CHALMERS
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Managing External Knowledge in the Fuzzy-Front of NPD from Open Innovation Perspective

Master's Thesis in the Master's Programme International Project Management
HAFEZ SHURRAB

Master's Thesis in the Master's Programme Management and Economics of Innovation
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Illustration of the fuzziness of idea exchanging across companies.
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ABSTRACT

At the commencement of any new concept introduction pertaining to a product or a service, a lot of ambiguity accompanies the paths of development. Consequently, companies allocate uncertain figures in their budgets during the concept phases of new product development (NPD) projects, which could require delays for years before taking the shape of a typical controllable project supported by a promising business case. At project delivery, the final project cost calculations may exclude the activities of the front-end due to its loose definitions and lack of recognition as one fundamental part of the NPD project. Nevertheless, the top management is aware of how certain products could absorb dramatically much time and resources due to lack of structure and definition of this fuzzy phase. In other words, a company – for instance – may invest heavily in integrating new technology into their product ranges. However, the ongoing investigations may for example reflect the infeasibility of this effort too late, or they could explore a valuable source of knowledge or potential partnership too late leading to incurring unnecessary costs from a knowledge availability perspective. Therefore, the productive involvement of the right source and integration methods of internal and external knowledge becomes indispensable to optimize the innovation process. Nonetheless, organizational bureaucracy and the heritage of core competence and competitive advantage protection policies stand against forming a freestyle open innovation cooperation among knowledge leaders. That challenges the development of a structured logic for the fuzzy front-end (FFE) of NPD from an open innovation perspective.

As part of the efforts dedicated to bring structure into the FFE of NPD, this thesis aims at developing guidance for both innovators and their line management in light of the confusion concerning this phase. The focus is on two main areas including how triggering successful concepts usually occurs from the earliest possible starting point, and who should be the potential key contributor(s) at each stage of the FFE along with when this should happen. The findings reflect a generic guidance to the timing of the involvement of the specific key contributors and their roles at each stage during the FFE of NPD. This recommends streamlining resources in a more specific way along the FFE. The thesis report ends with a summary and potential topics suggested for future research for whom the continuation on this topic may concern.

Key words: *Open Innovation, Fuzzy Front-End, New Product Development, Knowledge Management, Project Management, Partnership*

Contents

Preface

Without the support from following people, it would not have been possible to proceed with this thesis report. Therefore, we would like to thank them. Thank to our supervisor Petra Bosch at Chalmers University of Technology for her relentless support, patience and guidance throughout the whole thesis. You were not only reviewing our content, but also small details. You went through word by word many times in order to ensure findings of high quality. This this would never have been shaped into what it is right now without you.

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Hafez Shurrab & Lian Hong Zheng

Abbreviations

NPD	New Product Development
FFE	Fuzzy-Front End
IP	Intellectual Property
OI	Open Innovation
OOI	Outside-In Open Innovation
IOI	Inside-Out Open Innovation
BE	Back End

1 Introduction

In the commencement of this master thesis, the following sections represent a general background from which the main topic is derived. That is followed by a problem description concerning the main challenges that encounter integrating external knowledge during the earliest stages of New Product Development (NPD) projects, which is referred to as the Fuzzy-Front End (FFE).

Closed innovation was first coined by Chesbrough (2013) as the management paradigm by which companies tightly control generating ideas and tend to prioritize owning them as their intellectual properties (IP) to protect them from being commercialized by other companies. In fact, there are many other reasons for why companies adopt a closed innovation philosophy. Examples may include performance efficiency, consistency and standardization, which were reinforced by many years of adopting almost the same internal concepts related to involving limited group partners and using limited pool of tools and methods, which might in turn have been developed and upgraded internally. Nevertheless, Chesbrough (2013) believes that such organizational behaviour is not responsive with Today's rate of change, which is considerably increasing. Consequently, he promoted open innovation as a new management paradigm in which knowledge is more openly managed and transferred across organizational boundaries – inward and outward – leading to higher individual and collective innovation productivity. To manage knowledge means to enable a process to capture, manipulate, share, and reuse organizational information effectively (Dalkir, 2011).

According to Chesbrough et al. (2014), open innovation could be used in research, product development, manufacturing and marketing. Further, open innovation could be used for current markets, new markets or other firms' markets. Finally, the flow of knowledge in open innovation can be outside in or inside out. When a company collaborates with other partners to above all make advantage of their knowledge sources, the process is termed as outside-in open innovation (OOI). On the contrary, if a company is willing to share knowledge as part of real intention to make business, the process is to be termed inside-out open innovation (IOI) Chesbrough et al. (2014). In this study, OOI is primarily considered.

Recently, there is growing interest toward open innovation. Large-sized companies such as Google, and lately Intel, recorded success stories with open innovation, which indicates how more and more market leaders are getting aware of the effectiveness of open innovation to confront current and future challenges, which were emphasized by Hamel (2007) as the ability to rapidly react to/shape future changes both efficiently and effectively.

On the other hand, there are many companies failed to properly align their strategies with open innovation. According to Wessner (2012), one important failure factor to apply is that open innovation as a concept drastically grew to form a big umbrella

under which many sizes can fit without crossing each other, meaning that things can go in all directions. The driver for this end was the fact that open innovation received huge attention from researchers, which resulted in many contextualized frameworks and models for specific industries, positions in the supply chain network and many other parameters Chesbrough et al. (2014). Adner (2013) addressed the failure factors from unsuccessful open innovation journeys taken by many companies such as Michelin, Sony and Hollywood studios. The majority of these factors – if not all of them – were in the early stages of new product and service development such as improper partners' selection, very broad set of suppliers, ambiguous business model agreements and many other factors. Additionally, most of the current literature outlines great strategies related to external knowledge capturing and concept development, but they lack connecting these strategies together chronologically (Brem & Tidd, 2012) and consistently as part of OOI approach starting from the very early stages of a project. Besides, literature has very little contribution to practical scenarios for how new product development (NPD) projects are systematically triggered and sensed in light of OOI (Brem & Tidd, 2012). Not least, most of the strategies for selecting and collaborating with partners in literature are developed from a static perspective, including a few scenarios that could be dynamically outlined along the early stages of NPD from an OOI perspective. Therefore, this study is aimed at including more scenarios through analysing a case study applied on an innovation-demanding business unit at a large company.

1.1 Problem Description

1.1.1 New Product Development Fuzzy-Front End

The earliest stage of NPD – referred to by many researchers as the Fuzzy Front End (FFE) – is characterized by challenges including complex information processing, conflicting organizational pressures, considerable uncertainty, and tacit knowledge (Khurana & Rosenthal, 1998). Furthermore, Montoya-Weiss and O'Driscoll (2000) claim that missteps are quite difficult to avoid in the FFE stage because it is most of the time ill-defined and important decisions are made during it based on ad-hoc style. According to Gassmann & Schweitzer (2014), FFE is the period of time that starts with observing/sensing a change opportunity until the time after which the project realisation is to be undertaken. The term FFE is a concept that emerged as a response to the efforts dedicated to shorten time to market within product development. The plan is to make quicker effective decisions related to opportunities and ideas in the early phase of product development (Gassmann & Schweitzer, 2014). One advantage of this approach is the fact that the cost is lower to change in the earlier phase. Another advantage is the higher speed of product development and faster market releases. Despite the advantages of the FFE, there is great uncertainty related to technical feasibility and market acceptance. Furthermore in the FFE, it is difficult to control competitors' actions and economic dynamics. The great uncertainty means that project leaders have to come up with countermeasures and properly manage risks. For

that, enabling flexible testing will significantly reduce the risk of technical or market failure (Gassmann & Schweitzer, 2014).

1.1.2 FFE Challenges in Relation to External Knowledge

The FFE phase is particularly problematic from Ghezzi's et al. (2014) point of view when it comes to the failure factors of open innovation realisation. On the one hand, open innovation was used to enhance the firms' competitive advantages including exploring new strategic spaces and alternatives, reinventing the firms' value proposition by leveraging their external sources of innovation, and extending the firms' research and the product or service pipeline. These advantages were realised by many companies through different strategies including increasing service differentiation of effectiveness-related innovation and reshaping the key activities and assets/resources, extending the value chain base and being open to external entities, and finding alternative intangible sources of advantage like change culture, customers'/ users'/ developers' communities and external partners' orchestration. On the other hand, three major challenges were the drivers for open innovation failure for some companies. One challenge is to determine to which extent the parameters of a business model should be opened to the third parties in the agreements. This challenge could be hidden or underscored by some overestimated – sometimes inexistent – relationships between the overall business strategy and the process of business model design. Last but not least, some companies were jammed at the challenge of integrating the open business model with different patterns of closed business models that are internally or externally existent. As a result, to effectively coordinate external knowledge and innovatively collaborate among partners is the key ability to overcome such challenges Ghezzi et al. (2014).

In the FFE, the key capability is being good at managing people, i.e., finding the right people, setting up a good network, coaching the teams, identifying the creative potential of the individuals and providing them with a strong vision and direction. Yet, the front end is where most companies have huge potential for improvement and the gap between best practice and average practice is enormous. One of the reasons is that it is much more difficult and complex since it is much harder to describe a good front end of innovation and consequently implement it (Gassmann & Schweitzer, 2014).

Furthermore, the strategies to involve different partners at different stages of NPD may result in different consequences. For instance, early involvement of many suppliers may be exhausting (time and cost consuming) to manage in particular context. The decisions made to activate and deactivate the relationships with contributors should be reasoned from a value perspective. In other words, inviting the right partners to the events where they can be relevant and value-adding to a concept to be developed or ideas to be screened can be based on different rules and logics depending on which innovation concept is adopted (IOI or OOP). Therefore, a company should know when to partner with whom and to which extent Geum et al.

(2013). Additionally, it is common for companies to enforce their departments/units to support each other in order to optimise the overall resource utilization. Therefore, in practice, departments have restricted freedom on selecting and collaborating with the right partners they wish (Hollen et al., 2013). In addition, trust and sensitive corporate information are other factors to Hollen et al. (2013) be counted in collaboration with external partners. All these conditions represent challenges that would strangle the early possible collaboration efforts for bringing the FFE into an effective and productive process structure.

Generally, along the FFE of NPD projects, many decisions may allow or prevent significant opportunities, and they can be even catastrophic in terms of confidentiality (Shen & Yu, 2009). The decisions and strategies previously addressed are especially interesting when OOI is to be deliberately or spontaneously considered, which is why this study is focused on the FFE of NPD projects in light of OOI principles.

1.2 Purpose and Research Questions

This study is aimed at exploring effective strategies and recommendations to be used as guidelines for the management of external knowledge in the early phases of NPD projects. The deliverables are mainly gathered from gap analysis findings resulting from studying both the current state of a case study (business unit in a large company) and the state-of-the-art literature. In order to achieve a gap analysis, an empirical study is conducted at that business unit and compared with the most recent OOI theories related to collaboration in the FFE of NPD projects. As a result, managerial and academic implications are discussed and outlined for future considerations. The main findings are detailed answers to a main research question, which is highlighted for investigation, analysis and discussion reviewed later in this study. The main question together with its underlying questions are listed in the following points:

- How could external knowledge be managed and leveraged toward innovation in the FFE of NPD projects?

    1. How could external knowledge systematically contribute to triggering, approaching and proceeding with innovative NPD?

    2. How could different partners be involved and collaborated within the FFE of innovation projects?

1.3 Delimitations

The two main topics in this study are open innovation and the FFE of NPD projects. Both topics are quite wide and only one limited aspect are focused on. First of all, only a single case is studied, which is a business unit of a large company. This department is responsible for developing products for both niche and mass markets. In order to get the knowledge needed for these markets, the unit is only studied from an OOI perspective, as it is easier to get acceptance from the larger companies on this perspective than on IOI. The reason is large companies deal with information to be

shared from their side with great carefulness, which slows down the processing of concept development in light of IOI (Chesbrough et al., 2014).

The focus on the case is limited to product development projects in which the proper level of structure and organization in the early stages is missing, see Appendix A. Therefore, these are the only stages to be considered in this study. Furthermore, in order to explore effective strategies to manage external knowledge in the FFE, particular aspects are studied including strategies to sense triggers for collaboration; select and collaborate with partners; and generate, evaluate and decide on ideas to be proceeded with. Besides, only few projects done by the case company are considered, which not necessarily includes the complete picture about any of these projects. They are rather studied to capture a clear perception about the strategies between different projects. Consequently, the gap between the state-of-the-art and the current-state strategies is highlighted and responded to accordingly.

2 Literature Review

This chapter is aimed at reviewing researchers' concepts and philosophies related to the key theories used in this thesis. First, the background of OOI is discussed in details. Then, the definitions of the FFE of NPD are reviewed and commented on. As part of defining the FFE, models were developed to integrate some structure into it, which is also addressed in this chapter. That is following by discussions concerning different strategic directions that could drive the development path in the FFE including corporate foresight strategy, innovation opposition strategy, deliberate vs emergent strategy, and other possible orientations. The chapter continues with some theories of knowledge management as managing external knowledge could be seen as a form that is driven from a more generic knowledge management framework. How knowledge is managed according to a knowledge management process model is reviewed. Finally, different modes of partnerships in the light of innovation in the FFE are discussed and different triggers for partnership are identified.

2.1 Outside-in open innovation

After Chesbrough (2003) has introduced the idea of open innovation a decade ago, many following contributions added changes to the original concept. According to the new definition,

> *"open innovation is a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with each organization's business model." (Chesbrough et al., 2014, p. 27).*

The new aspect here is the additional combinations of open innovation and open business models that can be generated. In other words, previously, open innovation strategy was only discussed given that the business model should be kept closed, while analysing the possibilities of having business models also open resulted in a classification of innovation modes that turned out to be common in literature nowadays including outside-in open innovation, inside-out open innovation, and closed innovation (Chesbrough et al., 2014).

Chesbrough et al. (2014) illustrated that OOI could be using others' knowledge to develop either new offering or new business model showing a contrast between both situations. In general, the innovation process of the outside-in style is dedicated to enrich the company's own knowledge base through extracting and integrating others' knowledge. On the other hand, gaining business benefits from exposing internal ideas to market, spinning off ventures that are not sufficiently relevant to the company's core business and selling or licensing IPs are examples of IOI strategies (Gassmann & Enkel, 2004). The different interactions in both modes are illustrated in Figure 2-1. The circles represent the external knowledge base if they are located outside the firm boundaries, while being inside it makes them part of the internal knowledge base. The paths of interactions are extended along the new product/service development process

from research and development phases, passing through manufacturing, and ending by marketing. The dotted line of the firm boundaries is a unique aspect that makes the difference between open and close innovation. In general, the porosity of the dotted line holds the idea of the possibility to interact with external parties at any point along the different phases. Finally, the focus of the back-end of the funnel refers to the market in which the product/service development project is dedicated for. The position of this market is shown to be in very different spots at it is common in reality (Chesbrough, 2013).

NPD projects are depicted as funnels due to the high degree of uncertainty in the concept scope. Moreover, although open innovation in its model reflects high degree of dynamics to catalyse and leverage the collective creativity across firms, Jörgensen et al. (2011) confirm that the front-end of the model is even fuzzier than it actually seems or the new product development projects are in their nature.

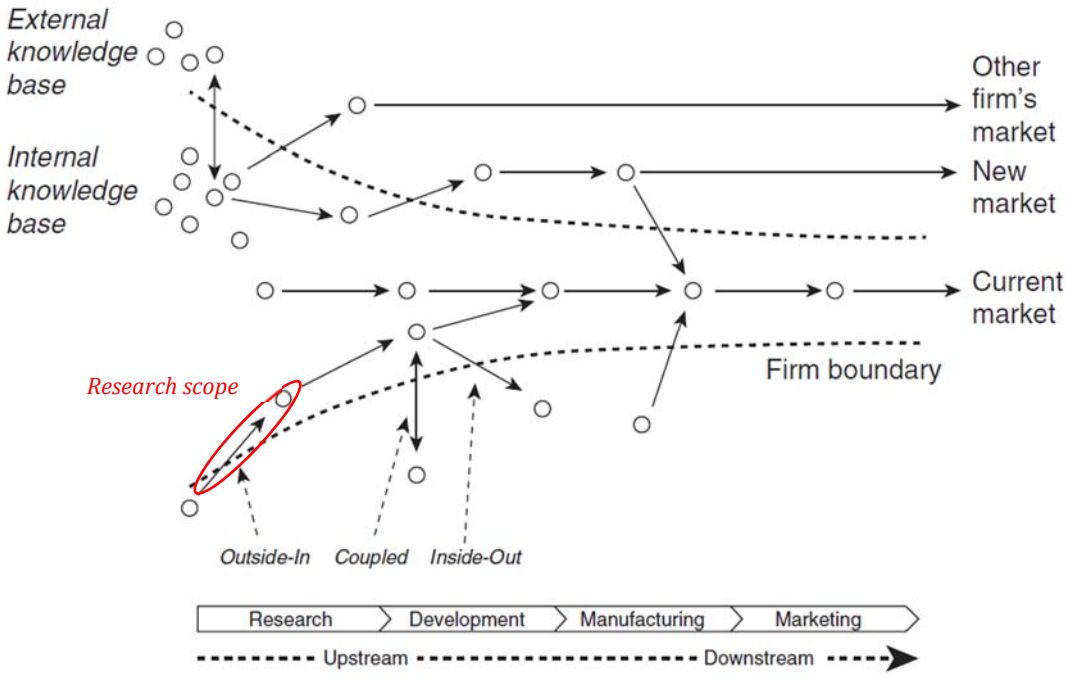

Figure 2-1 The Open Innovation Model – source (Chesbrough et al., 2014).

2.2 Innovation fuzzy-front end

Gassmann and Schweitzer (2014) claim that most managers are only involved in the late innovation phase in which processes and procedures are clearly defined and roles and responsibilities are properly documented. Nonetheless, they argue that innovative ideas whereby the competitive advantages of business are enhanced could be exclusively detected in the front end of innovation. The first phase of the innovation process is commonly termed as the *fuzzy front end* (FFE), which is where the idea generation for incremental or radical product/service concepts takes place (Jörgensen et al., 2011). Smith and Reinertsen (1998), first attributed the term fuzzy-front end to the zone between the time when an opportunity is detected until the time when serious

effort is exerted to realise the opportunity. Similarly, Kim and Wilemon (2002) define the FFE as the period between the point at which a value-adding idea for new product or service is noticed and sensed until the point at which the governing representatives in a firm make decision whereby the opportunity is given formal approval to be developed and realised in a structured and well-defined manner. According to Brun et al. (2009), the aspect of fuzziness has to a great extent consensus concerning the ambiguous nature of this particular phase and the looseness of inter- and intra-firm communications during it. Nonetheless, Gassmann and Schweitzer (2014) believe that the FFE phase structure could be to a limited extent described, which may represent a first step "towards managing the unmanageable".

2.2.1 FFE process structure

Gaubinger (2009) believes that the structure of the innovation process is one critical process-related factor among many other factors that influence the success of knowledge extraction in innovation. For him, the process models are designed so as to structure work tools, methods and techniques in a way facilitates communication within the company through developing a common understanding and making the process transparent across all departments, and also across the company network. That is, the structure of NPD processes may define the timing, content, and means of communications with other parties, which are significant elements in OOI (Chesbrough et al., 2014).

