roles not only as boundary spanners, but also gatekeepers, and project brokers at different interfaces of the innovation process. The common denominator of these roles may be their capability for carrying different types of knowledge across organisational or cultural borders or drawing on and gathering knowledge to establish new product concepts. In a study of knowledge management strategies, Mangiarotti and Mention (2015) found that innovation outputs are less dependent on codified knowledge (e.g. knowledge accumulated in databases) and more dependent on personalisation strategies where the specific and customised knowledge is developed through knowledge sharing practices.

To explain innovation, Nonaka and Takeuchi (1995) argue that we need a new theory of organisational knowledge creation. They criticise the traditional information processing understanding of innovation where an organisation processes information from the external environment to adapt to new circumstances. Instead, they propose that organisations create new knowledge from the inside out. The basic assumption of their model of knowledge creation is that knowledge is created through the interaction between tacit and explicit knowledge and takes place through a spiralling effect between four modes starting at the individual level and expanding throughout different organisational levels. Knowledge creation and the search for new opportunities have the side effect that existing knowledge domains and power bases can be challenged, especially when radical ideas are proposed, for instance when digital solutions threaten analogue ones. Therefore, a dilemma is present when management wants radical innovation and, at the same time, wants to protect the core business. In these cases of tensions between path dependencies and path creation (Garud and Karnøe, 2001), the informal and self-organising setups for knowledge sharing become even more prevalent and the requirements to the navigational efforts of the organisational members increase.

The translation perspective: Strategic deployment of conceptualisation

The translation perspective grows out of Science and Technology Studies (STS). STS is less well known in the mainstream innovation literature, but many STS researchers have examined how innovations have developed and been shaped as an ongoing interaction between social and technical dimensions (Akrich et al. 2002). Hence, STS scholars treat innovation processes as sociotechnical processes where the technical and social dimensions are treated on equal terms (McMaster and Wastall, 2005).

A key theory in STS is the Actor-Network-Theory (ANT). In ANT, the subject of analysis is viewed as a network of actors. We can thus view an innovation as an actor network (Christiansen and Varnes, 2007). The actor network is composed of a series of heterogeneous elements where both humans and objects are attributed agency i.e. they can act or speak on behalf of the network they constitute. The actor-network is seldom stable, as pointed out by Lundby and Sandahl (2000, pp.153) ‘according to ANT, actors are fighting/struggling in the process of establishing a network and their fights and struggles are the driving force in this process’. ANT offers a rich vocabulary to analyse the processes involved in the making of a heterogeneous network, and to see how actors are influenced and relations, content and meaning concerned with an idea or concept are translated. A core concept in ANT is translation. Translation is the process of growing and stabilising the actor-network, albeit the actor-network never becomes static and reaches a final state as it may always be contested. Michel Callon (1986a) describes translation as the following four actions; (1) problematisation, (2) interessement, (3) enrolment and (4) mobilisation. (1) Problematisation concerns how a key actor tries to become indispensable to the other actors in the network and thus be able to take on the role as a spokesperson for the network. E.g., a project manager can negotiate on behalf of his project team. (2) Interessement is a series of processes by which the spokesperson seeks to make other actors interested in the project and move these actors into the roles he or she has proposed for them e.g. specific roles in a project team or as users of the suggested ideas down the line. (3) Enrolment is a set of strategies that the spokesperson deploys to make alliances with more actors and coordinate relations such as with other managers or business partners in order to enrol them in the network. (4) Mobilisation includes a set of methods used to ensure that the enrolled actors are properly able to represent the actors they speak for. In other words, the process of translation is a process of negotiation with the aim of creating a strong network to carry the idea or product concept forward (Christiansen and Varnes, 2007).

The translation perspective offers a rather different understanding and ontology compared to the process and knowledge perspective by including both social and material actors and the content and meaning of the emerging idea and product concepts. It maintains a focus on describing the ‘real’ processes of interaction in idea and conceptualisation as they appear through ethnographic empirical studies. In ANT innovation is thus viewed as processes of network formation through which ideas and concepts are translated into stable sociotechnical networks of heterogeneous relations connecting social, material and technical elements into a meaningful whole (Akrich et al., 2002). In the perspective of ANT, a successful FEI process – being able to create an innovation opportunity and lead product ideas into good currency (van de Ven, 1986) – would be described as an actor-network going through a series of successful translations.

A key concept to analyse the negotiations of an actor-network is the ‘interessement devices’ (Callon 1986a, Hansen and Clausen 2017), non-human elements, which are circulated by key actors in order to move other actors and make them interested in supporting an idea. The notion of ‘devices’ (such as interessement devices) can thus be seen as a sensitising concept towards particular means of

intervention and ordering (Latour and Woolgar, 1986). Particular devices may work as translators of technological opportunities, market conditions, and user practices, as well as corporate strategies (Akrich, 1995; Clausen and Yoshinaka, 2007, 2009). The implication of this understanding is that process models should not be taken at face value but rather be seen as a device (a heterogeneous object or network including the model, its checklists, gates and staff), which performs as translator configuring the relations between engineering designers and management.

The translation perspective offers a reflexive perspective in contrast to the prevailing normative and prescriptive models. While this perspective is unsuited to offer best practice advice it stresses the transfer of lessons learned from a deeper understanding of single cases assisted by a reflexive use of key concepts as sense-making devices. Moreover, this approach offers a number of navigational strategies to be used by key actors together with modes of staging and facilitation of idea work and innovative processes. These navigational decisions could include the selection and design of material objects to be engaged as devices in network building. While ANT analysis primarily offers feedback and learning locally and provides support for navigational decisions, there are also cases where an ANT analysis leads to the definition of obligatory passage points for a network of actors to succeed (Legardeur et al. 2010).

Research methodology

The present paper consists of a literature review and a multiple case study. In the following, we first present how we have identified the relevant literature followed by how we have collected and analysed our case data. As an overall methodological approach, abduction (Timmermans and Tavory, 2012) has framed our analysis. In our open approach to understanding the cases in interaction with selected literature, a multi-perspective on FEI emerged. The resulting view consists of three perspectives on FEI: process, knowledge, and translation. On this ground we then revisited the interview data in order to exemplify and analyse the three perspectives. A comparison with the existing frameworks of FEI helped us to recognise phenomena not yet accounted for in the FEI literature; however, it was a back-and-forth exercise and the analysis of the data also led us to look for new frameworks. The literature review helped us examine and label the phenomena we observed, but different paths were also travelled to reach a robust explanation. The coding of our interview data was conducted in three steps, albeit iteratively: (1) an open coding informed by framework from the reviewed literature, (2) an adjustment of categories according to emergences in the empirical data, and (3) a more structured coding based on the final categorical perspectives.