According to Barczak et al. (2009), process models related to systematizing and structuring the innovation process in the FFE is only supported in literature at the operational level. Among many proposed structures of the FFE of innovation process, adapting a generic structure to the OOI flow is barely discussed in literature. Gassmann and Schweitzer (2014) proposed a generic structure for the activities to be involved in the FFE. By adapting the relevant aspects of the OI models developed by both Chesbrough et al. (2014) and Muller and Hutchins (2012), both the FFE and OOI might be integrated in as shown in part "a" of Figure 2-2. The dotted line represents the front end of OI funnel, while the inward pointing arrows represent the possible occasions along the FFE funnel at which external knowledge could be integrated using particular communication mechanism.

The first phase of the FFE starts by identifying a relevant problem (Griffin et al., 2007) (as shown in part "b" of Figure 2-2), which is called the *strategic arena setting* or *bubble-up-process* since the strategic decisions for NPD are made within it (Gassmann & Schweitzer, 2014). Therefore, the more diverse – but relevant – viewpoints are involved, the more effective are the strategic foundation of the project, which makes the management of interdisciplinary and inter-functionality quite important during this phase (Muller & Hutchins, 2012). However, Rohrbeck (2014) believes that finding the right problem starts with a trend scoping process through which related factors – such as supporting technologies and associated regulations and economic growth – are foresighted using different tools and techniques. For instance,

the insights into dedicated technologies and trends (e.g. use of particular devices) related to developing a product that is aimed at increasing organizational efficiency through mobility are crucial for first forming an expectation for how long the product will be useful for the firm, and then estimating roughly the return on investment earned by this kind of solutions. Therefore, Gassmann and Schweitzer (2014) emphasize identifying technical and market uncertainties iteratively with problems identification until they reach to the desired level. That is particularly specified by Kutvonen (2011) as an inbound OI area that is extensively practiced through collaboration with both internal units and external partners, since uncertainty level determination is extremely challenging and forked task.

Once the level of market and technology uncertainty is satisfactory in relation to the associated context, Griffin et al. (2007) believe that innovators' understanding of the problem should live up to significantly great level so that they are able to immerse, imagine or even dream about the problem and its complex aspects related to the holistic view and operational levels. Additionally, they claim that it is very common to go back to problem identification during while obtaining mature insight into the problem topics due to the fact that new knowledge needs are identified, and thus new external parties to deal with. This also means that even foresight activities may be triggered all over again (Gassmann & Schweitzer, 2014). As a result, internal and external knowledge leads to finding the right dots, gaining the understanding from the right domains (enabled by learning from external parties), and melding the pieces into a valid representation of the interesting problem (Griffin et al., 2007).

Once an interesting problem is considerably grasped, then it is time for the idea generation phase referred to in Figure 2-2-a (Gassmann & Schweitzer, 2014). In the same context, idea generation could be seen as the trigger for inventing and validating phase, referred to in Figure 2-3-b (Griffin et al., 2007). Simultaneously, it is expected that both internal and external parties to proceed the collaboration with are already screened, identified, and evaluated before communicating the resulted problem. Furthermore, the modes of collaboration in terms of business models and IP agreements maybe partially or greatly defined and prepared time at this stage depending on which strategies are to be adopted for concept development, project management, and collaboration (Braun et al., 2012). In the idea generation phase, innovators try to integrate external contributions as needed depending on which build and test models as well as problem solving tools are to be used and in what area the knowledge is to be derived from (Griffin et al., 2007). Kotter (2012) states that all parties to be involved in a change process should be well informed about the communication means to be used for collaboration; the communication materials (e.g. documents, templates, design artefacts … etc.) to be reciprocated; and the overall change vision, timeframes, and deliverables. Roughly, by considering the similarities between involving external and internal parties in the idea generation phase and involving them in a change process, one may also see Kotter's (2012) findings concerning communication as relevant.

Together with partners, ideas are generated and evaluated following the same or different communication mechanisms. The overall plan are then changed or updated depending on results of idea generation and in line with the strategies adopted (e.g. emergent vs deliberate strategy) (Gassmann & Schweitzer, 2014). For instance, changes concerning the number and type of partners is possible, meaning that a relationship with particular partners might be terminated or new partners might be involved in the idea evaluation phase. Likewise, the collaboration is proceeded with for the selected idea with possible changes in innovation and communication plan as well as partnership based on the same logic discussed earlier (Braun et al., 2012). However, it is expected that the rate of changes in the plan and partnership base decreases as the concept is developed and evaluated. In general, the changes should enable high interactions after the idea is selected, while meetings should be run at the highest possible speed once the concept is evaluated and selected until all iterations are conducted (Gassmann & Schweitzer, 2014). At this point, external knowledge management at the FFE finishes and the final proposal to be raised to the top management in the firm is prepared (Griffin, Price, Vojak, & Hoffman, 2007). Collaboration may continue in prototyping phase, however, changes in the FFE of the innovation process are easier to be made than how costly and time-consuming they would be later on (Verworn et al., 2008).

The tools used to generate and evaluate ideas as well as identify and evaluate concepts are too many and related to different scopes and contexts as listed by Nimmons (2015) in Appendix B. Through using these tools, innovators strive to make valid connections between the resultant conceptual models, meaning that there might be a need to simplify them in order to facilitate easier combination of the final solution patterns that fulfil a business need (Griffin et al., 2007).

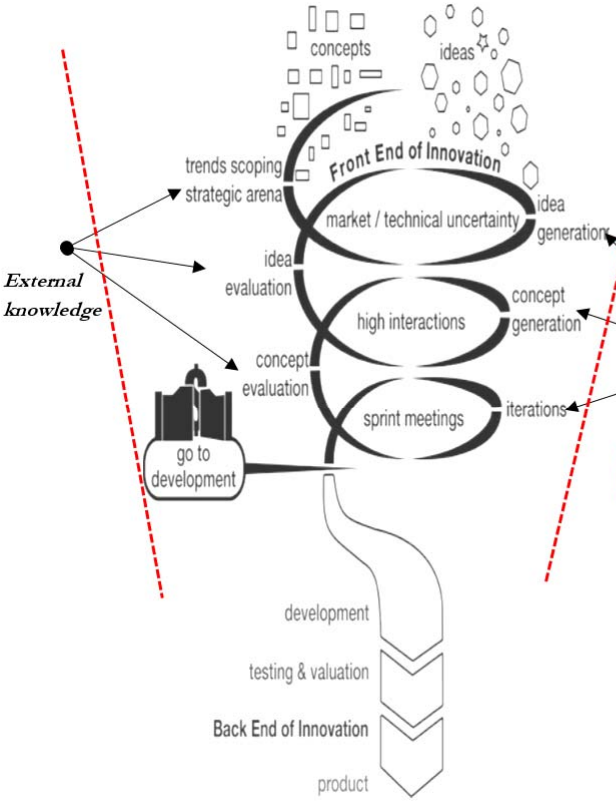

Figure 2-2-a: Activities at the fuzzy front end of product innovation – adapted from Gassmann and Schweitzer (2014).

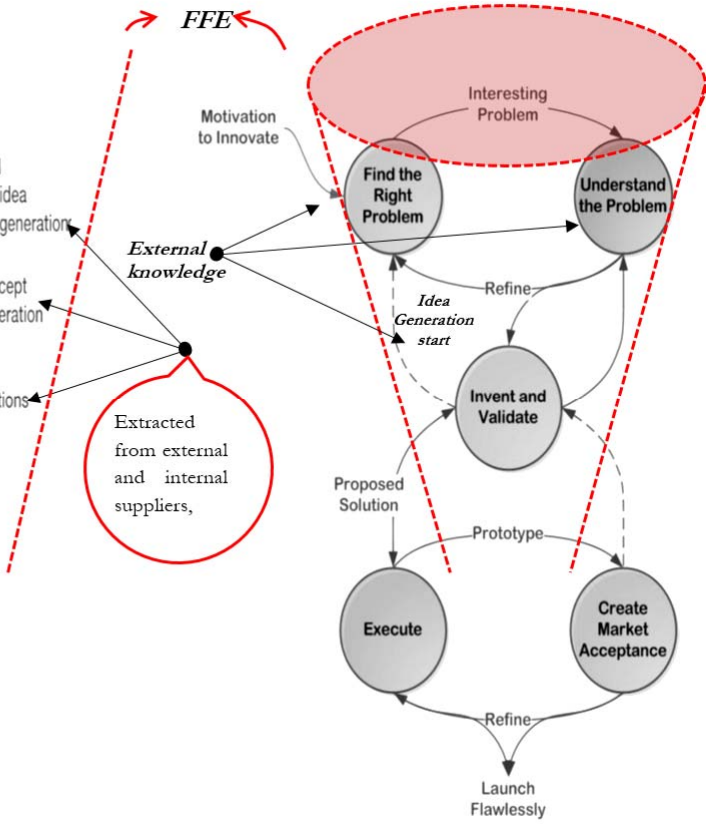

Figure 2-3-b: The behaviour of serial innovators innovate opposed to the FFE of OI innovation – adapted from Griffin et al. (2007).

2.2.2 Process strategic alignment in the FFE of Innovation

Unlike the FFE, the back end (BE) of projects is regarded as a well-defined phase since the product or service specs already live up to the level of detail makes the traditional process management a key to efficiently manage engineers and cross company teams – that require clear gates and strict processes – through deliberate scheduling of milestones and stage-gate elements (Gassmann & Schweitzer, 2014). On the other hand, the key capability process in the FFE is pertaining to how to manage people, not only to be good in leadership. That includes setting up a good network, finding the right people, noticing their creative potentials, coaching the teams, providing individuals with a strong vision and direction. The latest aspect is quite important since it provides meaning that in turn triggers the intrinsic motivation of researchers and innovators (Gassmann & Schweitzer, 2014). Andriopoulos and Dawson (2009) emphasize the fact that intrinsically motivated teams have much more likelihood to use their full potentials and creativity to overcome challenging tasks than extrinsically motivated teams that are keener on status and monetary rewards.

In general, Gassmann and Schweitzer (2014) stress that the knowledge development strategies are among other key factors (such as methods and tools, processes, networks and interdisciplinary systems, culture and people) that influence the core management capabilities in the FFE of innovation. More specifically, as discussed in

the previous generic structure of the FFE of innovation process, there are different strategies concerning the orientation of knowledge development in innovation. Rohrbeck (2014) discussed several foresight strategies related to detecting, interpreting and reacting to signals that indicate future changes. Gassmann and Schweitzer (2014) in turn claim that significant decisions concerning stability vs flexibility strategies are important to be made during the FFE of innovation since they determine many aspects not limited to the degree of risk taking. Other interrelated aspects may include creativity vs discipline strategies, certainty vs uncertainty strategies, dynamic- vs core-capability strategies, and emergent vs deliberate strategies (Gassmann & Schweitzer, 2014). Issues like how these strategies influence innovation behavior are further discussed in the following sections.

2.2.2.1 Corporate foresight strategy

Given that collaboration within and across organizations is very dependent on the rate and type of opportunities (Griffin et al., 2014), building capabilities to detect and grasp these opportunities in a timely manner becomes valuable for OOI in the FFE. According to Slaughter (1997), these capabilities are commonly referred to as corporate foresight capabilities, which encompass activities dedicated to identify changes, create a consolidated future outlook, and make contributing use of these insights to the organization. Examples for such uses may include activities like strategy development, innovations creating, risk management, and new markets exploration (Slaughter, 1997).

The activities of a corporate foresight strategy are regarded as successful when they enable generating useful awareness for the future and concurrently facilitate and trigger organizational reaction (Chandy & Tellis, 2000). However, innovating in new product categories is usually accompanied by a high level of uncertainty (Nijssen et al., 2005), which means that traditional techniques of evaluating innovations based on preferences to avoid risky projects are more likely to lead to established products categories, which limits the innovativeness (Rohrbeck, 2014).

Rohrbeck (2014) discussed solutions associated with the challenges of detecting effective triggers for NPD residing in the earliest stage of the innovation FFE. These solutions revolve around building corporate foresight capabilities and incorporate three main themes including scanning markets trends with a view to detect future changes, interpreting the impact of these changes, and highlighting triggers for new innovation initiatives.

Gassmann and Schweitzer (2014) discussed a common mistake that large companies unintentionally commit during trend scoping, which is trying to fascinate end users by playing their excitement cord instead of investigating their real needs that they themselves are most of the time not aware of. That could be an example of making the wrong decision in the very early stage of the FFE of innovation.

Detecting signals of change should contribute to a current or new competitive advantage. As such, Rohrbeck (2014) suggests that an initial screening should be done by identifying and recording weak signals, rather than mobilizing resources toward mega trends, which are also targets to competitors and embed high degrees of uncertainty. However, only relevant weak signals should be discussed with internal experts and/or be investigated further. As such, significant resources will be dedicated to limited choices of future changes. Figure 2-4 shows the probabilities of errors in detecting signals of change. Certain parties are expected to produce relatively low errors in their judgements including strong internal and external network, employees with good reputation and record in a given industry, and a management board. On the other hand, narrow educational backgrounds make it less likely to lower such errors (Rohrbeck, 2014).

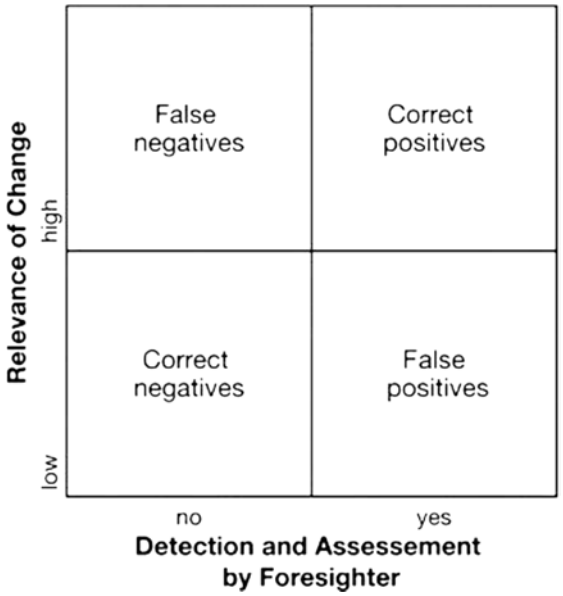

Figure 2-4: Errors in detecting signals of change – source (Rohrbeck, 2014, p 61).

In the same discourse, another effective strategy is to target relatively future changes with short timeframes over high-impact trends with long time horizons, especially in fast-changing markets. A good example could be from apparel industry in which the ability to spot changes in trend-defining subcultures is crucial to turn these signals into products within 3–6 months so that they are not old fashions if they come later (Rohrbeck, 2014).

Automatic scanning of changes is available using intelligent data mining approaches (Dubiel et al., 2014). Data mining is a process with computational capability to identify patterns in large data sets using methods at the intersection of database systems, statistics, machine learning, and artificial intelligence. Extracting information to be transformed into structures that fit further uses represents the overall goal of the data mining process (Bhatnagar, 2014).

Generally, Rohrbeck (2014) claims that the uses of data mining could be as significant as scanning for terms associated with new changes to be explored, which is particularly advantageous for converging industries in terms of the identification of

innovation opportunities. For him, data mining could be as simple as searching for and monitoring a specific development pertaining to a keyword. Rohrbeck (2014) adds that even though publication and patent databases are valuable sources of relevant data, social networks succeeded in proving their worthiness when it comes to key experts' identification and communication in technological domains. In the same point, von Hippel et al. (2008) attributed the techniques dedicated to find key experts who belong to the right level of expertise to be part of the *pyramiding* principle shown in Figure 2-5. The principle shows how the true expert level associated with the sought-after knowledge and skills is reached through pyramiding.

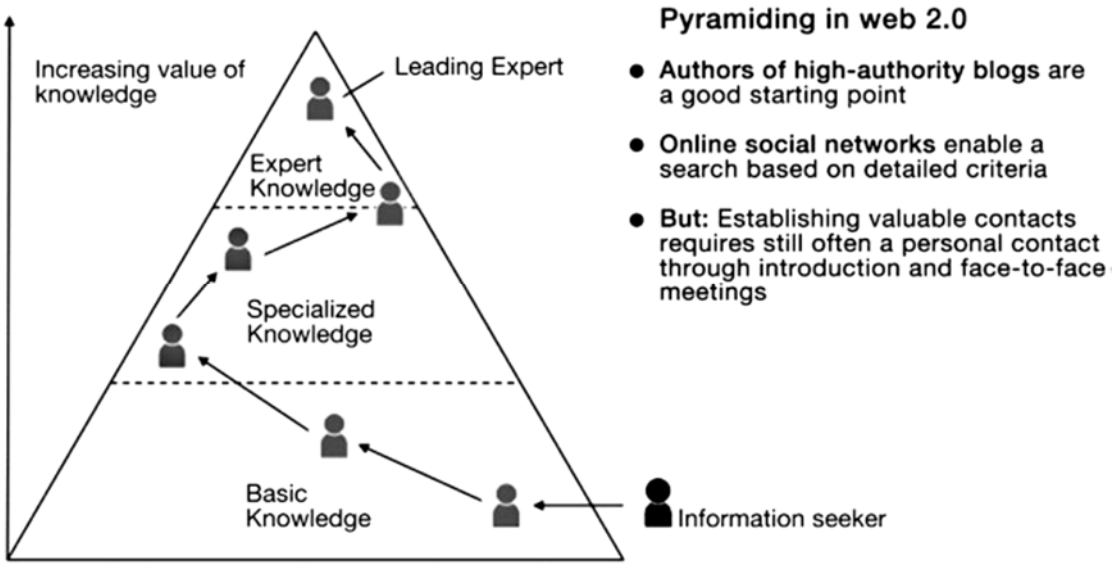

Figure 2-5: Expert search through pyramiding - source (Rohrbeck, 2014, p 62).

According to Rohrbeck (2014), there is a challenge in keeping leading experts in different converging areas connected and updated during the development process, which is ideally done through *scouting networks.* The most valuable contribution a scout may deliver is capturing a much more comprehensive understanding of a phenomenon by quickly linking *user-generated content* and *crowdsourcing* to other related terms – such as social networks, wikis, blogs … etc. – through talking to experts. Rohrbeck (2014, p. 64) concludes that "*scouting is only one possible method of establishing foresight*". Nonetheless, to design a tailored foresight approach, there is a challenge in deciding which methods to use for a given context and task. Porter et al. (2004) believe that foresight methods could be classified into two main categories based on their purposes in which the dominant factor to select the right method is the level of uncertainty, meaning that methods can either facilitate exploring new user needs, new approaches or other type of options; or support task planning; and a method to be selected should be able to deliver relatively reliable results under a respective level of uncertainty. Further, Rohrbeck (2014) claims that methods can be themed based on the investigated context as to be suited for either exploring the market future, or technology aspects, see Appendix C, Figure C-0-1 and Figure C-0-2.