Literature review

As a first step, we employed an explorative review of literature dealing with varying perspectives on the management of FEI. A simple framing of the search was to identify different ways of approaching, analysing, and modelling FEI in product innovation companies. It was a method to get the snowball (Bryman, 2001) rolling, where one paper or book would lead to another paper or book. At the same time, our empirical interactions would reframe our literature investigations in an iterative process and sharpen the emerging perspectives. At one point, the three perspectives would emerge as a dialogue between the empirical findings and the literature review and we focused on a deeper investigation of representative literature within process, knowledge, and translation perspectives. In our review of the literature, we seek to present the perspectives true to original ideas while pointing to areas of significance for the understanding of FEI that the perspectives do not cover in their view.

Case study

A multiple case study design (Yin, 2009) was chosen. In this way we were able to study the same phenomenon across the cases and in different settings. A case study focuses on understanding the dynamics present within the setting of the specific case (Eisenhardt, 1989) and thus allows the researcher to investigate a specific practice. In choosing case studies the selection criteria included structural similarities such as size, maturity, global business, and product development activities. The first author set out to find three large, well-established Danish companies with R&D activities. Further criteria for selecting the companies were age (>40 years), size (>500 employees), and experience with FEI activities. No criteria were set for a specific industry or markets, only that the companies developed and produced physical products. The three companies in the present paper have been given pseudonyms: Agro, HiLite, and MedX.

To collect data, semi structured interviews (Bryman 2001; Kvale 2009) were conducted at all three case companies and were recorded and transcribed. Questions addressed topics such as background information of the respondent, ways and challenges in working with ideas and conceptualisation, organisation of R&D activities, and strategies for carrying out conceptualising FEI activities. Number and length of interviews vary according to the time and effort each company could invest. Thus, the data collection methods vary slightly across the three cases. We see no problem in comparing across the three cases, as the information given was rich and qualitative regardless of difference in quantitative measures. At Agro, eight interviews lasting up to one hour were conducted with employees and middle managers from three functional departments: Concept Development, Business Development, and Technology Development. At MedX, two interviews were conducted with the Global R&D director and a Project Management Office (PMO) manager, each interview lasting two hours. At HiLite, three interviews were conducted in a radical innovation department, two with the department director and one with a business developer, each interview lasting two hours.

To generate insight, a case narrative for each case was written (Eisenhardt, 1989). The aim of writing up the case narratives was to identify and present the companies' challenges when organising FEI activities while also being aware of the actors' individual agendas and perspectives. Due to the article format, the cases are only presented briefly. The abductive analysis (Timmermans and Tavory, 2012) being recursive and iterative in nature led us to revisit data and theories through several turns in the research process as previously described. The potential relevance of unanticipated and surprising observations relies on the observer's theoretical lenses, but in contrast to deductive research, the abductive approach helped us to remain open to emerging themes.

Results and analysis: Three perspectives used on three cases

Agro

Agro operates within solutions for agricultural production and specialises in high-technology analytical instruments. Agro is a leading global company, which was founded almost 60 years ago by a father and son. Agro focuses on its core technologies and application areas, although there is increasing focus on customer-driven innovation. FEI is divided into the functional departments of Technology Development (TD), Business Development (BD), and Concept Development (CD). A standard stage gate model formally structures the process, where the functional departments join specific stages depending on the relevance for their functions and domains.

“We cannot handle something, if it is not following our process”. (Business Manager)

The process perspective is a quite explicit and dominant paradigm in the Agro case. Agro operates with a stage gate process, and the managers of Business-, Concept- and Technology Development Departments are very much aware of the company’s stage gate process and refer to it and its stages throughout the interviews. This is done in terms of discussing the “ideation process”, the “concept phase”, “G0-G1”, and “development chain” among many other examples:

“We begin with the idea, for us it means a project, and we would begin with what we call G0 – our first gate, where we have an idea and need to figure out how to proceed with it.”
(Concept Manager, Agro)

In particular, the Business and the Concept Development departments take ownership of the stage gate model, actually the Business manager refers to the individual stages as if they are entirely responsible for them:

“From G0-G1, it is Business Development, and from G1-G2, it is Concept Development.”
(Business Manager, Agro)

Whereas the Business and Concept Development departments are ‘owning’ and comply with the different stages of the stage gate process, the Technology Department, although acknowledging the stage gate model’s significance in the company, does not see itself equally loyal to or even suited for the ordering mechanism of the model:

“We are in the front end of the innovation process. And that actually means that we work a bit outside [the stage gate process] that we have in this house. Because it doesn’t work if we should work according to a process.... [...] If I meet with an external professor from a University and say ‘I need to pass ‘Gate-something’’, well he wouldn’t care, it won’t be of his interest at all. I can simply not manage [the project] in that way. I need to perform up till ‘Gate 1’, and what is before ‘Gate 1’ you need to let me be free to do as I want.”
(Technology Manager, Agro)

Because the stage gate model is the controlling management mechanism in Agro’s new product development activities, the more ‘fuzzy’ activities in FEI seem to stand in immense contrast. Here our second analytical perspective, the knowledge perspective, suddenly becomes evident when examining this contrast. During all interviews, emphasis is placed on cooperation and knowledge sharing. However, the structure and purpose of the cooperation and knowledge sharing seem to follow different patterns. One pattern relates to the stage gate model and the formal set-up of the organisation. The stage gate model prescribes some obvious interfaces and knowledge sharing between the different departments:

“There is, of course, also a ‘leg’ called business. [...] Of course we work together with [the Business manager] and his department, because we do not make anything that we cannot sell.” (Technology Manager, Agro)

In general, the three interviewed managers refer extensively to each other and their interdependence on each other’s departments and knowledge areas and competences. Another pattern of knowledge sharing relates to FEI activities, where there is a need to open up to the outside world in order to create new insights and innovations:

“Out in the world, a large network exists. We try to participate in conferences, and we try to create some open innovation events.” (Technology Manager, Agro)

Whereas the purpose of the first pattern is to share important knowledge regarding specific concepts and products in NPD in order to make a joint effort, the purpose of the second pattern is to invite new knowledge into the company. The first pattern is characterised by its highly designated purpose, whereas the second is more explorative. A third pattern (similar to communities of practice) is also evident in the case. The employees in the Concept Development Department (as well as other departments) are assigned to different projects and thus contribute with their specific knowledge to that project within the stage gate paradigm. However, a need for creating “spaces” outside the planned projects and share knowledge across organisational or structural boundaries exists:

“I have helped in starting many ‘spaces’ – some knowledge sharing forums – and this company offers many opportunities for bottom-up processes. Not much is coming from above [...] but they support a lot of the initiatives individuals come up with. [...] I had a need for knowledge sharing. And they accepted that we meet once a month. Now it is a quite well built network and new employees enter it quickly.” (Employee, Concept Development, Agro)

In some cases, cooperation and knowledge sharing develops. In this case, what started as random knowledge sharing takes form with a purpose and develops into an idea that needs championing and gatekeepers:

“Then there are those projects we start ourselves. There is somebody, and this is highly individually, who is very good at catching [Jens] or [Thomas] in their lunch break and saying ‘I am working on this thing, it is so interesting, but I have some doubts about how to run it’. [...] In my view, this is common stakeholder management. If you want somebody to accept your ideas, then it is necessary to involve them in the process.” (Business Manager, Agro)

This is the point where the knowledge sharing activities transform into our third perspective, the translational perspective. When employees want to pursue new ideas of their own and start projects they need to enrol other actors in their network as in the example above. This is a clearcut example of innovation as network formation. We can see another example in how Agro’s Jump projects are handled. Jump projects are more radical than ordinary projects:

“The Jump projects have their own life. They get more money and attention from top management. We have actually made a template regarding the market potential and the kind of technology we work with. [...] I think we are in a process where we are figuring out how to use it, how we should prioritise, [...] When we can see that this fits into the rest and it has a possibility to be realised, then we move it to become a project, a GO project”. (Concept Manager, Agro)

To mobilise an actor-network it is important for the key actors to understand what kind of strategies they need to apply to enrol the necessary actors. In this case to get approval from Top Management the line of argument has to be accurate and convincing. In an organisation such as Agro where emphasis is put on formal processes, roadmaps, and clear-cut roles and responsibilities, you have to pursue the formal channels to gain support.

One strategy is to make a document, such as the template mentioned in the quote that is based on a rational line of thought. Here, the argument is translated by the engineering designers into the language of a rational argument that is understood in the formal processes.

Another strategy used in the Jump project for enrolling top management to support an idea is to refer explicitly to an official strategy document, but translate the language of the strategy document to fit a proposed idea. In this way also a strategy document can be enrolled to support the project.

The creation of particular devices, non-human elements such as the templates that is sought mobilised in the translation of market knowledge and the considerations about how to navigate the formal channels or the selection of particular arguments in order to interest particular actors and gain support are illustrative examples of the translation perspective.

MedX

MedX was established over 60 years ago and is today a global, divisionalised company. MedX's products address delicate and intimate healthcare needs and the intimate everyday life of the user is a central driver in the development of new products. MedX has in the 2010s gone through reorganisation where a new FEI unit was established to ensure a more market-driven approach and viable concepts acceptable for NPD.

During our interviews, NPD was continuously brought up both as a reference and a contrast to FEI. The primary touchpoint between FEI and NPD is the deliverance of a design brief and the development of a concept ready for product development. The NPD process is essential for MedX in developing the product from concept to launch:

"...at gate 1 we have something substantial to show, we believe it can create good business. Gates 1 to 2, we commit each other, on the product, business, and production. Between gate 1 and 2 is our concept development. Gate 2, is design freeze and then there is a stretch from a to b, finish the design, production, user testing, sales organisation, etc. The usual process of developing a product up to market launch." (R&D Director, MedX)

The interviewees frame their explanation of FEI by applying a process perspective or by contrasting it when explaining how FEI is different from NPD. Frequently, we encounter statements such as *"the process model shows how it is supposed to be done, in reality we do it like this..."*. The FEI is through the process perspective perceived as a funnel or as a solution space diverging or converging:

"It is the journey towards the funnel, the idea is to avoid saying, now we have a great idea and then just run it through, but to keep the space open for as long a time as possible and then narrow it in a good and right way. And to narrow down the space, we have a touchpoint with management so they join this process. There can be 100 ideas when we have a design brief; these we can narrow down to three directions and in one direction we have five concepts and two of them will be recommended. We do not decide but we recommend, so we keep on inviting people on the journey so they are not left in the dark – that is important." (R&D Director, MedX)

This helps explain the process of FEI, but in terms of the dynamics and what makes FEI happen, MedX perceives FEI as much more than a process:

"Before, we prioritised to go straight from innovation roadmap to innovation brief. Now, we want it to take some time, we can't just say that it needs to be a square with four holes in it, it is a completely different approach, it can be anthropological studies, it can be everything. We try to say, before we start, what are we missing, what knowledge, what do we need to understand about this problem to make the right brief? And there can be many dimensions but typically, it is a user approach." (R&D Director, MedX)

While the process perspective is primary in describing NPD, it is secondary in describing FEI where we see clear examples of the knowledge perspective. In relation to the NPD process in MedX, the R&D Director explains how they care about providing the right competencies and functions in the different stages of development, not names of individuals but rather competencies and functionalities. We see here a rational and exploitative view on knowledge and a knowledge perspective primarily related to knowledge management. In contrast, the knowledge perspective in FEI is more explorative and relates to specific individuals:

"We have a group of people who are really competent to run these front end processes. We have a certain group, 4-5 people, but they are quite diverse. [...] We try to put a coordinator on this front end process and ask him to spend the time up to the innovation brief. What is the focus? And then gather people. You can do anything here, user visits, technology input, prototypes, idea generation, but in common we try to have a very holistic approach in the beginning, so it is not only the product but also everything around the product." (R&D Director, MedX)

The R&D Director exemplifies how they constantly challenge the perceived use practices by placing the developers among users. Furthermore, he explains how different areas of expertise are brought into play in the space of FEI. Besides drawing on knowledge from the specialised departments in the organisation, it is also important to bring in new knowledge from outside. An innovation roadmap, defined by selected people in the organisation, will create the framing and directions for FEI:

"...a multidisciplinary group of people engaged with strategic work, people from R&D, marketing, together with experts from different areas, and consultants. It can be people with special knowledge. It is a knowledge picture that needs to be put together." (R&D Director, MedX)

In sketching out FEI in MedX, the R&D Director is quite concerned about how the configuration of people, knowledge, and expertise will create the desired output of FEI. Knowledge and expertise brought into FEI projects has to be situated and relate to the relevant opportunities identified:

"...we have defined what we want to do in the innovation space, there is a headline, and it is the understanding and the solution space that are being defined towards the design brief so we have the right cornerstones for further concept development. [...] The design brief should be understood both by a marketing guy, production, etc. The design brief is not about making the product, it is about framing what we should make." (R&D Director, MedX)

When we begin to view FEI and NPD in MedX from the translation perspective, it is evident in how FEI is approached in MedX. Before establishing the FEI organisation in MedX, the Global R&D Director explained how expensive and unfruitful technology development projects were driven up to the NPD pipeline, and then terminated because of too many unanswered questions concerning markets and production. He explains that this unfruitful effort was caused by the lack of involvement

and coordination with marketing, sales and production, thereby missing crucial buy-in from these parts of the organisation, as well as top management. In meeting this problem, he further explains:

"By inviting top management from the very beginning, approving the innovation roadmap, being part of starting up the projects in the front end innovation, seeing them when they are through the front end and go to concept development, and again see them when they go to product development. [...], top management are updated on a continuous basis. This has resulted in being free from the discussions that could arise before at the pipeline of product development, they have disappeared, because you have commitment early on..." (R&D Director, MedX)

For FEI concepts to succeed, FEI needs to frame the concepts so that the NPD understands them and is able to develop them, and to do this, FEI needs to understand the NPD process. In this way, the structure and process of NPD becomes an element to navigate. In MedX process models are used as an important tool that provides a frame to develop products and they are aware of continuously adjusting the processes according to practices:

"Every time we implement or adjust stage gate processes in MedX, it is extremely customised. Because of a very dialogue-based culture you will get a lot of pushback if you don't make a process that works and can deliver results. It happens all the time, things are in constant development and are continuously adapted to what makes sense." (PMO Manager, MedX)

The PMO manager further describes how process models in MedX are continuously negotiated and adapted to fit the way people in MedX develop products and that there is a significant amount that process models cannot say anything about:

"The process models do not say much about the configurations and the dynamics going on inside the model and that is the focus in my world and this you can get a sense of by walking around the departments and divisions and observe and understand how meetings occur and who are involved when and things like that, that is what sets the pace." (PMO Manager, MedX)

In the translation perspective, MedX are using process models as a tool, a device that has to be navigated. The process model sets the timeline and creates a shared understanding of progress in relation to the NPD model as reference and obligatory passage point. But, the process model does not govern the FEI. Instead, the translation perspective becomes visible in the focus on the content and framing of the concepts and on how to build a heterogeneous network to carry it as a mutual process between framing moves and network building activities. In MedX key actors consider whom they should bring in and when in the process in order to move a conceptualisation process forward and have product concepts accepted by NPD. The translation perspective enables these key actors to embrace the complexity of their conceptualisation processes. The focus on translation also becomes clear in the strategies for making top management interested in the very beginning of a project and enrolling them by acquiring their approval throughout the continued journey of the project. Further, top management and the different functional departments in the FEI organisation is made to constitute a shared space for explorative yet strategic knowledge-creation aiming towards developing an acceptable concept for NPD. Such strategic concerns can only be recognised through the translation perspective.

HiLite

HiLite is a globally leading company supplying the market for residential house construction. A visionary entrepreneur founded the company in the 1940s. Today, the company is owned by a holding company. The company is somewhat conservative, bound by a well-established supply chain network, and has a strong product paradigm. The products developed are highly standardised, as is the product development process as well as further downstream processes, to ensure a high-quality product that maintains its position on the market. The product paradigm creates a shared and somewhat rigid understanding of how new ideas are conceived and what kinds of ideas are acceptable. Nevertheless, this case study is an example of a company that tries to create a strategic and organisational space for radical innovation. Following the industrial discourse on innovation in the 2000s, HiLite was on the lookout to expand its product platform programme and business and decided to establish a radical innovation department. With a strategy for conducting radical innovation within an established product paradigm, the company faced a strong internal dilemma, as top management, on the one hand, wanted to expand the product programme but, on the other, would not risk disrupting the current highly standardised product platform.

Hence, the HiLite case is concerned with the role and working of a small FEI unit (5-20 employees) in a large mature organisation. The unit was established as a support for the top management referring to the concern director (ranking number 2 in the corporate hierarchy). Through a number of organisational changes it ended up being located under sales and marketing. The task of the FEI unit was to contribute both radical and less radical ideas. After having contributed one major radical idea the unit was transformed into an organisation dedicated to the implementation of this idea leaving the role as FEI unit vacant. The case is thus concerned with the working of the FEI unit during its five years of operation.

The process model perspective is less clear but still quite prevalent in this case. First of all, the FEI team was, from the outset, expected to feed ideas and concepts into the product development process at the development department but also to a variety of business units in the larger concern. While the development department was concerned with the further development of the current product platform as well as updates and improvements of the product, top management also wanted to receive more radical ideas in order to develop a new business line to complement the existing one. An idea funnel process including stage gate-like meetings with a steering group located with top management was set up in order to facilitate decisions concerning the passing and uptake of new ideas. While the FEI team was concerned with the development of the qualitative content of ideas and concepts, the funnel model included a quantitative focus on the production of a particular number of ideas but also the selection of ideas. The FEI team saw the funnel as a necessary communication device with top management (steering committee) even they did not consider the brief gate meetings as reflecting the quality of the suggested ideas nor the processes taking place.

”They hardly understand the complicated idea suggestions” (Head of FEI unit), and “[The funnel model] is made and then moderated a couple of times. It’s really designed so that a linear mind can understand it, but there’s nothing in it that really is linear. If you do not think about it as something linear but something that happens all the time, this is how you should perceive it”. (Business developer, HiLite)

Besides the task of contributing ideas for new businesses lines, the FEI unit have increasingly been expected to take on the tasks of handling ideas and concepts and placing them in relevant and fitting innovation projects down the line. A clash between the explorative processes of the FEI unit

and the exploitative and incremental processes of the development department being occupied with incremental innovation was expressed.

”This is engineers who are fantastically skilled in optimisation and work on a clearly defined task about a better insulation ...(...)... they are not creating new business but are hopefully sustaining the business we have .... (...) ...this is their role and they do it well”. (Department director, HiLite)

While at the FEI unit at HiLite, the process perspective was seen as underlining the incremental and path-dependent innovative processes, the generation of more radical ideas was based on knowledge sharing and knowledge recombination. Accordingly, the exchange of knowledge across the company’s internal as well as external markets and technological sources and the facilitation of idea generating workshops became the most important approach. Here, the company’s internal and highly established knowledge positions and taken for granted assumptions were challenged by inviting experts and experience from university as well as other industries. A key challenge was to identify and develop ideas with a relevant strategic fit. Ideas had to be different to the existing product platform in order to create something new that would not challenge the existing business, yet in contrast, new ideas should be sufficiently close that they could build on existing competences.