A plenty of foresight methods still lack the ability to translate the results into organizational interpretation. As such, linking innovation to foresight is discussed and

the change is clarified for all innovation managers and foresighters before they work together to identify opportunities for innovation. In this regard, both the direction and rate of change usually embed certain degrees of uncertainty. If both dimension are sufficiently certain to work with in an innovation context, they could be referred to as trends, otherwise, they represent uncertain dynamics (Popper, 2008). Planning for uncertain dynamics, which their respective innovation opportunities are thought to lead to revolutionary results, could be only done manually using the art of scenario development. That requires companies to acknowledge uncertainties and do not waste their time and resources in developing complex predictive models. Instead, organizational resources should be leveraged so that several consistent and possible scenarios are efficiently developed (Rohrbeck, 2014). For more information about possible modes of scenario development discussed by Gausemeier et al. (1998), see Appendix D.

From the different discussions about foresight above, it is clear that external knowledge starts to be considered very early in the NPD based on both current static and dynamic facts related to the context of innovation. It can influence decisions that are most of the time quite difficult to be changed in later stages. Therefore, detecting relevant change drivers through relevant and reliable scanning and foresight techniques and methods as well as managing relevant networks of skills and competences efficiently is a key input to determine how the innovation is going to proceed. That includes the modes of collaboration and partnership as well as knowledge development strategies.

2.2.2.2 Innovation opposition strategy

As discussed in section 2.2.1, the role of innovators boils down to finding the right problem, understanding the problem right, and then inventing and validating innovative solutions, which is reflected from Figure 2-3-b. However, creativity responsibility of innovators could be both advantage and disadvantage, since innovation performance could be hardly measurable as the quality of ideas dramatically depends of how they are realized into new markets. Therefore, it is quite difficult to articulate or explicate KPIs for innovators, which makes them naturally working with more flexibility than other organization members (Marr, 2015). For top management, that does not sound integral since they should make sure that all members live up to the ambition level of the organization and that they are all pushed out of their complacency zones (Hughes, 2015). Alternatively, innovation success is assured by innovators' opponents who continuously keep on challenging innovators constructively in order to ensure superior product quality. Rohrbeck (2014) believes that the opponent roles is represented by challenging the basic assumptions concerning regulatory issues, technological development, and customer needs; challenging the state-of-the-art adopted by R&D projects; and scanning for disruptions that embed risk for current and future innovations. Therefore, innovators' opponents should have equal personal qualities in terms of innovation and organization knowledge that challenge but not undermine innovation performance.

Rohrbeck and Gemünden (2011) suggested that specific foresight units could be periodically involved as opponents in workshops held by the project teams who are in charge of ongoing innovation projects. That is one way of institutionalizing the opponent role. Furthermore, Rohrbeck (2014) suggests that opponents should have the authority to terminate a p**r**oject due to reasonable facts about it if the results are not leading to any promising end. In this context, Rohrbeck (2014) highlights the importance of celebrating this termination as a "death party" whereby team members are urged to see the termination as a liberation from developing an innovation failure instead of perceiving it as a mere failure.

2.2.2.3 Deliberate vs emergent strategies

According to Brem and Tidd (2012), in NPD projects, the way external knowledge is channelled into firms is influenced by the alignment towards emergent and deliberate strategies. In the later type, the flow of decisions usually follows top down approach, where all resources are structured around the company vision (McMillan, 2008). Therefore, the knowledge to be integrated into the organization in terms of talents, tools and other supporting resources are typically aligned with their contribution to the main vision (Ives & Combs, 2012). As a result, decision similar to the selection of strategic partners are made based on their potentials to contribute to the current and future outlook of the company (Brem & Tidd, 2012). Therefore, if NPD projects are to be governed by deliberate strategies, many platforms in the development process may be already restricted such as the pool of suppliers and consultants, development software and tools, communication platforms, development devices and many other areas (McMillan, 2008). In other words, the more deliberate the strategy is, the more NPD projects become "drag-and-drop" oriented, whereby project managers just pick their resources from very limited pools and handover the deliverables without be enlightened with respect to the strategic alignment and significance of the project to the business.

Typically, enhancing organizational core capabilities is supported by deliberate strategies. Companies' competitive advantage is used as input to the innovation process. As such, the directions of the concept development and the contribution of the deliverables are predefined (Fischer et al., 2010). Furthermore, due to the high confidentiality of core capability-related knowledge (Birchall & Tovstiga, 2005), OI is usually not considered in such contexts. Instead, specific strategic alliances are limitedly involved to do particular tasks, while the rest of the NPD job is done internally.

On the other hand, Mintzberg (2000) discussed a different strategy commonly termed as "emergent strategy". He claims that emergent strategy refers to the learning process of collaboration interactions that is intended to introduce new products and cannot be pre-planned for since the resultant products may represent combination of collaborators' capabilities and should therefore should be approached agilely. However, some central parties might lack the maturity of a required competence to keep up. Therefore, the ability to productively build, integrate, and reconfigure any

relevant internal and external competences is a crucial organizational capability if emergent strategies are to be adopted. This type of capability is termed "dynamic capability" (Kyläheiko et al., 2011).

Nonetheless, Maier (2007) discussed 5 main guidelines adapted from Grant's model of resource-based strategy development. The discussion could be of interest for how a company would go for emergent strategies without being concerned about the potential significant investments in specific competence and resource development. According to Grant (1996), the first guideline is that strategists need to map out the company resources and appraise all associated strengths and weaknesses relative to competitors. Then, strategists try to identify those capabilities that the company could outperform their competitors on together with what is required as well as challenging for each capability to set up. As for the third step, strategists should appraise the potential of capabilities for sustainable competitive advantage and their profitability in the long run. After that, a strategy with the best exploitive approach for the capabilities and resources relative to external opportunities is developed. Finally, the resource gaps should be highlighted and enhanced by effective and efficient investments. It is also worth mentioning that periodic iterations of the 5 steps are recommended to be triggered when necessary (Grant, 1996). That could be for instance the stage in which new generated ideas need to be evaluated through collaborative workshops and the current strategies need to be adapted to an idea that all parties together can realise. This point is particularly important from OOI perspective since it refers to the flexibility required for emergent strategy adopters in order to see the real benefits from investing in the required capability enhancement. These benefits become visible if they are factual and scientifically supported, meaning that the absorption of such opportunities requires internal knowledge capacity that is able to develop sufficient degree of understanding. That is usually referred to as "absorptive capacity" (Hidalgo & Albors, 2008), which is tightly connected to "knowledge assimilation" (Lin et al., 2012) further discussed in 2.3.

Briefly, both deliberate and emergent strategies are intended to be used as innovation creation strategies that attain loyalty of customers and good reputation through ensuring that customers' needs are sensed and realised (Brem & Tidd, 2012). Deliberate strategy usually embed less degrees of fuzziness – as shown in Figure 2-6 - in the front end of innovation since many aspects of the concept to be developed are based on solid ground represented by the core capabilities and competitive advantages of the company that leads the NPD project. On the other hand, in emergent strategies, the front end is fuzzier since the concept to be developed is partially based on the core capabilities and competitive advantages of an individual company per se, and the value proposition could be instead seen as a forged contribution by a group of many organization's core capabilities and competitive advantages. What makes emergent strategies fuzzier in general is the fact that it is well suited to collaboration and the adaptation to the collective behavior of a coalition and the overall core capabilities (Chesbrough et al., 2014) in which the effective innovation solutions are quite

difficult to be planned for without continuous open interaction (Gassmann & Schweitzer, 2014), which is in turn driven by regulations and degree of trust, and never taken with pure good intentions (Brem & Tidd, 2012).

Deliberate strategy employs classic research into market opportunities using analysis of market growth rationale and the development of different associated options as well as the evaluation of actions to be taken. Usually, a deliberate strategy is based on traditional powerful planning tools and high innovation orientation including constant search for novel product concepts, constant refinement and development of products, fast and cross-functional implementation of innovation, and horizontal and vertical participation of all personnel in developing novel ideas (Brem & Tidd, 2012). Differently, in emergent strategies, the enhanced creativity (intuition) and experimentation (trial and error) related to technologies and designs are relied on to work out the problems being tackled (Mintzberg, 2000). In other words, emergent strategies require outstanding reactive (instead of proactive) personal and collective abilities. However, scenario-based planning could be recommended to control the cost-efficiency of collaboration and reduce the level of uncertainty (Rohrbeck, 2014).

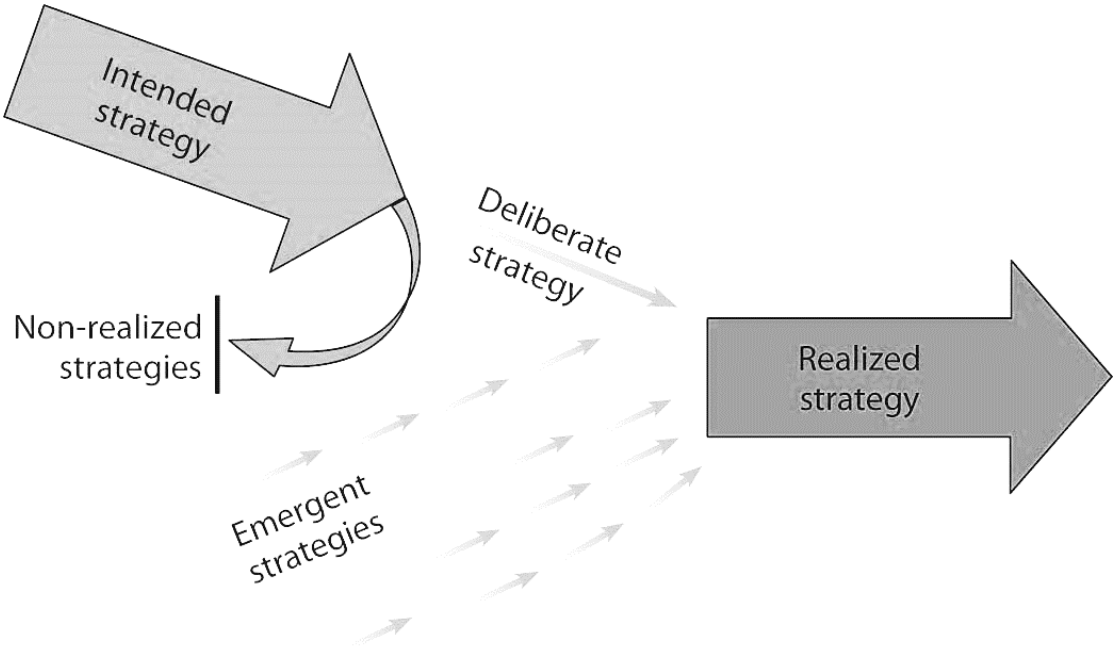

Figure 2-6: Emergent and deliberate strategy (Mintzberg, 2000, p 24).

2.2.2.4 Other orientations in innovation strategies

NPD projects are quite contextual and situational (Bonesso et al., 2014). Even though emergent strategies are frequently used when uncertainty level is high, and thus may need building high degree of flexibility together with creativity in the FFE (Chesbrough et al., 2014), it does not necessarily mean that deliberate strategies should be only connected to certain contexts that require stable discipline instead of creativity (Brem & Tidd, 2012). In the first place, new products represent a combination of systems, subsystems and components that could be partially or greatly

realised using the current capability of the firm (Christensen, 2013). Moreover, having the capability inside the organizational boundaries – in terms of internal units and existing partners and suppliers – does not imply that they are available in terms of time, deliverability, and quality (Brem & Tidd, 2012). In other words, a firm unit might be obliged to deal with a current partner for traditional services, which limits the overall flexibility even if the followed strategy is of emergent type. The idea for selecting a favourite partner or service provider is quite exciting for innovators (Griffin et al., 2014), but top management tends to naturally look after the overall efficiency and other types of concerns such as confidentiality and supply chain sustainable advantage, which are greatly influenced by the type of and relationship with business partners and consultants (Brem & Tidd, 2012). Therefore, in order to minimize the uncertainty percentage as much as possible consistently with what the NPD content may allow, top management in large enterprises makes sure that a significant percentage of the concept to be developed is stably realised through institutionalized disciplined purchasing and third-party involvement processes (Griffin et al., 2014). That includes the way and means of communication and interaction, which could be then categorized into formal and informal communication, which is further discussed in 2.3.

2.3 Managing knowledge in innovation FFE

According to Puschmann (2014), both formal and informal communication channels should be highly activated in NPD projects with OI orientation. García-Fernández (2015) developed a generic model describes how individuals, teams, and organizations acquire and exchange knowledge. In the first place, García-Fernández (2015) sorted out the most significant studies in knowledge management (KM) and came to a conclusion that they revolve around three basic knowledge management dimensions, which are divided into several sub-dimensions. According to García-Fernández (2015), all widely used literature on KM emphasizes three main items including knowledge creation, knowledge transfer and storage, and knowledge application and use. The models contribute to knowledge creation mainly discuss three main sub-dimensions including information acquisition, information dissemination, and shared interpretation. Figure 2-7 shows the hierarchy of KM dimensions and sub-dimensions.

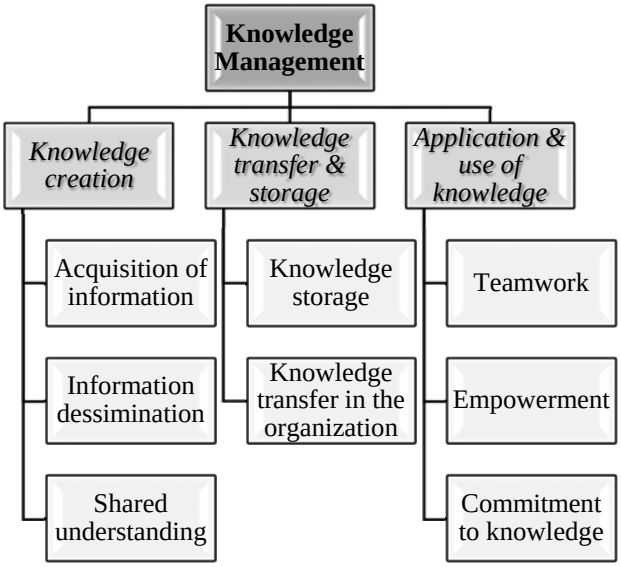

Figure 2-7: Adapted from García-Fernández (2015) - The structure of knowledge management items in literature.

2.3.1 Knowledge creation

According to Dalkir (2011), to acquire knowledge means to extract, structure, and organize knowledge from one source, which is commonly used to be human experts. The acquired knowledge is mainly used in software such as an expert system. In general, acquiring knowledge and information may refer to different levels of details. Ackoff (1989) suggested five categories represent almost the most common types of informational content including data, information, knowledge, understanding, and wisdom. He perceives data as raw symbols exist in any form and have no meaning of itself or significance beyond its existence. Information in turn is any form of informational content gives meanings to data and connect it between each other and between other different forms. This kind of connection may answer questions start with what, who, where, and when. Nonetheless, in order to answer how questions, all aforementioned questions should be answered, which means both data and information should be gathered and applied. The result in this case would be knowledge. Ackoff (1989) also goes beyond the knowledge level and defines understanding as a form of knowledge where why questions are appreciated to interpret trends, patterns and run interpolative and probabilistic processes, while he sees wisdom as another form of knowledge used to evaluate understanding under extrapolative and non-probabilistic, non-deterministic process.

As a knowledge management dimension, García-Fernández (2015) perceives knowledge creation to comprise three main sub-dimensions including “information acquisition”, “information dissemination”, and “shared interpretation”. Practically, acquiring information is performed within organizations as a form of information collection from both employees and customers. Additionally, organizations may acquire information by conducting market research and retrieving and transforming data from their databases and records that provide necessary information for a task intended to be done in the future. In the FFE of innovation, Gassmann and Schweitzer

(2014) emphasize crucial significance of information gathering intellegence during trends scoping whereby market and technology uncertainties are formed before ideas are generated to help detecting the right problem, as Griffin et al. (2007) refer.

As for information dissemination, García-Fernández (2015) believes that organizations should allow frequent formal and informal information sharing within them in order to have this sub-dimension, which is also affirmed by Puschmann (2014) in OI contexts. Furthermore, informative reports should be periodically produced and made available for organizations' employees, and the information systems already setup for use should facilitate easy and friendly sharing of information (Dalkir, 2011).

García-Fernández (2015) uses "shared interpretation" term to express about organizational practices such as obtaining agreement on the way any new information affects organizations, and creating understanding for employees concerning the issues related to the departments they work at. That is highly important to be clear NPD collaborators due to the likelihood of exposing or even generating confidential information during collaboration (Brem & Tidd, 2012). Besides, García-Fernández (2015) refers to the importance of having organizations the capability to detect and remove obsolete information and discover new alternatives, which is – according to Griffin et al. (2007) – done usually done iteratively between the process of finding the right problem and the process of understanding the problem. Finally, organizational functions should be performed according to particular industrial protocols and standards as a contribution to the collective shared interpretation aspect (García-Fernández, 2015), which is might limit the flexibility of the emergent strategy if it is adopted in NPD projects (Chesbrough et al., 2014).

2.3.2 Knowledge transfer and storage

According to Argote (2000), to transfer knowledge means to go beyond the traditional communication means such as e-mails, memorandums and meetings; to seek organizing, creating, capturing or distributing knowledge; and to ensure that future users are able to reach out this knowledge. The complexity of knowledge transfer stems from the fact that knowledge exists in tasks, tools, and sub-networks, and that much of this knowledge is tacit and difficult to be articulated (Nonaka & Takeuchi, 1995).

Holsapple (2003) points out the issue of knowledge assimilation that represents one part of the knowledge transfer process. Knowledge may be created, gathered or transformed, but without having it assimilated, associated actions required to be taken in which all of its potential value is actualized will not be possibly supported. Consequently, the transferred knowledge will have limited organizational use, reuse and impact. That is generally challenging in the FFE since the knowledge assimilation of all parties involved in problem identification and understanding should live up to a level that sufficiently enable productive solution inventing (or concept development) and validating (Newey, 2010).

Holsapple (2003) defines knowledge assimilation as the ability to incorporate and take in knowledge as one's own (absorb); to bring knowledge into conformity with collective customs, norms, attitudes, and culture; and to convert knowledge into suitable format. Gassmann and Schweitzer (2014) believe that difference in how these aspects among collaborators may influence the agility of NPD progress if the agreement previously settled is not mature enough as a driver to objective judgement, which is quite important in idea and concept evaluation stages. However, Chesbrough et al. (2014)mentioned that such conflict potential is much less when the power between collaborators is unevenly distributed, meaning that the format of final information results will be more suitable to the collective customs, norms, attitudes, and culture of the innovation project leader. Generally, there are two main factors support the knowledge assimilation process including new knowledge consistency with previous knowledge and proper fitting knowledge formatting to the organization's way of doing things. To facilitate knowledge assimilation, organizations should pay attention to how knowledge is stored, massaged, structured, integrated, filtered and navigated through (Holsapple, 2003).

As knowledge is a key element for knowledge assimilation (Holsapple, 2003), and key sub-dimension of knowledge management (García-Fernández, 2015), it is important to sort out how knowledge is stored in organizations practically. According to Holsapple (2003), there are different conceptual models used to store knowledge including documents, cases, rules, diagrams, FAQ files and Bayes' Nets diagrams. In practice, organizations relentlessly strive to document and store scattered tacit knowledge reside in experts' and practitioners' intellects and intuition so that staff turnover has as least impact as possible on the overall organizational collective knowledge or skills. Likewise, to facilitate knowledge transfer, organizations also follow sets of procedures to distribute the collected knowledge from individuals once it has been designed and/or assessed. However, given the fact that employees are in average conservative toward knowledge sharing since it represents their source of power, organizations establishes mechanisms to ensure that the best practices are shared. In order to do so, organizations enable accessibility to databases, documents and other forms of knowledge storage conceptual models through computer networks (García-Fernández, 2015).

2.3.3 Application and use of knowledge

Knowledge application and use has been highlighted by García-Fernández (2015) as the third dimension of knowledge management after reviewing a plenty of models and theories pertaining to this concept. Three main sub-dimensions were incorporated under this dimension including teamwork, empowerment, and commitment to knowledge. To facilitate collective application and use of knowledge, organizations promote teamwork and cross-functional working styles to propose innovative solutions by means of dialogue to specific problems and general issues affecting the whole of the organization. That is asserted by Griffin et al. (2007) as an enabler to more agile and efficient invention and validation of concepts and solutions. Moreover,

organizations motivate collective actions of groups and teams by seriously considering their recommendations concerning different topics and matters, which is greatly influenced by the organization culture in terms of its attitude towards individuals (Kim, 1998). In general, as part of the communication process in change management, organizations hold periodic meetings that are aimed at informing all the employees about new methods, tools, and/or any other developments (Kotter, 2012).

Another sub-dimension that facilitates knowledge use and application is empowerment. García-Fernánde (2015) believes that empowerment in this context means that organizations should enable employee's control and responsibility for their work and autonomy in decision making, and it should also stimulate their willingness to make suggestions. Furthermore, the organization's strategy should be formed and redefined in a way it takes into account as many people as possible (García-Fernández, 2015). Enkel et al. (2011) in turn developed a framework to measure OI maturity in which employee empowerment represents one of its dimensions, which emphasizes the necessity to allow greater autonomy and responsibility for NPD project teams and associated business units.

After building the capability to acquire, disseminate, share, store and transfer knowledge in teamwork contexts where employees are empowered, García-Fernánde (2015) sees the necessity to have commitment to this knowledge management dogma established and supported. He mentioned a list of initiatives and practices reflect commitment to knowledge. One could be establishing external networks and alliances with other organizations to promote knowledge, which is fundamental from OOI perspective (Chesbrough et al., 2014). Another similar initiative is to conduct agreements with universities and technological research centers (García-Fernández, 2015). In the same context, Bahemia and Squire (2013) mapped out a more comprehensive picture concerning the types of possible partners in OI collaboration in NPD projects. That includes including traditional external parties (e.g. suppliers, customers, competitors, consultants, commercial laboratories, research institutes, and universities), emergent parties (e.g. small players, start-ups, entrepreneurs, and individual innovators), open innovation intermediaries and members of the public/crowdsourcing.

Above all, customers' suggestions capturing should be planned for and properly supported since they represent future products and services. Organizations' infrastructures should enable knowledge promotion within them through tools or mechanisms, and their databases should be regularly updated (Shane, 2008). Further, employees should get sufficient guidance and training in order to ensure improving their skills and knowledge, and achieving organizations' goals and objectives (Whelan & Carcary, 2011). That means the main aim of organizations should be effectively communicated stating a strategic intention, purpose or guidance. In general, handbooks, quality norms, standards, requirements and other types of documents should be able to describe organizational processes with all details that matter (García-Fernández, 2015).

2.3.4 Knowledge management process

García-Fernández (2015) developed a model that represents generic knowledge management process using the dimensions discussed in the sections above. Figure 2-8 shows how creation of knowledge is done starting from the thoughts and ideas residing in the intuition of individuals that are turned into acquired information. Then, the information is interpreted to more individuals in order to disseminate their contents. After that, people behave collectively with actions and reactions, and adjustments are applied to the information content until it is accepted and therefore integrated. Finally, knowledge is considered created in an organization if the findings from the previous steps are documented, interpreted in the organizational level, and institutionalized to be included in the foundation of the organization (García-Fernández, 2015). This escalation style of learning may be interesting during the FFE of innovation due to the crucial influence of individuals especially if they belong to the group of innovators and innovation opponents discussed earlier by Rohrbeck (2014). In other words, enabling agile processing of individual and collective ideas and thoughts in a way enables dynamic feedback providence may have positive influence on the overall both innovation productivity and effectiveness.

In Figure 2-8, García-Fernánde (2015) goes further in connecting knowledge management dimensions by explaining how employee empowerment can contribute to knowledge storage, transfer, use and application. The process starts with Nonaka's (1995) conclusion pertaining to a given fact that knowledge is stored in individual memories (mental models), and collective memories (organizational schemes). Then, knowledge transfer between both types of memories is triggered through socialization among individuals, which is more likely to happen both effectively and efficiently if employees are empowered (García-Fernández, 2015).

Individuals react with teams by receiving feed-forward from their side and transmitting feed-back to the opposite direction. As a result, individual memories are externalized and exposed to teams (Nonaka & Takeuchi, 1995). Similarly, teams play the role of individuals described earlier and the result is a combination of team memories within the organizational boundary. That is primarily supported by great promotion of teamwork (García-Fernández, 2015).

In a higher level, García-Fernánde (2015) believes that the previous steps are not enough to prove commitment to knowledge. Organizations should collaborate together in a similar manner to how both individuals and teams collaborate to externalize and combine their memories, respectively. Consequently, inter-organizational interaction usually results in internalizing external knowledge residing in other organizational/corporate memories, which touches the essence of OOI (Chesbrough et at., 2014).

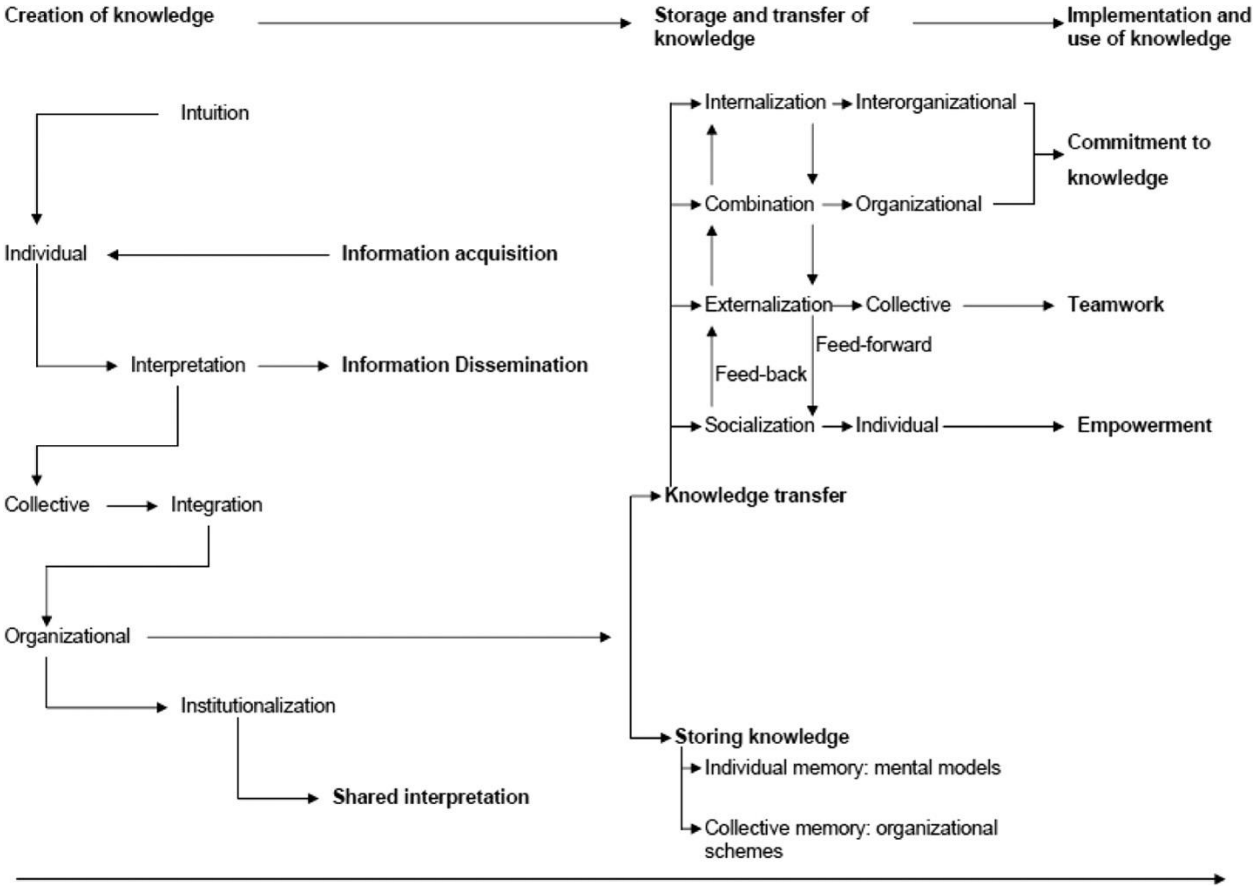

Figure 2-8: Knowledge management process - source (García-Fernández, 2015, p 116).

2.4 Partnership in the FFE of innovation

Chesbrough et al. (2014) discussed practical questions related to collaboration with external parties in OI including ***why*** a collaboration is triggered in the first place, ***who*** that answers what type of partners is to be involved, ***when*** the collaboration should take place along the project development timeline, ***what*** type of technology context should be included (in reference to emerging vs established technology, radical vs incremental innovation, and modular vs architectural innovation), ***where*** the different collaboration activities should be held, and finally ***how*** the collaboration should be managed. Issues such as the number of partners to be involved and the degree of openness to be granted to the external partners are of relevance to the last question (i.e. how) (Bahemia & Squire, 2013). In general, the purpose of partnership is to get access to the valuable knowledge of partners and effectively utilize internal knowledge (Li et al., 2008). However, in the FFE there is high uncertainty in the stage outcomes of the project. As a result, it might be difficult to define the task and understand knowledge needed. Nevertheless, according to Solesvik and Gulbrandsen (2013), prior collaboration contacts help to understand the core technology and firm process of the partners. Generally, prior successful collaboration strongly enhances trust with partners. Trust is in turn the most important factor that enables openness of collaboration. Consequently, this makes a virtuous circle that drives firms to select a few partners with previous connections (Petruzzelli, 2011). However, according to Stadlbauer and Drexler (2014), sometimes the most valuable resources are not from

known partners, and therefore, in order to gain certain knowledge, a selection process that takes unknown partners into account is required (Solesvik & Gulbrandsen, 2013).

In the following sections, the questioned posed by Chesbrough et al. (2014) are generally answered in relation to the FFE and OOI context excluding ***where*** question that has the least relevance among other questions to the area of study.

2.4.1 Triggers for partnership

Solesvik and Gulbrandsen (2013) pointed three important patterns when selecting partners for OI. Firstly, if there are mutual beneficial relationships, it will be a driver for openness and motivation. Secondly, sensitive information might be shared in order to have the necessary resources for innovation. Finally, there is higher uncertainty since there is no clear boundary of control (Solesvik & Gulbrandsen, 2013). More specifically, Lichtenthaler (2008) discussed different types of motives behind organizations' tendency toward OOI. One significant trigger for collaboration is the fact that products are getting more complex and sophisticated, which made the minimum organization's technology's base required to fulfil customers' expectations expanded into many connected technologies, which is termed as *technological diversification*. The value of deliverables are getting more evened out between subsystems, which makes the controlling position of focal firms less influential than ever. Therefore, even large enterprises are enforced to team up with other players to support their current products' deficits using the power of knowledge transfer to apply *technology cross-fertilisation* to the product development deliverable (Licht et al., 2014). Moreover, the unexpected changes in the market trends that stem from its dynamics pushed most of large companies out of their comfort zones making them more welcoming to ideas far from their core capabilities as precautionary initiatives against the curse of *disruptive technologies* (Christensen, 2013).

Another common trigger for collaboration is basically competition (Chesbrough, 2003). Companies are currently open than ever for collaboration whenever it has potentials for enhanced market position and sustainable profitability even though collaboration might include sharing the same *business model* (Chesbrough et at., 2014). For instance, organizations may give each other free commercial usage of some IPs in order to benefit patents not owned by them but very complementing to their core capabilities. Additionally, products or services resulted from collaboration contributions may be cheaper, more productive or faster to be delivered than to be undertaken internally (Christensen, 2013).

2.4.2 Partner selection process

In the partner selection process, there are two strategic approaches including causation and effectuation. Based on the causation approach, scientific methods are used to analyze market and set short-, medium- and long-term goals. In order to execute these goals, much attention is given to partners screening with the required knowledge (Solesvik & Gulbrandsen, 2013). That again brings up to the discussion the way the

generic deliberate strategy works, which is discussed earlier in section 2.2.2, C. According to Brem and Tidd (2012), partners are selected in light of deliberate strategy based on their alignment to the future outlook of the firm. In other words, the more the partners may have influence on the future value of the firm's products, the more interesting they are from deliberate strategy perspective. This approach is quite exploitative and gives little space for knowledge that is creative and possibly innovative.

On the contrary, the effectuation approach has no specific biased goal to strive for, and instead, the focus is to explore external knowledge and to make the best out of it for the business (Solesvik & Gulbrandsen, 2013). This approach for selecting partners may be homogenous with the nature of the FFE of innovation (Gassmann & Schweitzer, 2014) and the essence of emergent strategy in which no specific goals are approached and high flexibility is allowed for the possible paths of idea and concept development (Mintzberg, 2000). Therefore, the likelihood of involving new partners during the FFE is relatively high depending on the status results gained from the collaboration (Brem & Tidd, 2012).

From all above, the effectuation approach may be seen as more effective strategy for the FFE of NPD projects. In this regard, Solesvik and Gulbrandsen (2013) illustrated three steps for partner selection from an effectuation perspective. The first step is identifying the internal knowledge and the knowledge network. In order to do that, Solesvik and Gulbrandsen (2013) suggested answering the following questions:

1. Who are we? By asking this question, the overall vision and product focus are settled without deciding the goal.

2. What do we know? In this case, the internal knowledge is identified and even the knowledge building capacity is clarified.

3. Whom we know? In this question the knowledge of the partners is identified and also the relationship to partners (such as trust and openness) is defined. Even more relevant is to find a way to increase the network. Specifically, getting access to the network of partners is a good way to find rare knowledge.

Synchronously with the third question of this step, a connection may be detected with the earliest stage in the FFE of OI shown in Figure 2-2, which is the trend scoping stage. This connection is represented by the fact that external knowledge is needed to detect valid signals associated with the valid problem identification stage (Gassmann & Schweitzer, 2014), as shown in

Figure 2-2-a: Activities at the fuzzy front end of product innovation – adapted from Gassmann and Schweitzer .

Figure 2-3-b: The behaviour of serial innovators innovate opposed to the FFE of OI innovation – adapted from Griffin et al. .

-b. As such, many tools could be used to answer the aforementioned questions depending on the level of uncertainty of the context and the degree of deliberate

strategy involved as shown in Appendix C (Figure C-0-1 and Figure C-0-2) (Rohrbeck, 2014).

The second step is to find out what outcomes is possible with the knowledge (Solesvik & Gulbrandsen, 2013). In this stage, it is important not to limit the creativity by criticizing the ideas, but rather following the diverging style referred to by Muller and Hutchins (2012). For instance, by identifying knowledge that is from other sectors, it is possible to create radical innovation. Furthermore, ideas should be tested considering the affordable loss of partners in the exclusion process in order to know what kind of partners is suitable for collaboration (Muller & Hutchins, 2012).

The third step is stakeholder management in which the purpose is to clean the political obstacles concerning the choice of the desired partners' knowledge (Solesvik & Gulbrandsen, 2013). In general, in order to gain acceptance among the stakeholders, trust is the main success factors (Brem & Tidd, 2012). In such situations, a commonly observed pattern in the industry is to share rewards and risks with partners (Solesvik & Gulbrandsen, 2013).

Stadlbauer and Drexler (2014) discussed a different way to select partners. According to their view, when choosing partners, it is important to have a long-term perspective, which may reflect some kind of degree of causation and deliberate approach. Furthermore, this view emphasizes that both technological infrastructures and market insight are dynamic, and in order to seize the ever changing opportunities from market, the understanding of technological trends is important (Stadlbauer & Drexler, 2014), which is deliberately approached by the corporate foresight strategy and the related methods and tools shown in Appendix C (Figure C-0-1 and Figure C-0-2) (Rohrbeck, 2014). Among these methods Stadlbauer and Drexler (2014) believe that there are two main common ways to sense the technological trends and simultaneously evaluate potential partners. One is to use patent search to find appropriate partners, which is more casual since the technology are defined before the selection of partners. The other approach is to participate in workshops, where all the companies within the scope of the business are involved. In this case, the technology is not defined and the selection of partners is conducted through coincidence planning, which is basically dependent on what workshop environment has to offer in terms of the high likelihood of getting stumbled by potentials partners. This kind of approach creates opportunities to find partners with knowledge rather than a specific technology, and is therefore considered effectual (Stadlbauer & Drexler, 2014). In the following two sections, patent analysis and workshops are highlighted as common effective methods for successful partner selections.

Partner selection using workshops

Workshops offer a concise time frame with candidates for ideation, reflection and interaction (Farrington et al., 2012). Rau et al. (2014) mentioned some considerations in selecting partners using workshops. First of all, the purpose and the content have to be defined. In doing this, appropriate participants should be invited, and in this case, it

is important to send clear signal to the potential participants such as the specification and the expected output (Rau et al., 2014). Particularly, the openness of the workshops should be defined and there should be known that high degree of openness may increase not only the insights diversity, but also the complexity of coordination (Chesbrough et al., 2014). Since the goal is to facilitate knowledge input, it is common that professional innovation intermediaries are invited in order to assist high quality assurance in such workshops (Bogers & West, 2012).

Secondly, to get important knowledge input, it is essential to recruit participants that are visionary, open and innovative. Furthermore, another aspect of consideration when choosing the participants is the valuable networks those participants can bring (Rau et al., 2014). Fichter and Beucker (2012) believe that strategic partner selection and innovation coaching through workshops is rarely applied despite their extreme significance for innovation communities in terms of performance and development. While Rau et al. (2014) believe selecting partners in workshops is done through an emergent strategy whereby possible coincidence is essential, Fichter and Beucker (2012) add a deliberate strategy may reduce the fuzziness of thinking which partner is interesting. They claim that the strategy is not necessarily quite deliberate, but rather based on three main drivers. One driver is establishing a dynamic method to quickly determine if a workshop member has the capability to significantly contribute to the completeness and complementarity of competences together with other members in the innovation community. The second driver starts by gaining sufficient information concerning members' networks before workshops are held, if possible, in order to estimate their social capital and then roughly perceive possible strategic benefits. Above all, have mature understanding about members' functional identity is quite important and, thus, it is regarded as the third driver (Fichter & Beucker, 2012).

2.4.3 Orientations in partnership selection strategy

One major threat stands against any collaboration success in OOI at the project level is partners coordination cost (Poot et al., 2009). According to Bahemia and Squire (2013) there are many failure stories for companies that adopted OI at a firm level following the successful examples, but their context complexities show that being totally open to partners requires certain enabling conditions, and that there is a necessity to adjust innovation openness. This kind of adaptation is based on three dimensions of OOI partner involvement including breadth, depth and ambidexterity of partners involvement strategy, which significantly vary at the level of NPD and affected by the type of innovation (incremental or radical), the product complexity (discrete or complex) and appropriability regime (strong or weak) (Bahemia & Squire, 2013).