“We organise these opportunity meetings where we try to look out into defined areas, what happens within materials, for the city, people etc. where the world is heading. Then we link it to what HiLite stands for, competences, visions, values, strategies ... out of that we define a number of what we call ‘strategic spaces’ where there is a good match between the two dimensions.” (Department director, HiLite)

“This could not be carried out by the development department...they are much more technology driven and not oriented towards open innovation” (Business developer, HiLite)

A concern for the FEI unit is the current knowledge silos of the organisation, which are perceived as key obstacles for cross-disciplinary collaboration. A poor alignment between sales and marketing located at the headquarters in Copenhagen and the ordinary development departments located with the factory located in the province is taken as a prominent example. The FEI unit, however, has developed its own local model or approach of working with innovation. The model merely exists as an internal guideline to be adapted to the specific situation and task. It does not follow formal processes but rather selects different informal navigational approaches, such as whether to continue to build up ideas within strategic spaces or to pursue top management support and/or promoting new ideas towards other departments. Such navigational considerations can be referred to enrolment processes of network building strategies and reflect examples of the translation perspective. The following quote further shows how such strategies are part of political struggles.

“It is our own decision whether to pitch ideas to management or to develop them further... Frequently I am surprised to hear top management’s priorities, and frequently they do not agree internally.”

“Basically, we have the competences to get the ideas into the HiLite machinery” (Department director, HiLite)

Concepts that are close to the core product platform are immediately placed in the ordinary development process in order to prevent using scarce FEI resources on development activities.

“Projects being close to the core can easily be kicked along.” (Department director, HiLite)

Concepts that are far from the core product platform remain in the radical department for incubation, and relevant competences are brought in from the main organisation.

“Projects like these (the radical ideas), they face resistance and people have difficulties understanding them and they can neither apply resources to them nor mobilise the competences needed. A project like this (a new business line proposal, author comment) they had to establish a new department, it demands more from the management, it costs some resources” (Department director, HiLite)

Such navigational strategies of how to promote, translate, and negotiate the uptake of ideas and the development of concepts and business plans are key elements of a translation perspective. They frequently take into account the vested interests, as a FEI project manager recalled:

”If top management said it’s a good idea, and we got the licence to press things through, it might entail some dissatisfaction among line managers saying: ‘now they have taken our resources once again’... I guess it created some irritation elsewhere in the organisation” (Department director, HiLite)

Here, it becomes clear, that the project manager try to establish him / herself as a network builder, but, that enrolment strategies effective in relation to one actor may be less effective toward other actors who seem to prefer to defend their position in the already existing actor-network. This fight over actors where strategies for building new innovative networks may appear to work only at the expense of existing networks are a clear illustration of how translation strategies may clash in an organisational setting.

Discussion

In the following section, we will discuss our main findings across the three cases.

The process perspective as a reference point and a communication device

In all three cases, we see the process perspective as being highly present in the reflections of FEI approaches. Process models, such as the stage gate model, work as a general reference point either as a prescriptive model for some of the FEI activities such as managing the flow of ideas, or they define the target for the FEI activities and the criteria to feed the NPD with ideas and concepts. Process models are considered to provide a formal structure with measures of progress. As such, our interviewees frequently portray process models as management tools that are primarily concerned with the control of progress and frequently in quantitative terms. It is also explained how the process models can define project organisations and departmental functions referring to specific stages of the overall process such as conceptualisation, business development and so on. This seems to somewhat support a rational and exploitative perspective on the organisation of knowledge flows where specialised knowledge centres in the organisation provide resources to activities in specific stages of the process. Even though the process perspective is prevalent in all cases its role and status vary considerably. Both in MedX and HiLite, we see how process models are actively used as navigational tools in translating ideas into acceptable concepts where the NPD process model in Agro is providing direction and support for ideas and concepts that can fit into their process model frame.

Therefore, while we find the NPD process used as a reference for progress and functional organisation in all three cases it is also seen as a contrast to FEI or activities with explorative characteristics. Process models are, in this manner, described as setting the conditions of FEI activities and signalling a particular order of innovation (path dependencies, incrementalism etc.) or possibilities and limitations in FEI. However, process models are not (or only to some extent) considered as prescribing or offering support to the qualitative aspects of FEI such as knowledge processes cutting across boundaries or conceptualisation. As a common denominator, we see process models as significantly losing their dominant position when we discuss FEI elements, such as knowledge sharing, ideation and creation of new concepts. The cases indicate that the process models should not be taken on face value, as they do not support the work in FEI with unquestioned recipes. Nonetheless, they contribute to structuring the interviewees' view of the organisational processes. The process models play a significant role in all three cases. Process models are an essential reference for the interviewees and part of the vocabulary and way of perceiving innovation processes and product development in practice. At the same time, the process models are problematized but also considered as more or less necessary in reference to innovative activities of the organisation.

The knowledge perspective: filling in the gaps

As the process models are problematised and perceived as rather unhelpful in relation to the management of FEI activities, the interviewees are looking elsewhere for inspiration and supplementary guidance for the FEI work. Instead, a number of strategies concerned with the sourcing, sharing and creation of knowledge with involved actors complements the process models. Here, innovation is not seen as a linear process, as indicated by the process models, but rather as an interactive knowledge process, where exchange of knowledge across knowledge domains is key. The knowledge perspective gives voice to an informal response to the limitations of process models but also as something that offers inspiration to fill in the gaps of what the process models cannot support. In the knowledge perspective, knowledge flows and enabling processes of search and dialogue across internal and external sources, departments, specialists, etc. are in focus. In the knowledge perspective, process models are perceived and used as communication devices in managing knowledge across knowledge areas, particularly to management but also across knowledge centres making process models, such as the stage gate model, similar to the role of boundary objects (Star and Griesemer, 1989; Carlile, 2002).