According to Leiponen and Helfat (2010) most of collaboration failure examples reflect low breadth of partnership base. They refer here not to the quantity of partners, but to their diversity, which was limited to the traditional players such as customers, suppliers, consultants, competitors, universities, commercial laboratories, and private

and public research institutes. On the other hand, Bahemia and Squire (2013) assert that the breadth of collaboration and partner network is as effective as if it includes small players at least in the concept development stages such as high-tech start-ups and entrepreneurs, open innovation intermediaries, and members of the public/crowdsourcing.

Bahemia and Squire (2013) identified depth and ambidexterity dimensions to enable more tuning option related to the openness to external partners. In other words, two more questions are added to positioning a party in the pool of partners as opposed to a specific project (i.e. on the project stakeholder map). First question is about how often – referring to the degree of depth – each partner should be invited to collaboration, and therefore exposed to confidential information related to a particular project. This depth dimension reflects that any participant of a collaboration event should live up to both the right involvement timing and event conditions, which are basically related to their knowledge influence, product complexity, trust and credibility, and accountability (Bengtsson et al., 2015). As for the second question, Bahemia and Squire (2013) claim that it is important to determine how often a new partner should be involved to the collaboration, and when an existing relationship needs to get mature and long standing. Both decisions determine the degree of ambidexterity dimension and enable new facets of OOI collaboration.

In general, the combination of decisions related to the three dimensions previously discussed should be contingently calibratable to dynamically re-form the OOI partnership strategy depending on multiple project contingencies including type of innovation (incremental vs radical), the product complexity (discrete vs complex) and appropriability regime (tight vs weak) (Bahemia & Squire, 2013). That is particularly important from both emergent strategy and innovation fuzziness perspectives since they are based on the ability to quickly respond to changes that enables greater flexibility in being open to the external parties up to the right degree in order to create trustworthy atmosphere in which partners are more willing to share their knowledge with least conservation.

3 Methodology

This chapter describes how the study was conducted and which methodology concepts and techniques were used, which is greatly influenced by Bryman and Bell c. The first section describes the research strategy and design, and how it was executed. After that, the techniques used in the empirical study are described regarding how the data were collected. Further, concerning which approaches and concepts were used to analyse the data, a following section is dedicated. Last but not least, controlling the research quality is further explored in comparison with literature recommendation.

3.1 Research strategy and design

The foundation of this thesis includes both an empirical study and a theoretical study. The later contribution addressed the content of the three research questions from the state of the art perspective, while the empirical study was dedicated to first investigate the current state of the case and then analyse the gap between both states. The theoretical study included the following steps:

- Investigation of what strategies are used to manage the exploration of external knowledge before collaboration with any potential partner.
- Screening the approaches used and capabilities required to evaluate and prioritize external knowledge in a systematic manner.
- Exploring how the common collaboration strategies are developed concerning partners selection and involvement in the FFE of NPD project from OOI perspective.

As for the empirical study, gathering data included the interactions with the innovation manager and the head of the department. The research approach is based on inductive reasoning since the findings of this study could be seen as outlined theories (Bryman & Bell, 2015), which are mainly the strategies and decisions to be made concerning the collaboration for external knowledge exploitation in the FFE of NPD projects from OOI perspective. On the contrary, Bryman and Bell (2015) claim that the theoretical framework and the setting of hypotheses usually precede the outcomes and observations when a deductive approach is to be used, which is not applicable in this study.

Qualitative research is a method of inquiry used in a plenty of academic disciplines and aimed at gathering thorough understanding of human behaviour individually and collectively. Qualitative method usually goes beyond investigating *what*, *where*, and *when* questions and includes *how* questions concerning decision making (Denzin & Lincoln, 2005). Qualitative research strategy is only considered in this study. According to Byman and Bell (2015), when subjective data – i.e. data influenced by or based on personal feelings, opinions, or tastes – is more interesting for a study and its wanted findings, qualitative research strategy is recommended to be developed and

followed. Moreover, in accordance with the qualitative strategy, the interpretivism view is adopted as a base for the epistemology orientation (i.e. knowledge acceptability view) of this research. According to the interpretivism view, we cannot separate ourselves from what we know, and reality is constructed intersubjectively through the understandings and meanings developed experientially and socially, which could be obtained in practice through analyses of existing texts, interviews, and observations (Bryman & Bell, 2015). The interpretivism view is of interest to the research since the collaboration between different partners are significantly influenced by these aspects during the early stages of NPD projects (Strang, 2015).

3.1.1 Research execution

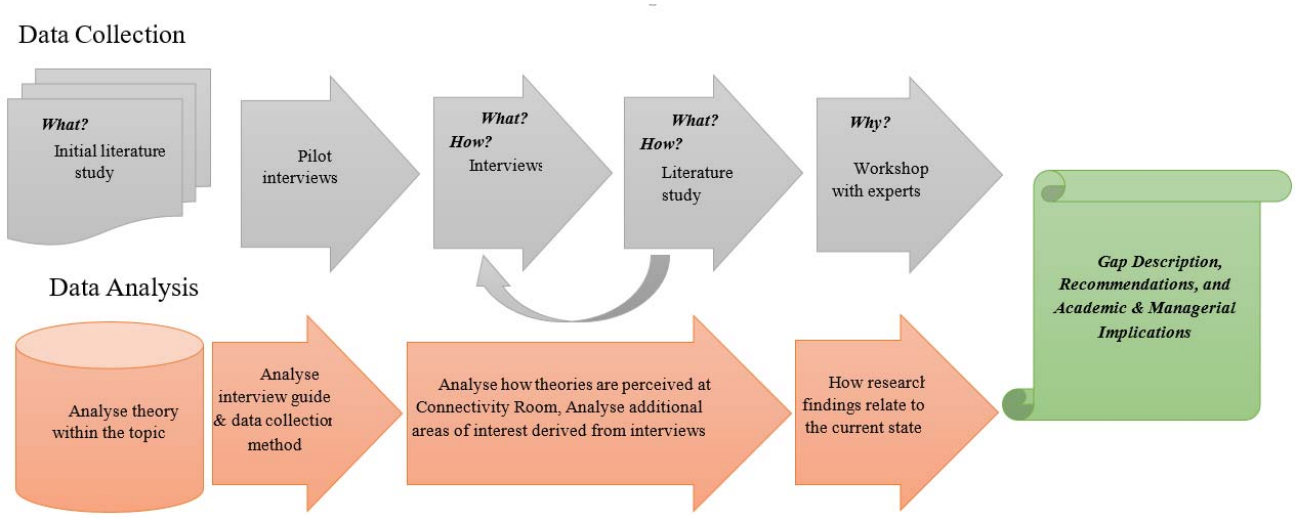

Figure 3-1: Research Execution Process at the Business Unit.

As shown in Figure 3-1, the research execution in this thesis included two parallel paths of data collection and data gathering. Before studying SKF Connectivity Room, an initial literature study has been conducted to highlight the main up-to-date challenges and contributions in the area of knowledge exploration and integration through collaboration. The main goal of this stage was to get rich insights into the topic in general, and ensure that a suitable ready-to-use model is not available for this special context. As shown in the figure above, the outcomes from each stages were used as inputs to the next stage(s). The pilot interviews were basically used to create a common ground of perceptions concerning the thesis scope and test the effectiveness of interview as a data collection technique. As a result, the research questions were adapted to that common ground. The iterations developed between interviews and literature study were dedicated as a backup plan in case the interview answers do not sufficiently contribute to the research findings. In exploratory studies, researchers decide to stop gathering information once the arguments of the findings can be properly supported by the current amount of facts gathered from both the case and the literature (Bryman & Bell, 2015).

For the parallel analysis path, and in order to develop a consistently connected big picture, the comparison between what is discussed in literature and how different

aspects of the main topic are perceived, sorted out, handled and applied at SKF Connectivity Room. As a result, from both research paths, the gap between the current performance of SKF Connectivity Room and literature was described in detail and underlying recommendations were discussed and highlighted.

3.2 Data collection

The data of this study comprises interviews with key people from SKF Connectivity Room and their collaboration partners, observations, and interviews with experts. At SKF Connectivity Room, people who are in charge were intensively interviewed. Managers of Connectivity Room were targeted due to the fact that they the greatest potentials to describe the whole picture of the process even if it is not well defined or structured. The interviews provide a deeper understanding of how external knowledge at Connectivity Room is managed and made use of during the early stages of NPD projects. Moreover, the interview questions enable opportunities to familiarize with how collaboration with the external partners of Connectivity Room is triggered systematically. Further, the interviews were conducted with external partners of different background in order to understand the knowledge transfer between external partners and Connectivity Room. For external partners, the formulations of the questions were based on literature study and the finding from previous interviews. The choosing external partners for the interviews are production customers, service engineer customers, Group IT and external suppliers. Since this is an inductive study and to perform interviews is an efficient way to extract relevant qualitative information. The interviews are performed according to following procedure. First, the intention of the interview is presented to the interviewee, after that the interviewee will present the background of their organisation. Finally, questions about partner selection, the process of collaboration and the performance of collaboration are asked. Since partners of different background are chosen as interviewees, the viewpoint from different perspective is covered.

Along the interviews, the understanding from the theoretical study is further discussed and developed based on the data from the respondents. Investigation of the already existing strategies and method at Connectivity Room provides the research with understanding of what tools are used to facilitate collaboration from the very beginning phases at which there is a lack of strategy toward which kind of knowledge is valuable for future businesses. The screening of external usage of collaboration strategies and methods is an overview scanning of open material to investigate if there already exists a successful strategy that would contribute to the current management strategies at Connectivity Room. An examination concerning the processes of product development projects is performed as part of the initial literature study in order to get mature understanding of product development projects. Furthermore, a parallel theoretical study to the interviews is dedicated to any possible phenomena applicable to Connectivity Room, which is aimed at investigating the possibility of having other factors to be considered.

According to Bryman and Bell (2015), structured interviews represent a common approach when a quantitative research is to be considered. On the contrary, they claim interviews in qualitative research tend to be less structured and interviewees' opinions are more interesting, which makes more rooms for deviations from the interview plan than the case of the quantitative approach. As such, in order to get sufficient engagement from the interviewees, the chosen interview approach is based on the interactive semi-structured style. The interviewees are given more space to go back and forth to the discussion point. However, the main interview guide is roughly backed up by literature study and supported by pilot interviews with managers of CR and partners. The content of the interview guide is mainly questions related to the process and the strategy to detect, approach and collaborate with partners.

The layout of the interviews is determined once the pilot interviews are done. Six main interviews were conducted to get complementary yet validating results of interest to the research questions. Six interviewees were considered including the general manager of Connectivity Room, the innovation manager of Connectivity Room, an internal supplier (IT department), an external supplier , an internal customer (manufacturing facility), an external customer (wind energy), and a collaboration expert. Questions have been modified to some extent so that they fit the interviewee.

Adapted analysis strategy

Figure 3-2 shows the analysis strategy that is mainly inspired from the grounded theory approach. It starts with the initial data screening phase that comprises research questions formulation, theoretical sampling, and data collection. After that, the coding phase is initiated by mapping the different interview and theoretical results related to knowledge exploitation strategies in the FFE of NPD projects from OOI perspective. Then, the mapped items are categorised and clustered, and comparisons are made among results inter and intra clusters. The arrows between the coding and data screening phases represent the continuous influence and iterative feeding of information. The coding output is the strategies that are formed by the clusters. The strategies are continuously fed into the comparison phase in which the strategies are

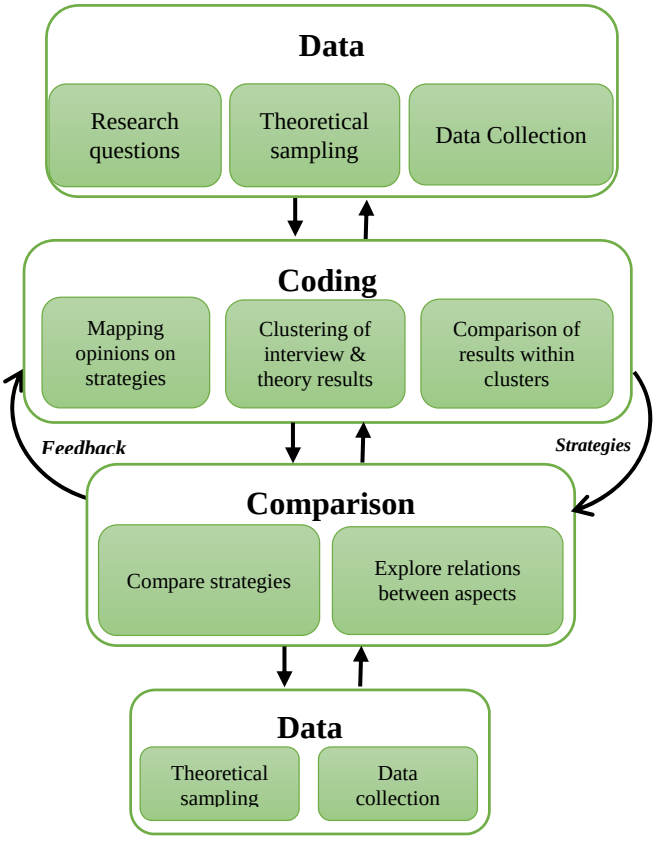

Figure 3-2: Adapted analysis strategy.

compared and sorted into a network of relationship, which is in turn transmitted as a feedback to the coding phase.

Comparison consists of developing the strategies by comparing the knowledge of these strategies with the audio recordings and by constantly questioning and changing the relationships between the strategies accordingly. As a result, a network or strategies is developed. The network is completed when relevant data from the research is thought to be relatively supporting.

3.3 Research quality

According to Bryman and Bell (2015), reliability, replication and validity represent the most common criteria. They call a research to be reliable when the factors and measures used do not produce changes in results within short intervals of time. As such, in this thesis, the risk of having undermined reliability stems from the fact that the data is qualitative and interviews vary based on the backgrounds and understanding of interviewees. Therefore, inconsistencies in answering the same questions are possible. Moreover, interviewees may change their opinions over the study period, which means the different answers may be obtained from the same interviewee during the research. As a countermeasure, the interview questions will be made clear and supported with illustrating figures to reduce the risk of misinterpretations and misperceptions.

Bryman and Bell (2015) highlight the importance of replication in business research as to make it possible for other researchers to initiate the study again in order to question or confirm the results, which means that the different research steps should be kept in high detail level. Since data should be continuously qualitatively processed (i.e. analysed and interpreted) in this thesis, it is difficult to include all detailed notes and the related reasoning and mapping throughout the study. However, key discussions, decisions and figures are documented and maintained in this thesis, while further invisible effort could be documented in a journal. Nonetheless, since the availability of collected data is important to replicability, the interviewees in this study case requires great coordination effort, which makes data accessibility an additional significant limitation to replicability.

As for research validity, Bryman and Bell (2015) claim it represents the most important part of research evaluation since the integrity of the study's conclusion are concerned by validity. They discuss two types of separate validity including external and internal. External validity is related to how the research outcomes could be generalized into different contexts and settings. Even though this study is delimited to developing strategies could be an effective fit to SKF Connectivity Room, it does not necessarily mean the developed strategies cannot fit other settings. Managerial and academic implications discussed in this study can be valuable to future similar initiatives.

As for internal validity, the theory developed – i.e. strategies in this case – itself is checked against its alignment to the performed observations. For this study, the researchers dedicate a significant amount of time to thoroughly understand and discuss the observed situation with stakeholders, which is the main way concerning how the alignment is secured. Another dedicated approach to support the alignment is to combine theories from recent, homogeneous and reliable sources of knowledge including those pioneers who turned out to be the inspirers of some key interviewees.

4 Case Background

The company used for the case study is a Swedish manufacturing company with an international presence. The company possesses great knowledge and competences within applications related to friction and force transmission. In Addition, it is the market leader when it comes to providing solutions related to all types of bearings.

Today, in order to succeed in a business, internet and ICT technologies are becoming indispensable attachments. Using mobile devices for accessing the internet is growing rapidly. In 2011, the internet usage from mobile was 5%. In 2012, it grew to 10%. The forecast is that by 2014, more than half of the global internet traffic will come from mobile devices. Unsurprisingly, the company reacted to that by establishing a business unit, which has a vision to make it the easiest company to do business with through apps and mobile devices. There are two main expectations from this business unit. One is to provide new business opportunities and new revenues. For instance, having machine-to-machine communication enables new technological solutions. The second expectation is to increase the productivity of the company employees through enabling more efficient work procedures and time savings using mobile communications, see Appendix A.

The business unit has a procedure to generate new ideas and further develop the ideas to products, see Figure 4-1. According to the innovation manager of the unit, the company is good at operational tasks such as market strategy and product offering. However, as the case for many large companies, the company has serious difficulties in creating new businesses that are radical unlike small companies that are agile and can easily adapt to new technologies or markets. Therefore, the unit was established by the company as an ambiguous organization behaves like a small company and has less restrictions toward planning and managing radical new product development projects, Appendix A.

The company's core competences are bearing solution and the competences the unit needs reside in information technology and software development areas. In order to get the competences needed, the unit has to collaborate with external companies. Moreover, the company has already well-defined and structured capabilities concerning how to plan and implement the later stages of product development projects – i.e. project realisation – that have already mature concepts. However, when the concept to be developed is related to new mobility and IT solutions that are very far from the company's competences, the unit is in charge of exploring and screening ideas, as well as selecting and collaborating with partners in order to overcome the challenges of the early stages of NPD projects that are fuzzy and essential to succeed in the business, see **Error! Reference source not found.**. Figure 4-1 shows the main structure of the workflow adopted by the unit from the very early stage of NPD.

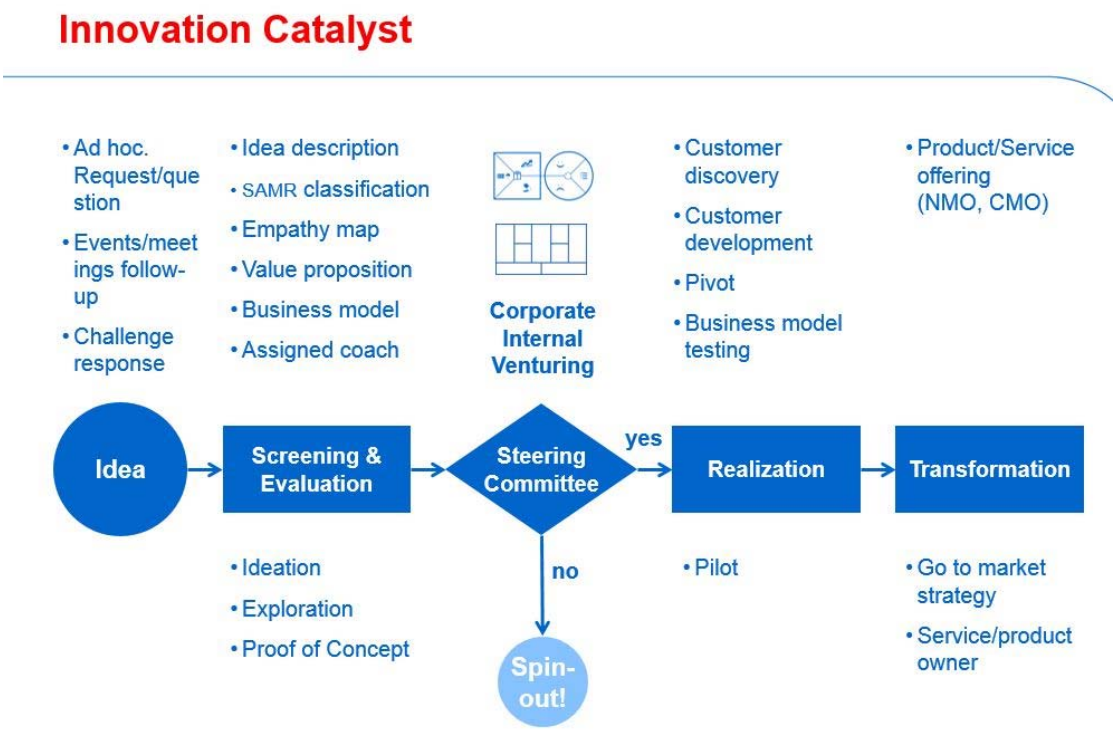

Figure 4-1: The Domain of the Unit's Operations.

4.1 Idea Generation

There are several triggers of ideas. One is that the unit targets employees and departments in all levels within the company to gather relevant information concerning their needs as input from internal customers. Normally, employees in different departments focus on doing the work efficiently within their work tasks. However, when posing questions from the unit perspective to those employees, they become urged to think differently and many interesting ideas emerge. Another trigger is through events such as workshops with communities or with other companies. By participating in fares, innovation jams and other similar events, the coincidences to transfer ideas and find the right people to collaborate with become greater.

4.2 Idea Screening and Evaluation

In this stage, the task is to proof the relevance of the idea. The unit uses SAMR model to classify ideas based on the generated business value as shown in Figure 4-2. According to this model, transformative ideas provide higher business value. However, transformative ideas are more complex and require fundamental changes. Besides SAMR classification value proposition is another aspect to be considered. A good value proposition is essential to manifest the contribution of an idea. Furthermore, value proposition should be aligned with the business capabilities, processes and functions required to proceed with the idea. In order words, value proposition should answer questions related to investment alignment, risk and business impact.

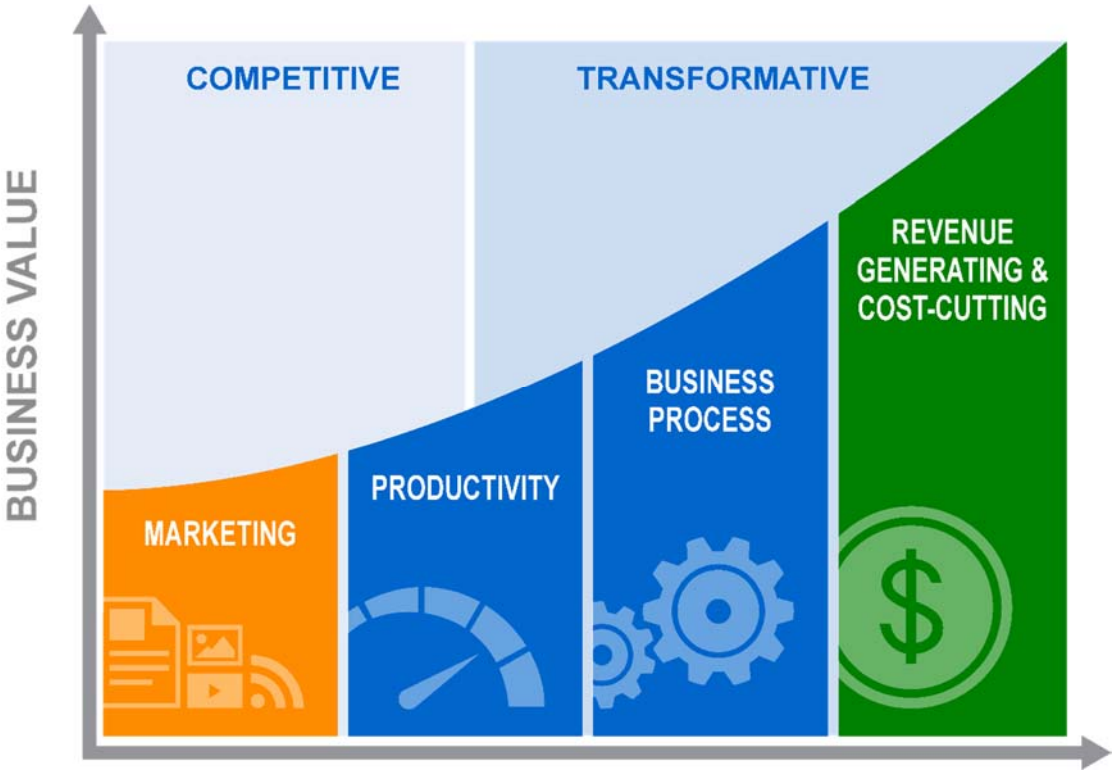

Figure 4-2: SAMR Model to classify ideas based on business value.

4.3 Steering Committee

There are regular meetings with the steering committee to discuss strategic issues. In those meetings, the unit shows the impact a developed concept will have on the future business of the company. In order to convince them, the unit secures sufficient information to develop a business case for each concept to be reviewed and highlights all possible benefits, gains and risks. Eventually, each concept has a destiny to either get a budget to be realised as later on in a structured manner, or to be spin out.

5 Empirical Results

The results are based on the respondents and the innovation manager is the main respondent. Many specific examples from the project cases are highlighted to provide a general understanding as the base to answer the research questions. However, the purpose of the examples is to provide important data, and therefore, there is no detailed description of a single case.

5.1 Open innovation

According to the head of the unit, there is support and trust from the top management and therefore, the unit has high flexibility concerning striving for the vision. For instance, the unit has the freedom to choose any partners as long as they are not too many to manage. In addition, the unit is not constrained by budget and by having strong financial resources, which means that the unit can choose the most suitable partners. Moreover, due to the involvement of internal departments, there is no such situation of unwillingness to collaborate. This is possible due to the fact that high their level of involvement facilitates commitment and trust. One good example according to the company IT department is that they help the unit with valuable knowledge and relevant network to find relevant partners. Another example that an external partner pointed at is the fact that suppliers work autonomously together for the unit and in some situations, the external suppliers will use their networks to find the right people without a formal request from the unit.

As many interviewees mentioned, there is enough openness to gain the necessary knowledge in successful collaborations. According to the manufacturing development department (internal partner), the unit received all information and resource needed, and in turn, the unit was always available if there is any problem or question. However, the IT department stated the fact that the unit has different IT structure, which represented one major obstacle in their collaboration with the unit. Having a separate system increases the workload of alignment and integration, even though it enables flexibility and independence for the unit. But according to the customer of the unit, the problem of separate systems is mainly when integrating in the company's servers, and for customers, the flexibility and quick response are appreciated.

5.2 Organizational capacity for knowledge

To relevantly compare how the organizational capacity for knowledge looks like in the unit, behaves, the following sections follow a similar shape of the theoretical structure discussed earlier in the second chapter "Literature Review" in order to make it easier to compare. That starts with reviewing how the unit perform its role as part of the knowledge management process in general and how knowledge transfer and storage is represented in particular.

5.2.1 Knowledge management process

The unit has an innovation manager and the purpose of this position is to catalyse innovation and to enable networking. According to the innovation manager, people has useful knowledge even though they are not able to articulate the value of the knowledge due to their daily focus on ensuring high efficiency and the existence of the departmental walls. One clear evidence is the several solutions came to life through investigating the opinions and expertise of employees in all levels. However, a developer from an external partner emphasized the importance of seeing the big picture and combining knowledge from different competences and origins. In the same context, an external partner stated that the contribution of knowledge from their side is to find the right person from their network. Another way to manage knowledge at the unit is finding channels to tell their success stories and build a reputation out of innovation. This strategy turned out to be effective since different customers admitted that they approached the unit due to the publicity of its solutions across the company.

5.2.2 Knowledge transfer and storage

According to the innovation manager, there are no efficient tools used to transfer knowledge due to fact that the knowledge resides in people's minds. One way to transfer and store knowledge is enabling short project cycles with partners. By having frequent learning cycles, it is possible to make small improvements, which build up huge amount of knowledge in the long-term. A common view of suppliers is that the tacit knowledge is more difficult to transfer. For instance, there are transactions of documents such as solutions, proposed design artefacts and data, but physical collaboration is used to transfer tacit knowledge. One potential risk stated by both the unit and their partners is that there is no work rotation, which means that specific knowledge is owned by a single or a few individuals. This means if one knowledge-owner leaves the unit, the competence and networks will disappear accordingly.

There are mainly two reasons for leaving the unit. One is to start an own business based on the competences that one has learned in the unit. Another reason is the desire of new challenge and individual development in new working environment. In fact, two suggestions were stated by the innovation manager to protect knowledge internally. One is to co-create a company with the knowledge-owner, and in this way keep the contact. Another strategy is to build up a cluster where the unit can easily pick the right person in the cluster network. According to an external partner, some contribution of knowledge storage has been applied by an external developer. He added, members in his team were encouraged to test and find creative ways in the daily work tasks under his supervision. Good information related to techniques and technical tasks were asked to be properly documented as guidelines, FAQs, best practices, tutorials … etc. That last two actions reflect that the unit creates rooms for reaching creativity and ensures proper transfer of success stories.

5.3 FFE process structure

According to the innovation manager of the unit, project managers that run their projects usually apply the most critical decisions and, thus, has a huge impact on the FFE results. In addition, the development process is based on the tacit knowledge of these project managers since no standard manuals or models are currently recommended for them to follow. In the FFE, the unit does idea generation and tests each idea. After that, the unit validates if the partners have the required resources. In this situation, the project manager starts to realize the specific knowledge and resources needed based on previous experiences and the personal network with partners. The focus of the FFE mainly depends on the project type.

The innovation manager has pointed out that the unit has to align to the vision, which is approached using SAMR model that is used to classify projects. The vision is to be the leader in mobility and the unit would like to be the coordinator to creatively create business value and revenue. According to SAMR classification, there is a transformative part where value creating is in focus and below that there is a baseline where efficiency is emphasized. This kind of classification is simple to communicate and functional as a tool to decide when to stop testing and development iterations. Beyond this, there is an emergent way to sense the signals across the organization.

After candidate ideas are selected and narrowed down, they are developed to be concepts. However, each idea has different grounds and potentials to turn into a mature concept. For instance, along the FFE, some projects run by the unit may proceed with ideas that have clear patterns of concept development. According to the manufacturing development at the company, the concept in terms of customer needs and functions were to a great extent defined by the users, and thus, it was not difficult to simply let the unit to take care of the technical part of the solution. This means that customers may approach the unit with semi-complete concepts. On the other hand, there are projects in which concepts were not defined when external partners started to collaborate with the unit meaning that design parameters were still open to discussions and testing. In this regards, the business development manager of the wind energy unit emphasizes the significant role of iterative co-prototyping with both the unit and their reference group from the beginning, which considerably supported identifying hidden user needs and potential issues within relatively short time and a few numbers of iterations as the concept was taking a shape.

5.3.1 Corporate foresight

The innovation manager stated that the unit considers all actors along supply chain from R&D to end customer when they are looking for trends. Moreover, the unit has learned from experience where to look and the focus has been limited within specific scope boundaries in order to get more outcomes. The advantage of having a target group increases the possibility to see the holistic picture and to sense interactions within the group. In this way, measuring and managing ideas become easier and more productive.

According to the innovation manager, an efficient way to sense trend is to use user communities and for the unit, there has been informal networks or workshops where the meetings facilitated corporate foresight. Besides, the unit also uses publications from academia as another great source of foresight. According to an external partner, it is mainly consultants who work inside the unit and contribute to trends. Moreover, an external partner stated that by using networks to sense the trend, the unit does not reinvent knowledge that others have. A common view from both manufacturing development and wind power business is that the workshops held with the unit were useful to capture the trends in the industry and imagine the potential consequences of generated ideas on the whole company.

5.3.2 Emergent and deliberate strategy

According to the innovation manager, there are two ways of partner selection. One is going through bureaucratic procedures that most departments should go through, and the other way represents a special fast track supported by the CEO to enable shortcuts for special cases. By using this track, the unit is not obliged to wait and comply with the strict rules of long term partnership that is dictated by the procurement department. Instead, the CEO is taking the responsibility of allowing such urgent collaboration efforts and partnerships. Nonetheless, the unit always needs to explain and give valid motives and reasons for using the fast track to the CEO. The fact that the unit is one of those bodies within the company that are singled out with such an advantage enables them to act more emergently. Nonetheless, there is a hidden difference between using this power once needed and misusing it by not involving proactive planning and early partner selection if possible purposively.

According to the head of the unit, the projects are managed in an agile way. This means small adjustments with short intervals are made along the project. The reason of this approach is due to the fact that an idea grows and matures along the FFE and it is impossible to have a deliberate plan. In addition, the innovation manager highlighted that emergency represents the nature of everything the unit does. For instance, there are no business plans or operational missions. In addition, the core management team is consisted of three entrepreneurs and one venture project manager making the overall entrepreneurial behavior more prominent than the managerial structure behavior.

As the manufacturing development admitted, there was no awareness of either deliberate or emergent strategy when they worked with the unit. During their collaboration, the unit has defined the steps of the project and showed high flexibility to test and rework different solutions with specific fit for machine operators. According to an external partner, the emerging strategy is beneficial for testing and practicing fast prototyping. However, there is a lack of structure in communication and this was affecting the capability of quickly finding the right people once needed. In addition, a project manager of an external partner mentioned that the product owner has grown from one to more than twenty, which caused great confusion and

unnecessary delay during concept evaluation and validation. In general, the product owner is responsible for approving concepts and solutions to be raised to the steering committee. By not having structured communication, the coordination of projects at the unit had high tendency to get complicated after a short period of time. Not least, the project manager admitted that they would have been better in terms of resource utilization if the unit was more structured and if it followed deliberate strategies in some of what their activities. As for individual work experience, an external consultant confirmed the fact that there was a lack of introduction when he started with the unit, but he was told to be creative and fast, and to do that, he created his own structure.

Why would the unit follow emergent strategies than deliberate ones? In general, the IT department stated that the unit was established to be explorative and conduct prototypes, which explains its lack of structure. When doing this by using emergent strategy, the unit could be flexible and creative by making things happen more quickly than others allowing the same staff to gain much focused experience within quite short time. According to the innovation manager, short project cycles avoid the knowledge immigration problem high employee turnover usually bring. Besides, projects that last for long years due to their scale or complexity demotivate generating creative ideas internally. Instead, the unit acts emergently until they need to scale up their products and services. Here, they need to have certain things in place in order to operate efficiently meaning that they start to move into the deliberate strategy arena. As for the team size in light of emergent strategy, an external consultant believes that it is suitable for a small flexible team, while in large project teams issues and changes take longer time to react to. When the project team grows, the holistic view disappears and communication obstacles appear to cause double work.

The external consultant continued, there are potential area of improvements if a structure is in place for the unit. One is that to develop live visibility of the current progress and vision across partners and bring up hidden information to the surface so the ongoing challenges and undertaken development paths are visible. Another challenge is to come up with a structure that can resolve the previous communication problems related to the globally distributed teams and team members with tight schedules and clear tasks and internal task customers. Distributed teams used to cause lags, re-works and even repetitions of discussions during online and face-to-face meetings. Similarly, the same external partner stated that there is a lack of documentation and structure of learning. In addition, there is multitasking which disturbs the innovation where focus is essential.

5.3.3 Other Orientations in Innovation Strategies

According to the innovation manager, value proposition is an outcome that the unit focuses on by testing and co-creating with customers. After all, it is the value creation that can convince people and therefore the new ideas are related to a business model, not a business plan. To focus on business models is more emerging and it creates

tensions with the core business. This is particularly obvious when internal processes are complex and slow. In many cases, the unit has to wait until the actors are ready for its approach and persistent in having a dialog with actors to change the perception of the unit. For instance, the IT department pointed out the separation issue of the IT-infrastructure deployed for the unit is problematic because it adds double work and extra effort. In some situations, the unit wanted to do things not aligned with the process. In those cases, there were difficult discussions. According to the head of the unit, there is no situation of lack of support, the communication with top management is open and related to the problems of collaborations. Because the unit operates separately, it is not limited by internal constraints and there are always external competences. Related to this, the IT department stated that due to the strict internal policy, the unit selects external suppliers so that they can be more flexible. However, according to both suppliers and the management team in the unit, there is an opponent assigned for their generated ideas. The opponent is a part of management team represents the end customer and business stakeholders. In general, along the FFE, the opponent is involved from defining customer needs to the development of solution to critically challenge the resultant concepts so that failing ideas are killed before they deplete significant amount of resources.

5.4 Partnership in the FFE OF innovation

Understanding the partnership building process in the unit is specifically interesting for this thesis. However, three main topics are to be more considered than others including the triggers partnership, the usual or standard process of approaching partners, and other orientations in selecting partners.

5.4.1 Triggers for partnership

According to the innovation manager, the customers' problems and challenges are the base for finding new services and offers. This means that the first selected partner in a project is a potential customer. After that the relevant knowledge is defined as a base for selecting suppliers. However, this has no formalized process. Instead, it is based on an entrepreneurial emerging strategy. Sometimes, there is a foresight of a particular technology from a specific supplier, and based on foresight, future customer needs may be identified. Commonly, the customers are aware of their problems and will approach the unit since the unit has a reputation of developing innovative solutions.

5.4.2 Partner selection process

According to the innovation manager, there is no outspoken way to select partners, even though there is awareness of how to do this. In general, informal and formal networks are used to select partners. The formal networks are applied in situations like events, fairs and conferences where potential partners participate. The informal networks are networks of existing partners. The strategy getting the unit in contact with those networks and showing what the unit does to attract potential partners who are willing to share new knowledge for future collaboration dedicated to value

creation. In those networks, coincidental meetings with different companies could increase the possibility of finding the right partner. Furthermore, the fact that the unit has the option to incorporate new partners (as clarified in section 5.3.2) through a shortcut supported by the CEO enables a flexible way to reach out new partners making relatively late considerations of new partners possible. Moreover, there is an awareness for the need to balance out the selected partners by ensuring the participation of new partners that have never been dealt with before. Along with that, the innovation manager thinks that diversity of backgrounds, ethnicity, gender and culture is supposed to enable better environment for innovation creation. However, he admitted, around 90 % of the collaborating partners are men and they are mostly engineers. In addition, the unit would like to stay in the creative part of a project, and as soon as suppliers can take over, the unit will move on to the next project.

5.4.3 Orientations in partnership selection strategy

According to the innovation manager, there are active suppliers whom the unit frequently communicates with, and there are passive but interesting suppliers where the unit keep them shortlisted until a need for them pops up. To ensure fast and productive communication and involvement of external and internal partners, the innovation manager believe agreements should be smartly formulated to offer many options to protect ideas depending on the role of the partner. However he admitted that there is no formal strategy for idea protection the unit consider. Sometimes, partners show the interest to collaborate and the company itself needs evaluate if it is safe to allow the unit to let them in. Most of the time, there are informal agreements with supplies that are built on trust, which means that there are no disclosure agreements with suppliers, but if an IP is not defined, it is difficult to consider that as part of the company's knowledge properties. According to IT department, certain things have to be done in house because of security reasons.