Knowledge processes in FEI appear to be highly explorative and less goal-oriented compared to the activities in NPD. In both MedX and HiLite, interviewees describe how search and selection processes are managed through setting up so-called strategic spaces as focusing devices for the exploration of particular ideas. The key difference here is that ideas are not perceived as stable concepts as in NPD, but rather as something to be developed in an interaction (Gish and Clausen, 2013) and even contestation of taken for granted ideas with strategic management and other actors. In Agro, FEI explorative activities are less spelled out, but the need for knowledge sharing, flow, and creation are still expressed in the interviews. Explorative activities are particularly included in the technology development of Agro, where developers participate in conferences and collaborate with university researchers but without specific goals other than to explore new knowledge in the fields defined by strategic interests. We also see the expressed need for exploration in the concept development of Agro but also the difficulties in sustaining knowledge creation activities due to restrictions and a dominant position of the stage gate process model. As illustrated, the knowledge perspective seems to dominate in the interviewees' concerns, vocabulary and account of their FEI

activities and, in particular, the creation of ideas. However, it does not explain how ideas are navigated into good currency (van de Ven, 1986), and able to enter the NPD gate.

The translation perspective: navigating ideas into good currency

While the knowledge perspective can be seen as a widespread supplement to the process models, the translation perspective seems to be an emerging approach in managing FEI, where process models, knowledge strategies and objects become elements in a navigational strategy. To open up for knowledge sources and enable learning across established 'silos' such as in open innovation (Chesbrough, 2003) is clearly not sufficient when questions arise of where to search, how to open up, how to make organisational actors interested and how to decide which established knowledge to be contested. The translation process captures the mutual processes of conceptualisation and network (re)-creation, meaning that the content and intentions of FEI activities become more important than the formalities and forms of collaboration. Translation is illustrated by the strategic considerations of key actors in their navigation of the process of promoting ideas to strategic management or down the NPD line. The change in MedX from a technology-driven orientation of projects with high failure rates to a strategic market direction and commercialisation of their technologies represents a reframing of what counts as innovation.

The movement towards a more strategic mindset where networks of individuals, technology applications, production opportunities, and business cases are challenged and then configured or re-configured in a FEI space illustrates how the translation of ideas are catered for in order to increase the chances of developing acceptable concepts ready to enter the NPD process. In this perspective, the process models are perceived and used as a device or boundary object in translation processes. As both experiences from MedX and HiLite show, strategic directions or spaces are aimed at creating a fit between technologies, business cases, and what the organisation is capable of delivering. To make or work with this fit requires a translational process that includes considerations of all variables and elements that can oppose or support the idea.

Translation is considered where knowledge from a variety of sources are configured in a purposefully selected setup, for instance in workshops where knowledge, objects and actors are configured in attempts to create actor networks or when they, through a targeted dialogue, aim at creating ideas and concepts. This is also where designers and project managers consider how to organise their work with conceptualisation with the aim of matching or challenging corporate product strategy. FEI activities engage with political processes by configuring and directing workshops and create alliances across the organisational boundaries to convince strong decision-makers and create buy-in from downstream development. Key actors exemplify how they decide whether or not or when to involve top management and important decision-makers in FEI activities such as in workshops. Another example is how to use early mock-ups or other models on different levels in order to organise an explorative yet directed process. When key actors involve other actors it is not just a measure of knowledge sharing, the intention is also to create ownership and support to particular concepts. It shows how they use different actors in a purposeful way to configure and stabilise the network around the desired concept output. Table 1 below, provides an overview of the perspectives in the three cases.

Table 1 Overview of the process, knowledge, and translation perspective in the three cases

Case	Process	Knowledge	Translation

Agro	Functional division of FEI activities are ordered and referred to stage gate model Process models prescribing FEI interfaces and activities Process provides measure of progress	Formation of CoPs and workshops aimed at knowledge sharing and knowledge creation Emphasis on cooperation across process gates	Technology department see themselves 'outside' the process rules Strategies for involving actors around an idea, creating and circulating templates, translating strategy documents Negotiation of gate passing and work around
MedX	FEI as formal department/unit are separate, preceding, and different from stage gate NPD Stage gate model serves as an ordering coordination mechanism and common reference and understanding FEI as funnel to keep 'the process open and then slowly narrow down' Process as measure of progress	Composition of project teams across knowledge domains according to a holistic perspective in line with direction of FEI space Challenges perceived use practices by placing developers among users Design brief as framing what to make	Reframing of what counts as innovation from technology drive to market drive Involving top management in selected workshops along the process in order to enable early commitment Navigate NPD process and frame concepts to ensure NPD understanding
HiLite	Clear separation of FEI unit from NPD process model Process models/idea funnel as communication tool towards 'linear mindsets'	Exploration of ideas and idea generation in thematic workshops involving external and internal sources Contestation of taken for granted assumptions in NPD	FEI actors define and take responsibility for own process adapted to particular situations Navigating actors and knowledge domains externally and internally along the NPD process in pursuit of network formation

In contrast to ordinary project and stakeholder management within the process perspective, where the main goal is to reduce uncertainty, a translation perspective appears to embrace uncertainties (Garud et al., 2013) in FEI and even seek uncertainty to create new opportunities, destabilise the current understanding and networks around product- or business paradigms. As we see in both MedX and HiLite with their innovation directions and strategic spaces, key actors try to retain the uncertainty instead of eliminating it. It may seem disordered, chaotic and unclear but, as observed in our cases, it appears highly purposeful. Managers or engineering designers reflect on the modes of ordering they are facing and consider how they may mobilise a network (Christiansen and Varnes, 2007) in particular ways. Here, the interviewees are concerned with actors, socio-material objects and purposeful transformation on the road to frame or coordinate the use of models, knowledge processes,

and technology in a purposeful way in order to perform explorative yet strategic-minded FEI. This is the way they seek to direct their search for ideas so they can connect with process models such as the stage gate models. Here, the translation perspective has a significant contribution because it can comprehend the complexity of FEI where exploration can exist together with strategic direction.

Conclusion

In the present paper, we have identified three dominant perspectives in FEI literature and analysed our three cases accordingly. Our study clearly supports the idea that different perspectives are simultaneously at play in FEI and when we consider the practices accounted for in our cases. To only focus on one perspective would not catch the many facets of managing FEI. We have identified three different perspectives which seem to provide sound coverage of what is going on but also seem useful in providing a holistic understanding of the diversities in managing and organisation of FEI. Compared to the process and the knowledge perspectives, which are broadly recognised in literature and extensively managed in practice, the translation perspective is an emergent perspective in managing FEI. This is not to suggest that translation practices are new in FEI, but that the conceptual understanding and recognition of these processes in FEI literature as well as organisational practice are currently lacking.

We suggest the translation perspective as a third emergent and promising perspective as being useful for managing and organising FEI. It allows us to take into account the objects and artefacts at play. In this way, the process models become a navigational object and something to be put into play. In the cases studied, we see a reflective approach among key actors to process models in how to use them as a purposeful means to achieve something. The same goes for knowledge sharing and creation where a reflective approach confronts, configures, reframes and reconfigures knowledge. The mindsets according to a translational approach are not bound by the understanding embedded in the process- or knowledge perspective. Instead, the focus is on how agency can be created and, while individuals may be embedded in the working of specific process models or understandings of knowledge sharing, the translation perspective points to how actors are able to escape their prescribed roles and take on new responsibilities. The translation perspective is a network perspective that builds upon an idea that the process model can be used actively instead of restricting FEI activities and knowledge processes can be strategic yet explorative. The study makes us aware that the companies approach FEI using different perspectives and a mix of these according to what makes sense in particular situations, tasks, and processes. Following this, the intention is not to dismiss particular perspectives, but rather to contribute to considerations concerning multiple approaches and the implications of applying them. Clearly, the different perspectives can be competing and conflicting as they also reflect different worldviews and even organisational perspectives. They tell something about the kind of models that form the basis of FEI and its different mindsets, perspectives and models and, hopefully, contribute to a higher level of awareness of the range of possibilities to manage and organise FEI.

As we have highlighted, the process perspective gives a reduced and overly simple understanding of FEI, which is both its strength and its weakness. It provides a reference point but does not support FEI; therefore, it has to be supplemented with other perspectives. The knowledge perspective can thus be said to filling in the gaps where the process perspective does not suffice, because it exceeds the linear understanding of FEI and highlights the exchange of knowledge across borders, both internally and externally. However, the knowledge perspective does not cater for the more political

aspects of FEI work, hence the translation perspective helps us explain how ideas are navigated into good currency.

Implications and further research

The perspectives we have presented in this paper are somewhat analytical and serve as a way of understanding FEI. In order to make the perspectives applicable in a practitioner setting they should be translated into a more operational ‘model’ or mindset. Further research should therefore concern how such a model or mindset can be developed so engineering designers and business developers can become even more aware of how they can make the different perspectives work for them in FEI.

Limitations

The analysed cases are unique and based in a Danish context. Generalisation of findings from these cases can therefore be difficult. However, elements of FEI in the three cases are likely to also be found in other large industrial companies.

References

- Adams, R., Bessant, J., Phelps, R. (2006) Innovation management measurement: A review, *International Journal of Management Reviews*, vol. 8, no. 1, pp. 21-47.
- Akrich, M. (1995) User representations: practices, methods and sociology, in Rip, A., Misa, T., Schot, J. (Eds.), *Managing Technology in Society: The approach of Constructive Technology Assessment*. Pinter, London/New York.
- Akrich M. Callon M. Latour B. (2002) The key to success in innovation Part I: The art of interessement & Part II: The art of choosing the good spokespersons, *International Journal of Innovation Management*, vol. 6, no. 2, pp. 187-225.
- Benner, M.J., Tushman, M.L. (2003) Exploitation, exploration, and process management: The productivity dilemma revisited, *Academy of Management Review*, vol. 28, no. 2, pp. 238.
- Boeddrich, H. (2004) Ideas in the Workplace: A New Approach Towards Organizing the Fuzzy Front End of the Innovation Process, *Creativity and Innovation Management*, vol. 13, no. 4, pp. 274-285.
- de Brentani, U., Reid, S. E. (2012) The Fuzzy Front-End of Discontinuous Innovation: Insights for Research and Management, *Journal of Product Innovation Management*, vol. 29, no. 1, pp. 70-87.
- Brown, J. S., Duguid, P. (1991) Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation, *Organization Science*, Vol. 2, No. 1, pp. 40-57.
- Bryman, A. (2001) *Social research methods*, Oxford University Press, Oxford.
- Callon, M. (1986a) Some elements of sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay, in Law, J. (Eds.) *Power, action and belief: a new sociology of knowledge?*, Routledge & Kegan Paul, London.
- Callon, Michel (1986b) The Sociology of an Actor-Network: the Case of the Electric Vehicle, in Callon, M., Law, J., Rip, A. (Eds.) *Mapping the Dynamics of Science and Technology: Sociology of Science in the Real World*, Macmillan, London.
- Carlile, P. R. (2002) A pragmatic view of knowledge and boundaries: Boundary objects in new product development, *Organization Science*, vol. 13, no. 4, pp. 442-55.
- Chesbrough, H. (2003) The era of open innovation. *Sloan Management Review*, vol. 44, no. 4.