6 Analysis & Discussion

The main purpose of this chapter is to compare the empirical results of the case with the relevant state of the art from literature and form clear answers to the research questions.

6.1 The Fuzzy Front End of Open Innovation

According to Chesbrough et al. (2014), OOI is a process to purposively manage knowledge flows across organizational boundaries with a focus on using external knowledge to develop either new offering or new business model. That is generally done through collaboration and partnership that leads to extracting and integrating new knowledge. Enkel (2013) explains that a general sign of OI behaviour is the freedom and commitment given to a department or unit to collaborate with external parties. In this study, the trust and the commitment from top management provided the freedom to collaborate with any partner. Moreover, the freedom facilitated the agile and flexible behaviour. Besides that, the external partners were committed to openly share the relevant knowledge. In some cases, external partners would coordinate collaboration independently to deliver results. In general, this kind of solidarity and trust is necessary to quickly applying external knowledge in an uncertain and dynamic environment.

6.2 Idea generation and collaboration

According to Muller and Hutchins (2012), the more diverse – but relevant – viewpoints are involved, the more innovative are the strategic foundation of the project, which makes the management of interdisciplinarity and inter-functionality quite important. In general, Gassmann and Schweitzer (2014) confirm that knowledge development strategies influence the core management capabilities in the FFE of innovation. In this study, the employees involved were mainly male engineers, which could result in narrow mind-sets. The diversity could be enhanced, if more female engineers were involved. Furthermore, by involving other professions such as psychologist, economist could further increase the diverse insights.

Slaughter (1997) claimed that corporate foresight could be used for strategy development and innovation creation. More specifically, Griffin et al. (2014) believe corporate foresight capabilities are quite important to deliberately and systematically detect and grasp opportunities through detecting future changes, interpreting the impact of these changes, and highlighting triggers for new innovation initiatives. In this study, detecting innovation project ideas were based on a few managers in the core team. The managers travelled around the globe to participate in innovation jam platforms, workshops and conferences to capture the newest trends. However, in order to generate ideas that are valuable for the corporate, the manager should have deep understanding of the corporate contexts. One pattern is the absent of structure in idea generation, which could result in high coordination cost. One the other hand, idea

generation is characterized by high level of tacit knowledge, which is difficult to be defined by a process.

In this regard, García-Fernánde (2015) highlighted a generic knowledge management process in which internal and external information are extracted from individuals, teams, and organizations to feed the ideation tools. This reflects a necessity to take partnership to the next level, which could mean more limited circle of partners, especially potential suppliers. In other words, all parties involved should be relevant in a way or another to avoid unnecessary coordination cost (Faems et al., 2009) and increase the interaction that would accelerate the ideation phase (Gassmann & Schweitzer, 2014). Moreover, flexible collaboration agreements should be initiated at this point to give exclusive benefits to the partners. However, in order to make sure that the partners are selected relevantly, the triggers for partnership should be clearly stated and justified for each partners, answering who we are, what we do, and whom we know (Solesvik & Gulbrandsen, 2013). In this study, external partners were carefully chosen and had long collaboration with the studied corporate. Furthermore, the external partners were leaders in the related business. This means the relationship with external partners is characterized by a high level of trust and understanding. In general, the relevant knowledge was extracted from the right people. In this respect, the high level of trust and understanding significantly lowered the coordination cost to find relevant connections. Besides, in order to be flexible, it is obvious that the relationship should be more trustful in a more uncertain and complex context. In some cases, the collaborations with external partners were more flexible compared to internal partners, which triggered conflict with internal partners. Since the internal partners had rather different need of flexibility, it is important to explain to the internal partners that the fast decision is needed to extract the relevant knowledge.

Having sufficient amount of knowledge to activate an appropriate collaboration is accompanied with another challenge, which is if partners should be selected based on specific purpose, or general connection to the topic (Stadlbauer & Drexler, 2014). Besides, the number of partners to be involved is recommended to be limited, and few partners are recommended to be new to the NPD leader (Brem & Tidd, 2012). Bahemia and Squire (2013) discussed the breadth and depth of partner involvement strategy in which not only strategic partners are involved in the early stages, but also new partners. In this study, inviting any supplier to an idea generation session was mainly based on a special purpose, not general connection, which reflected limited extent of innovation openness. Discussing special development areas limited the possibility to discuss areas related to the business opportunities and value propositions. Therefore, key contributors should be included in idea generation sessions as early as possible to allow more discussions with external parties on the business topic.

6.3 General Driving Strategies: Emergent vs Deliberate

Both the empirical and literature studies of the knowledge management behaviour in the FFE emphasize many significant points. First, the balance between emergent and deliberate behaviour is required. Emergent innovation in the early phases of NPD are important to make changes possible and iterations smooth, while deliberate strategy enables productive collaboration external partners through well-planned workshops for idea generation, effective partner selection strategy, and extensive scenario-based planning.

Emergent strategy is strongly recommended in the FFE since it allows shorter development loops, which makes it easier for the core project team to remember the knowledge and transform the organization gradually. Moreover, emergent strategy encourages broader employee enhancement and the possibility for employees to even outsource their work since it is challenge oriented and allows cross-organizational flexibility to work out dilemmas. In general, the FFE is similar to innovating in dynamic contingent uncertain environment, which means that what fits such contexts, may also fit the FFE context.

On the other hand, deliberate strategy could fruitfully strengthen some deficits of emergent strategy. For instance, having structured way to document knowledge extracted from external parties and lessons learned may reduce the number of iterations required to generate value-adding outcomes. Additionally, the lack of structured way of communication in light of emergent strategy may need more discipline to minimize the threat of increasing coordination cost, which is a serious failure factor for OI. Therefore, using compatible communication tools and channels for potential partner community that would not generate any conflict is a discipline in itself. The communication should be transparent enough so that collaborators are able to properly align their contributions and avoid possible reworks, delays and unnecessary expenses. The case reflects that communicating with external parties from the beginning could be direct or indirect. Direct communication means to find the required knowledge source may include executing pyramiding, exploring scouting networks, conducting ideation workshops, and participating in innovation jams. On the other hand, indirect communication could be promoting success stories, and partnering with reputable organizations.

Nonetheless, work rotations are still infeasible to apply in small teams and under emergent strategy since time margins are tight and the role of personality in innovation context is significantly individual.

6.4 General Managerial Implications

Both the literature study and the empirical findings of this study strongly support the fact that key people represent the way out of the FFE challenges. In order to make assessment of the current situation in the FFE challenges four questions are suggested to

1. Where are we now?
2. How much resources do we have?
3. Who should we talk to?
4. Who can connect us with them?

Along the FFE process different approaches should be applied to facilitate the contribution of the people. First of all, the support and the commitment of top management is a necessity to implement the process. After that, in the early phase a clear and flexible innovation strategy should be made. In this phase managers should have a broad choice of different potential partners. As the project proceeds managers have to make critical decisions over depth and timing of the involvement of each partner. Hence, the success of open innovation project is based on the skill of breadth, depth and ambidexterity in the different FFE stages. In general, the accuracy of critical decision making throughout the FFE process strongly depends on the ability to align the value proposition toward the market. In the aligning for market, an iterative process to experiment until the right value proposition is required.

When collaborate with partners that contribute with concept and ideas the collaboration should be in depth to ensure an innovative outcome. However, if the partner lack the previous collaboration more resources and the attention should be invested to alignment and learning. Another aspect that strongly increases the innovation is to promote joint work between partners to create trust and mutual knowledge. Moreover, in the dynamic environment of FFE a structured process in operative tasks will release resources that could be used for iterative testing. Finally, work rotation will increase knowledge transfer and storage, even though it will increase cost of human resources. Additionally, building a community platform could be a possible way to keep in touch with external knowledge.

6.5 Integrating External Knowledge in the FFE: Generic Conceptual Model

The empirical and theoretical studies conclude that no specific ready-to-use approaches frame a solution for the chaotic knowledge extraction behaviour in the FFE of NPD projects. Instead, generic guidelines may direct the attention to which type of partners NPD leaders may need to involve at different stages of the FFE. Figure 6-1 illustrates a generic conceptual model for integrating external knowledge in the FFE of NPD projects. The balance between knowledge creation and knowledge application is represented by centring customers along the process. In other words, even though the target may dramatically change along this timeline, the focus of what knowledge to create in order to innovate starts from defining the real needs of customers to ensure greater knowledge application, and thus corresponding level of knowledge creation. These needs may be subjected to many changes due to updates in the following late stages. However, this study recommends that creating knowledge

with external partners should be always based on a ground where the collaboration outcome is to be applied. Otherwise, processing irrelevant knowledge becomes greater than acceptable, and the application-to-creation ratio of knowledge becomes lower, which is an indicator for inefficient knowledge extraction performance. Besides, early collaboration disagreements are expected to appear. Therefore, this model targets NPD projects that have limited area for leaders who would define the initial customer needs to study before building on that.

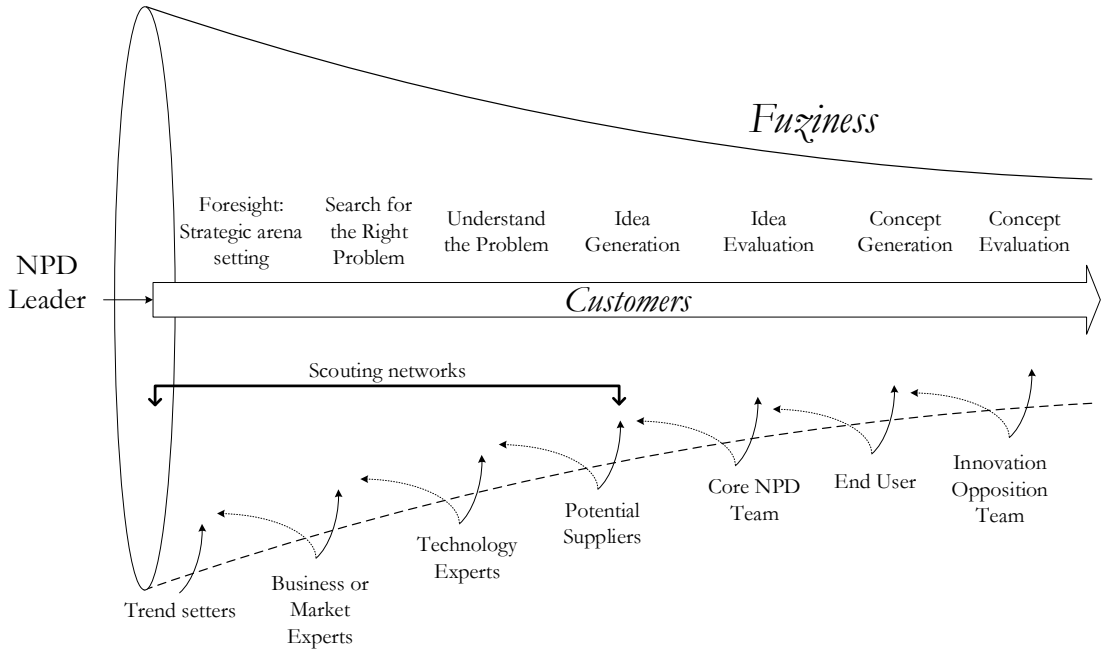

Figure 6-1: Generic Conceptual Model for Integrating External Knowledge in the FFE.

Having the initial customer needs to defined does not mean that they are known, but the space of investigation is rather themed and highlighted. That would trigger the foresight stage in which contextual trends are screened. According to the model, since the budget of a NPD project determines if inviting certain ranges of potential partners is acceptable from the beginning. If the budget has no margins to freely invite external parties to foresight workshops, focusing on key contributors at each stage may at least ensure appropriate depth, breadth, and thus ambidexterity of partner involvement, which is fundamental from OOI perspective.

6.5.1 Strategic arena setting

At foresight stage, focusing on trend setters is a priority according to the model. The trends setters could be seen as those kind of people, groups, or organizations that first introduced trends related to the context of target customer needs. When reflecting that on this study, convergence could be pointed out. Since both the studied corporate and some of the external partners were the absolute leader, which could have been more difficult for less reputable organizations. Moreover, one of the external suppliers had standards and products that were commonly used in the market, which significantly helped to settle trends.

6.5.2 Searching for Right Problem

As NPD leaders determine the general trends for further investigation, searching for the right problem comes next. According to the proposed model, getting sufficient insight into any generated idea for a problem requires relevant market experts who are conversant with the current market dynamics and levels of risk and uncertainties. Furthermore, experienced business strategists can actively process the outcomes of market experts to develop valid scenarios. Therefore, the proposed model recommends focusing on these kinds of partnership at this stage.

For this study, the core team itself includes roles such as the innovation manager and the business development manager who have great experience in mobility solutions. However, from OOI perspective, it is recommended that they invite external parties with corresponding expertise to exchange perspectives and ensure partner involvement ambidexterity in all stages. Additionally, the generated business solutions at this stage are expected to become more quickly value adding if they involve individuals with dedicated problem-oriented marketing experience. They could instantaneously validate certain workshop ideas and scenarios for innovative customer value by descriptively and statistically support fact-based customer behaviour to be implemented in empathy mapping.

The proposed model recommends – through the arrow that connects business or market experts and trend setters – that the second key partners to involve in the foresight stage are those who are the first key partners in the following stage. That is built on the assumption that the background for why the NPD leader chooses to follow particular signals or trends could make business or market experts live up to the corresponding development tempo at the time they are prioritized as sources of external knowledge. What could support this assumption is the fact that the knowledge management process is burdened with some inertia when involving new parties, which could be reduced by involving key partners one step earlier than when they are supposed to be the key external source of knowledge.

6.5.3 Problem Understanding

Once a promising problem from the end-customer perspective is defined, technology experts who can combine or even develop current solutions become the key external source of knowledge. Therefore, the proposed model suggests that to understand the problem details that could hide unexpected costs and other types of uncertainties, extensive analysis should be done using different dedicated analytical tools. This stage of development is more driven by deliberate strategy because it also deals with low-level specifications. However, the choice of technology, solutions, and experts for investigation is more likely to be aligned with emergent strategy.

As the problem becomes more and more clear, the proposed model assumes that at least some solutions are approved for further investigation and low-level idea generation. Therefore, involving relevant suppliers as soon as a solution is approved

could fruitfully contribute to the workshops and discussions under progress, and get these suppliers prepared to the following stage (e.g. idea generation) at which they are key external sources of knowledge. To decide whether the level of understanding is sufficient enough to invite more potential suppliers, NPD leaders typically rely on the level of uncertainty concerning product market and technology. Nonetheless, since inviting many potential suppliers is strongly connected to OI failure through uncontrollable coordination costs and competition among suppliers, gaining sufficient understanding to the problem maybe also related to the number of potential suppliers to invite. In other words, if the space of high-level solutions to investigate in ideation phase means involving a big number of different potential suppliers, more work may be needed for limiting the number of solutions, and thus corresponding potential suppliers. Above all, it is common to have more iterations and loops until the problem understanding stage since the problem may turn out to be unpromising in the first place. That means it is possible to go back to the foresight and problem search stages as needed.

6.5.4 Idea Generation

After obtaining sufficient insights into the NPD problem, the proposed model recommends to prioritize potential suppliers as the key external sources of knowledge. Together with potentials suppliers, many core needs are investigated more quickly such as system compatibility and integration, supply chain and logistics core issues, and rough economic and technical feasibility studies. As such, investigating more ideas is allowed if the potential partners are relevant and active, which eventually means more productive collaboration. The resulted ideas and related comments and reflections should be well documented for the following idea evaluation stage.

Practically, the involvement of partners from the foresight stage until the idea generation stage does not occur separately in a stage-gate fashion. It might be wise to involve a potential supplier from the foresight stage if (for instance) the probability of excluding related solutions is quite weak. Figure 6-2 shows an imaginary example of how the involvement of external parties may experience overlaps in reality.

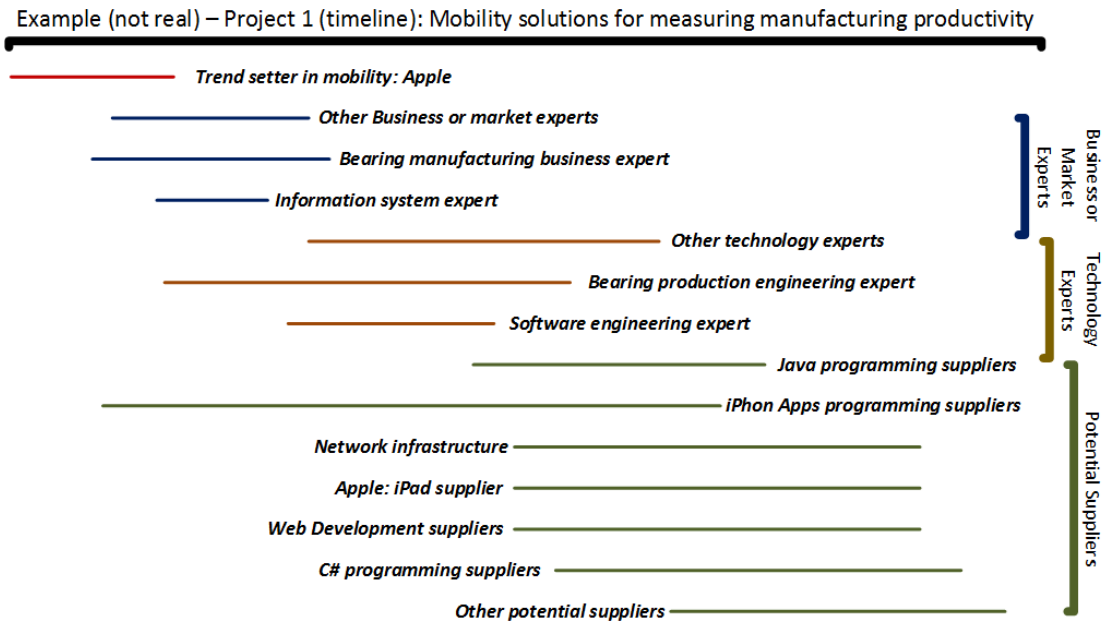

Figure 6-2: Example for involving external partners along the FFE.

Another common aspect in the first four stages of the FFE as proposed in the model is that partners could be productively reached through scouting networks. The reason for that is the selection of workshop participant is usually based on biased information relationship. On the one hand, information communication is efficient from time perspective. On the other hand, openness addressed according to OOI emphasizes exploring new partners even if the conclusion will be to select the close partner. However, expert exploration is sometimes expensive, especially if the core project team lack the awareness required to decide the specific area and level of expertise to look through. Therefore, scouting networks are strongly recommended to resolve that kind of issues when they emerge.

Nevertheless, these four stages may differ in how the knowledge is to be extracted. The proposed model recommends live workshops that should be extended for partners when they are prioritized as key external sources of knowledge. Additionally, such workshops could be properly supported by shared online project team sites with product and project directories; lists of related expert profiles and networks; discussion boards; supportive documents, plans, sketches, templates and glossary of terms … etc. The access to the ongoing outcomes could be tailored for those who are second-in-priority partners, which could represent a good inexpensive start for communication.