- Christiansen, J. K., Varnes, C. J. (2007) Making decisions on innovation: Meetings or networks?, *Creativity and Innovation Management*, vol. 16, no. 3, pp. 282-298.
- Clausen, C., Yoshinaka Y. (2007) Socio-technical spaces: Translating across boundaries in design, *The Journal of Design Research*, vol. 6, no. 1-2, pp. 61-78.
- Clausen, C., Yoshinaka, Y. (2009) The role of devices in staging front end innovation, in proceedings of the First International Conference on Integration of Design, Engineering and Management for Innovation IDEMI09 1-8.
- Cockayne, W. R. (2004) A Study of Innovation Ideas in Informal Networks, PhD Dissertation. Stanford University.
- Cooper R. G. (2008) The Stage-Gate Idea-to-Launch Process-Update, What's New and NexGen Systems, *Journal of Product Innovation Management*, vol. 25, no. 3, pp. 213-232.
- Cross, R., Prusak, L. (2002) The people who make organizations go-or stop, *Harvard Business Review*, vol. 80, no. 6, pp. 104-112.
- van Dijk, C. & van den Ende, J. (2002) Suggestion systems: transferring employee creativity into practicable ideas, *R&D Management*, vol. 32, no. 5, pp. 387-395.
- Dougherty, D. (2008) Bridging Social Constraint and Social Action to Design Organizations for Innovation, *Organization Studies*, vol. 29, no. 3, pp. 415-434.
- Ebner, W., Leimeister, J. M., & Krcmar, H. (2009) Community engineering for innovations: the ideas competition as a method to nurture a virtual community for innovations, *R&D Management*, vol. 39, no. 4, pp. 342-356.
- Eisenhardt K. (1989). Building Theories from Case Study Research, *Academy of Management Review*, vol. 14, no. 4, pp. 532-550.
- Florén H., Frishammar, J. (2012) From Preliminary Ideas to Corroborated Product Definitions: Managing the Front End of New Product Development, *University of Berkeley*, vol. 54, no. 4, pp. 20-43.
- Garud, R., Karnøe, P. (2001) Path Creation as a Process of Mindful Deviation, in Garud, R., Karnøe, P. (Eds.) *Path Dependence and Creation*, Mahwah, NJ: Lawrence Erlbaum Associates,
- Gassmann, O, Sandmeier, P., Wecht, C.H. (2006) Extreme customer innovation in the front-end: learning from a software paradigm, *International Journal of Technology Management*, vol. 33, no. 1, pp. 42-66.
- Gaubinger, K. and Rabl, L. (2014) Structuring the Front End of Innovation, In Gassmann and Schweitzer (eds) *Management of the Fuzzy Front End of Innovation*, Springer International Publishing, Switzerland. pp. 15-30.
- Garud R. Tuertscher P. Van de Ven A. H. (2013). Perspectives on Innovation Processes. *The Academy of Management Annals* 7(1). 775-819.
- Hansen, P.R. and Clausen, C. (2017) Management Concepts and the Navigation of Interestment Devices: The Key Role of Interestment Devices in the Creation of Agency and the Enablement of Organisational Change, *Journal of Change Management*, vol. 17, no. 4, pp. 344-366.
- Gish, L. 2011. Experiences with idea promoting initiatives: Why they don't always work. In *Proceedings of the 18th International Conference on Engineering Design*, Design Society 3: 83-92.
- Gish, L. and C. Clausen. 2013. The framing of product ideas in the making: A case study of the development of an energy saving pump. *Technology Analysis & Strategic Management* 25:1085-1101.
- Howell, J. M. (2005) The right stuff: Identifying and developing effective champions of innovation. *The Academy of Management Executive*, vol. 19, no. 2, pp. 108-119.
- Koen, P. A., Ajamian, G. M., Boyce, S. (2002) *Fuzzy Front End: Effective Methods, Tools, and Techniques*, in *The PDMA toolbox for new product development*, Wiley, New York.
- Khurana, A. and Rosenthal, S.R. (1997). Integrating the Fuzzy Front End of New Product Development. *Sloan Management Review* 38(2), 103-120.
- Khurana A. Rosenthal S. R. (1998). Towards Holistic "Front Ends" In New Product Development. *Journal of Product Innovation Management* 15(1): 57-74.
- Kvale S. 2009. *InterViews: Learning the craft of qualitative research interviewing*. Sage Publications, Thousand Oaks, London.

- Latour, Bruno & Woolgar, Steve (1986) *Laboratory Life*, Princeton University Press (Princeton, New Jersey).
- Legardeur, Boujut and Tiger, 2010, Lessons learned from an empirical study of the early design phases of an unfulfilled innovation. *Res Eng Design* 21:249–262.
- Lundberg, N., Sandahl, T. I. (2000), An ANT Perspective on Work Practice Design, in Dieng, R. et al. (Eds) *Designing Cooperative Systems*, IOS Press.
- Mangiarotti, G. and Mention, A-L. (2015) Investigating firm-level effects of knowledge management strategies on innovation performance, *International Journal of Innovation Management*, Vol. 19, No. 1, 24 pages
- McMaster T. Wastell D.G. (2005). The Agency of Hybrids: Overcoming the Symmetrophobic Block. *Scandinavian Journal of Information Systems* 17: 175–182.
- Markham, S. K. (2013) The Impact of Front-End Innovation Activities on Product Performance, *Journal of Preproduct Innovation Management*, vol. 30, no. 1, pp.77-92.
- Mullins, M. E., Kozlowski, S. W. J., Schmitt, N., & Howell, A. W. (2008). The role of the idea champion in innovation: The case of the Internet in the mid-1990s. *Computers in Human Behavior*, 24(2), 451-467.
- Nonaka I. Takeuchi H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press.
- Nonaka, I. and Toyama, R. (2003). „The knowledge-creating theory revisited: knowledge creation as a synthesizing process“. *Knowledge Management Research & Practice*, 1, 1, 2-10.
- Páez-Avilés et al (2015) Innovation and technology transfer of medical devices fostered by cross-disciplinary communities of practice, *International Journal of Innovation Management*, Vol. 19, No. 6, 27 pages
- Pattinson, S., Preece, D. (2014) Communities of practice, knowledge acquisition and innovation: a case study of science-based SMEs, *Journal of Knowledge Management*, vol. 18, no. 1, pp. 107-120.
- Reid S. de Brentani U. (2004). The Fuzzy Front End of New Product Development for Discontinuous Innovations: A theoretical Model. *Journal of Product Innovation Management* 21: 170-184.
- Smith, P. G., Reinertsen, D. G. (1998) *Developing products in half the time: new rules, new tools*, John Wiley & Sons, Inc., New York.
- Schön, D. A. (1967) *Invention and the evolution of ideas*, London: Tavistock (first published in 1963 as *Displacement of Concepts*).
- Schön D. (1983). *The Reflective Practitioner: How Professionals Think in Action*. Basic Books, New York.
- Schweitzer, F. and Gabriel, I. (2012) Action at the Front End of Innovation, *International Journal of Innovation Management*, 16, 6: sidetal
- Star, S. L., Griesemer, J. R. (1989) Institutional ecology, 'translations' and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, *Social Stud. Sci.* 19 387-420.
- Takeuchi, H., Nonaka, I. (1986) The New New Product Development Game, *Havard Business Review*.
- Tidd, J., Bessant, J. (2009) *Managing innovation*, John Wiley & Sons, West Sussex.
- Timmermans, S., Tavory, I. (2012) Theory Construction in Qualitative Research: From Grounded Theory to Abductive Analysis, *Sociological Theory*, vol. 30, no. 3, pp. 167-186.
- Trotter (2011), A new moodified total front end framework for innovation: new insights from health related industries, *International Journal of Innovation Management*, vol. 15, no. 5:1013-1041.
- Yin, R. K. 2009. *Case study research: Design and methods*. SAGE Publications.
- van de Ven, A. H. (1986) Central Problems in the Management of Innovation, *Management Science*, Vol. 32, No. 5, pp. 590-607
- Verworn, B., Herstatt, C. (1999) Approaches to the "fuzzy front end" of innovation, *Working Papers / Technologie- und Innovationsmanagement*, Technische Universität Hamburg-Harburg, No. 2.
- Verworn B., Herstatt, C. (2002) The innovation process: an introduction to process models, working paper no. 12, Technoval univeristy of Hamburg.

Wenger, E., & Snyder, W. (2000). Communities of practice: the organizational frontier. *Harvard Business Review* (January-February 2000), 139-145.