6.5.5 Idea Evaluation

The results of idea generation workshops are expected to be well documented. These documents may include a background for each idea, strengths and weaknesses, rough estimates of feasibility, notes related supply chain and logistics, general reflections and similar type of information that is not sorted out nor connected to basic facts. Therefore, the core team of NPD may need to take these ideas to the next level of analysis since idea evaluation represents a quality control gate in NPD projects.

According to the proposed model, no special external partner needs attention since this kind of work requires highly focused environment where members of converging mental abilities can synthesis data and put information together. However, it is very possible that the core team needs a special judgement from an expert for certain weights of relevant idea aspects, which could be done through informal communication (e.g. calls or portal inquiries).

After the ideas are evaluated and ranked for each field, at least one or more alternatives are expected to be in place for each winning idea related to a product element or supporting delivery system. The second and third ideas in ranking are set up in stand-by position in case the top ideas fail to be integrated into the concept to be developed. As such, quick iterations are allowed between concept and idea development stages.

6.5.6 Concept Generation

There is a significant difference between end users and customers. For this study, customers used to mainly be manufacturing facilities and their corresponding white-collar offices. Since the mobility solutions were employed at very contextual environment, manufacturing development experts were invited many times in the early stages as manufacturing experts, but they were also customers. The proposed model emphasizes the importance of involving customers along the process whenever they could play any role of the key partners such as business or marketing experts. However, the circle of end users may exceed the specified main customers since they will use the product but not necessarily own it. Therefore, the model suggests that end users become key knowledge sources when the concept of a product is to be generated and developed. Besides, the value that the suppliers and consults who will participate in developing the concept product are already known at this stage. That means the end users are expected to continuously provide the concept development team with feedbacks and reflections if not being directly observed. The user experience (UX) at this point plays a crucial role to judge if the generated concepts live up to the level of business and could thus be proceeded with to the concept evaluation stage.

As the proposed model shows, the fuzziness of the early stages of NPD project diminishes along the FFE. As the fuzziness gets tighter, the role of deliberate strategy in NPD becomes greater until the FFE is over at the end of the concept evaluation stage. The concept development team comprises consultants and business development experts in addition to the core NPD team and end users. They cooperate together to develop several combinations of ideas to construct complete concept products out of these ideas, which need to be evaluated before getting through.

6.5.7 Concept Evaluation

Many literature sources recommended the existence of innovation opposition team who have sufficient power to challenge and terminate NPD projects if they do not prove promising results. The reason for that is no innovation KPIs succeeded so far to

measure its efficiency. Similarly, the proposed model assumes the existence of such a team that could be possibly involved in any FFE milestone. Nonetheless, there is typically a moment where the opposition team gives the green light for the project realization, which – according to literature – comes by the end of the FFE when the concept product is to be presented in details. In this study, after several Scrum iterations, one concept is selected to present to the steering committee, which include corporate executives. The committee may approve the project realization budget or decide to turn the concept into a spinoff. This steering committee plays the role of the innovation opposition team and needs to be considered. The members of the NPD core team should be aware of the strategic preferences of the opposition team. Therefore, they should consider these preferences from the foresight stage and check if the resultant outcomes fulfil these preferences. The NPD core team evaluates the generated concepts and decide if there is one or more that deserve to be presented to the opposition team, or if the best available product concept needs further iterations of improvement. After the approval is gain, the FFE is over and the deliberate traditional project management tools become basic for project realization.

7 Conclusion and Future Research

The purpose of this section is to summarize the research and the contributions. In addition, the managerial implications and possible future research are suggested.

The purpose of this study was to explore the outside in knowledge management of an internal venture organization. Given that the corporate was short of relevant competence internally, the management of external knowledge were investigated to identify the success factors of innovation collaborating with external partners. The study was conducted on both internal and external partners to answer the following research question:

1. How could external knowledge be managed and leveraged toward innovation in the FFE of NPD projects?

    - How could external knowledge systematically contribute to triggering, approaching and proceeding with innovative NPD?

    - How could different partners be involved and collaborated with in the FFE of innovation projects?

The findings indicate some major patterns in managing external knowledge with innovative NPD. One major pattern is the ability to learn from the dynamic environments by testing with small loops. In general, this ability is common for smaller firms with few levels of middle managers. However, the internal venture could behave as a small firm if it has the support from top management and has the freedom to act independently. Despite this advantage, an internal venture organization has many problems to align with the main organization. One problem is the quicker response toward business environments, which make the collaboration with internal partners difficult. Another problem is the different infrastructures which result in double works and confusion. Finally, the behaviour of this kind of internal venture organization could result to absence of structure in partner selection and knowledge management.

Based on this the study emphasizes four main findings that could have significant implications in managing external knowledge in the FFE of NPD projects.

Firstly, there is huge difference in behaviour between external- and internal partners. The internal partners are slow and structured, whereas the external partners require speed and flexibility. As a result, there could be problem with speed difference when collaborate with external partners. In general, there is a space to clearly communicate about the speed differences between external- and internal partners. Furthermore, the external partners will have to wait some times since internal partners will move slower in the project. Moreover, in order to more effectively collaborate there is a need of mutual trust and understanding of the infrastructure and process.

Secondly, in the partner selection and collaboration there is a risk of high coordination cost. A high coordination cost could exploit resources that otherwise could be used for more innovative task. One reason of high coordination cost is the fact that there is a lack of structure in communication and partner selection, which can lead to double work.

Thirdly, external knowledge is extracted from the right people at different phases of a project. In general, this ability to find right people is depended on who you know whether than what you know. Since the consultants of external partners are mobile, the knowledge will disappear with the consultants when a project ends.

Finally, external partners are rarely involved in the idea generation phase and the idea generation is managed by few male managers in an internal venture organization. This means there is lack of diversity in profession and gender. As result, this kind of organization lack different perspectives.

The research was concentrated on an internal venture organization and the ability to manage external knowledge in the FFE of NPD projects. However, the study strongly indicates the risk of losing key people when extract external knowledge. The possible future research area could be the preservation of knowledge. Could work rotation be a way to spread the knowledge in the organization? What is the cost of work rotation?

Another way to preserve knowledge could be to build a community platform to keep in touch with key people. Moreover, a respondent suggested some key leavers start new companies. What if the internal venture organization invests in those companies?

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Appendices

Appendix A

Interview 1

- **Job Position:** Innovation Manager
- **Description**: 3-setion interviews with one of the core managers of the unit and most relevant to the research scope. The main contributor of the how the innovation process and knowledge management works at the unit.

Interview 2

- **Job Position**: Head of the Unit
- **Description**: contributed with insights of how the core team works in light of the steering committee's authority.

Interview 3

- **Job Position**: Head of Manufacturing Development
- **Description**: described the personal experience with the unit concerning products that have been delivered to the manufacturing development department.

Interview 4

- **Job Position:** Industrial Sales Manager for Wind Power Business Unit
- **Description:** described the personal experience from the first trigger to approach the unit until the desired product became engineered and developed for the Wind Power business unit.

Interview 5

- **Job Position:** Project Manager of an External Partner
- **Description:** provided the personal experience of how the unit approached him and how they usually find the right people and collaborate with them in order to come up with a suitable business model and innovative product.

Interview 6

- **Job Position:** IT Application Manager of the IT Department
- **Description:** provided personal experience of how the unit works with them and handle the similarities of their competences internally and how this relationship is balanced from supply chain perspective.

Interview 7

- **Job Position:** Developer and Project Manager of an External Partner
- **Description:** Provide with insights about global distributed teams and how to delegate to let the employees to become more explorative.

Interview 8

- **Job Position:** Project Leader
- **Description:** described in details which strategies and approaches are used at the unit to handle knowledge acquisition in the earliest stages of the projects she was involved in and how potential challenges and solutions may look like.

Appendix B

Key Trends and Structured Problem Solving and System Thinking – source (Nimmons, 2015):

Key Trends

- Open Innovation
- Big Data
- Crowdsourcing
- Crowd Funding
- Gamification / Serious Gaming
- Semantic Web
- Internet of Things
- Enterprise of Things
- Alternative Delivery Models (PAAS, IAAS)
- Mobile
- Ageing Population
- Consumerisation
- Social Graph
- Context Aware Computing
- Augmented Reality

Structured Problem Solving & Systems Thinking

- VPEC-T
- Hypothesis Led Problem Solving
- Structured Interviews
- Issue Tree Analysis
- MECE
- SWOT
- EA Principles
- Transition State Planning
- Negotiating techniques
- PEST(LE)
- Scenario Planning
- Cybernetics
- McKinsey 7S
- Five Why's
- Porter's 5 Forces
- Choice Architecture / Nudge Theory
- Decision Science
- Innovation
- Brainstorming
- Mind maps
- Technology Radars
- Trend Radars
- Incremental v's Disruptive Innovation

- Open Innovation
- TRIZ
- Six Thinking Hats
- Ideation tools and platforms
- Gamification of innovation
- Crowdsourcing
- Idea Marketplace
- Collaborative Problem Solving (also see platforms such as NineSigma and InnoCentive)

Agile Methods

- Scrum
- ScrumBan
- Extreme Programming (XP)
- Agile Modelling
- Kanban
- Lean
- Feature Driven Development
- Dynamic System Development Methodology (DSDM)
- Test Driven Development
- Behaviour Driven Development

Agile Management Tools & Techniques

- Index Cards
- Task Boards
- Mediawiki
- Pivotal Tracker
- Agile Zen
- Trello
- Rally
- Kanban Boards
- Rational Team Concert
- Rational ClearCase
- Atlassian Confluence, Jira, GreenHopper
- Primavera
- XPlanner
- ThoughtWorks Mingle
- ScrumVSTS
- ScrumWorks
- VersionOne
- Google Hangout
- Google Docs
- CA Agile Vision
- Skype
- Huddle

- JBehave
- Lync
- Basecamp

Agile Certifications

- ScrumAlliance – Certified Scrum Master / Practitioner
- Agile Project Management Group (APMG) – Foundation / Practitioner
- BCS – Foundation / Practitioner Certificate in Agile
- Project Management Institute – Agile Certified Practitioner
- Lean Kanban University
- Scaled Agile Framework
- ICAgile

Data Analytics & Data Visualisation

- Javascript Charting Libraries such as D4, Google Charts
- Big Data Analytics
- Predictive Analytics

Platforms / Services

- node.js
- MySQL
- MongoDB
- Redis
- Neo4j
- Riak
- Apache Cassandra
- RabbitMQ
- MS Azure
- OpenShift
- OpenStack
- OpenDaylight
- Amazon EC2
- Hadoop
- Joomla
- BOSH
- CloudFoundry
- Heroku

Software Development Languages

- Java
- Scala
- .NET
- JavaScript
- Python
- Ruby
- PHP
- Perl

- Flex
- Objective C
- C/C++
- COBOL (particularly modernisation options)
- 4GL
- Visual Basic
- HTML 5 / CSS v3

Code Management / Continuous Integration Tools

- GIT
- SVN
- Hudson / Jeeves
- Jenkins
- Jazz SCM
- SCCS
- CVS
- Maven
- Grunt

Software Development Environments

- Eclipse
- VisualStudio
- IntelliJ
- JDeveloper
- NetBeans
- Xcode Developer
- Komodo

Software Development Frameworks

- Spring
- Struts
- Tapestry
- Lift
- Play
- Rails
- Grails
- jQuery
- Ajax
- Catalyst
- Zend
- Sinatra
- JPA
- Hibernate
- JSF
- Apache CXF
- angular.js

Code Testing Tools

- JUnit
- Grinder
- Selenium
- HP / Mercury QTP
- HP / Mercury LoadRunner
- Cucumber
- FitNesse
- IBM Rational FT/Robot
- MS Test Studio
- JMeter

Traditional Enterprise Architecture and Governance Frameworks

- TOGAF v9
- Zachman
- MoDAF
- ITIL
- COBIT
- Archimate

Business Architecture

- Six Sigma
- LEAN
- BPM
- BPMN
- SFIA (Skills Framework for the Information Age)
- Change Management
- Stakeholder Engagement
- Capability Modelling
- Value Chain (Porter's)
- Value Streams
- Business Model Frameworks (e.g. four-box, canvas, strategy diamond

Security Architecture

- SABSA
- Business Impact Assessment (BIA)
- RMADS
- CESG Good Practice Guides (GPG)
- Failure Mode & Effects Analysis (FMEA)
- IS1 Risk Assessment
- Security Enforcing Functions / Countermeasures
- Penetration Testing (awareness)
- Security Information and Event Management (SIEM)
- Splunk (for SIEM) & Tripwire (configuration protection) are useful tools to be aware of Information Security Management System (ISMS)

Project Planning and Project Estimating Approaches

- Sizing by Analogy
- Function Point Counting
- Planning Poker
- Product Based Planning (Prince2)

Soft skills for Business

- Presentation skills
- Storyboarding
- Structured report writing
- Blogging
- Conference and panel speaking

Appendix C

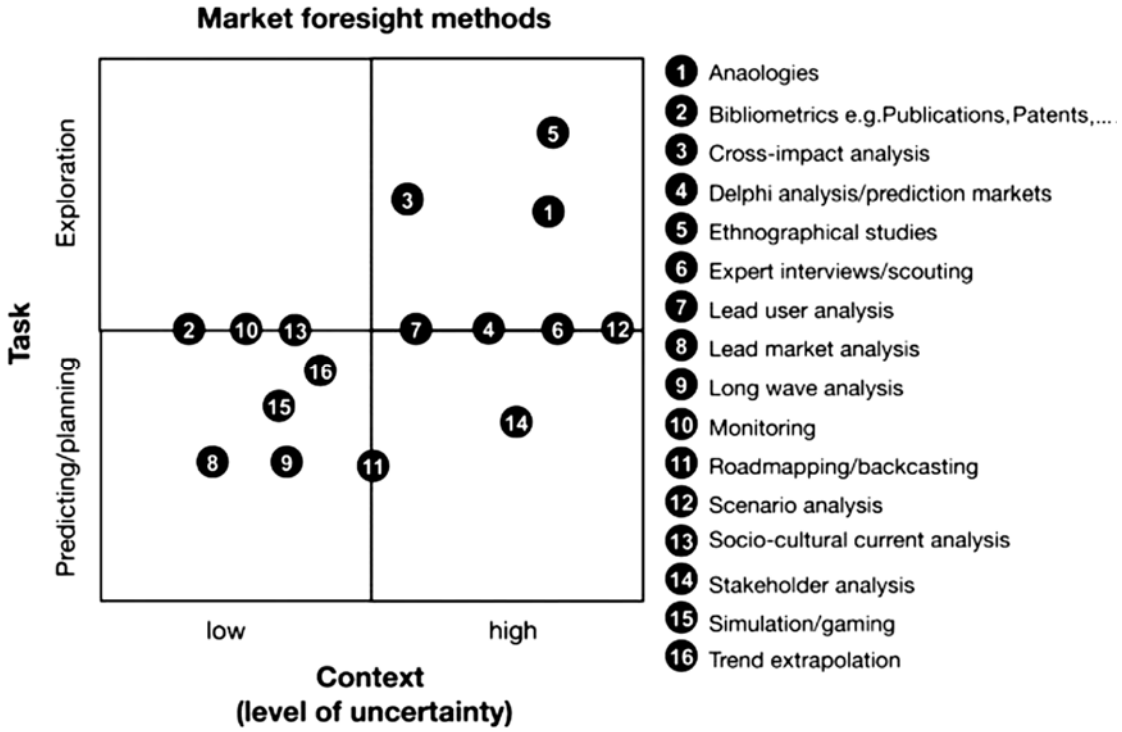

Figure C-0-1: Market foresight methods - source (Rohrbeck, 2014, p64)

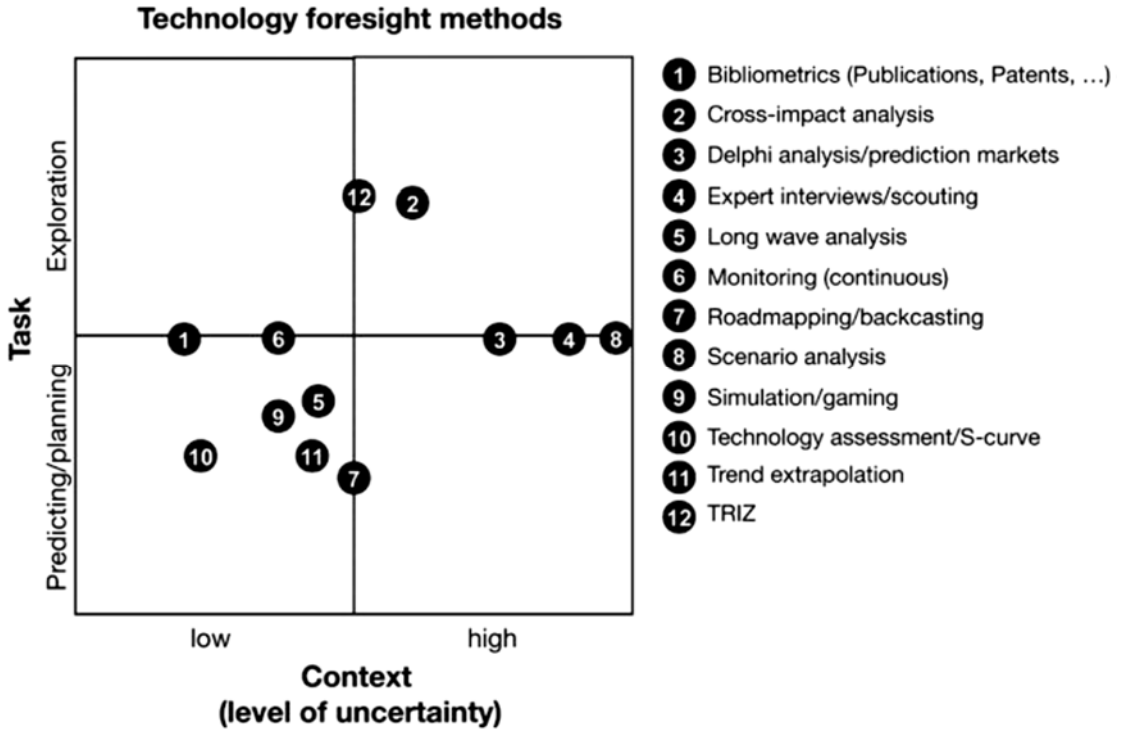

Figure C-0-2: Technology foresight methods - source (Rohrbeck, 2014, p65).

Appendix D

Modes of Scenario Development

Gausemeier et al. (1998) highlighted three modes of scenario development management including planning-oriented mode, responsive mode, and trend-setting mode. In planning-oriented mode, actions are based on the most likely path of scenarios, which is according to Rohrbeck (2014) more appropriate for large companies that are in pressing need to orchestrate their many overlapping units. As for the responsive mode, Gausemeier et al. (1998) clarifies that actions are planned in a way they approach the scenario with the greatest opportunity and avoid the scenario with the highest risk. Rohrbeck (2014) believes this mode fits companies that are not tolerant with risk. Finally, if the company is aimed at leading an innovation opportunity, Rohrbeck (2014) recommends the trend-setting mode to be followed, since as Gausemeier et al. (1998) described, actions in this mode are designed to get closer to the desired state, meaning that trend-setters should have the ability to control the overall situation.