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Proposing an integrative model and complementary mindset for idea evaluation

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Abstract

Innovation is increasingly claimed to be a major driver of growth and economic progress, and is seen as the basis for firm competitiveness. The traditional new product development (NPD) process prevalent in many large firms is more geared towards incremental innovation, such as improvements of existing products. However, to ensure long-term competitiveness, firms need radical innovation, which is often not aligned with these traditional NPD practices. In addition to this, large firms generally don't focus on the early phases of innovation prior to the NPD, i.e. the front end of innovation (FEI), in which early-stage ideas are managed, and which is critical for successful innovation, in particular for managing radical innovation ideas. With this in mind, the aim of this thesis is to contribute to the literature by proposing an integrative approach for managing ideas in the FEI, with an emphasis on leveraging uncertainty, which presumably enhances radical innovation in large firms. The thesis was conducted in the context of an innovation jam, i.e. a major brainstorming session using an online platform to suggest and revise ideas. This jam was conducted a few years back in a Swedish firm, and provided 137 ideas which are used for analysis and hypothetical testing to generate theory throughout this thesis. The research followed a qualitative research strategy, using inductive logic in its first phase, and abductive logic in its second.

The research led to several findings. In the first of the two phases, it was found that clustering of ideas was useful to provide an overview of the set of ideas, which can be seen as validating contemporary theory. However, it was also found that the ideas, being in an early stage, also contained significant uncertainty including lack of a clearer concept, and uncertainty related to further evaluation and implementation (e.g. if there would be demand for the solution suggested, if stakeholders would resist it, and so on). This seemed particularly prevalent for ideas with radical potential, and the literature reviewed so far did not seem to provide useful guidelines, mainly providing the view that the uncertainty ought to be 'linearly reduced' using criteria and gates, which did not seem suitable, for example since great ideas could be dismissed due to lack of data.

Hence, in the second phase, alternative approaches to manage uncertainty were explored. This led to the proposing of a model inspired by several different branches of literature, including but not limited to concepts such as lean startup, design thinking, real options reasoning and assumption-based planning. Over the course of the project, it was realized that these various concepts and approaches represented a distinctly different mindset than that of the mentioned linear view, including perceiving uncertainty as filled with opportunities. This finding was prolonged in providing an integrative mindset to accompany the model, proposing that if the logic of the firm is aligned and more suitable for managing the uncertainty of radical ideas, it would provide significant leverage for radical innovation.

Several of the proposed methods included managing assumptions, why assumptions of the ideas were explored more comprehensively. In doing so, the most significant finding was that assumptions can be distinguished into two categories, i.e. short-term and long-term. Short-term assumptions were seen to be more testable, often more related to the business case of an idea, and suitable for testing using iterative approaches such as lean startup. Long-term assumptions, on the other hand, were perceived to be less testable, but well suited for managing with assumption-based planning. Additionally, the researchers came to widen their view of the anchoring and adoption of radical ideas in a large firm, to include and emphasize the social context of the firm, which can both provide both pitfalls and support for this type of ideas. All hitherto mentioned dimensions were integrated in the proposed model. The contribution to theory of this thesis is hence seen as lying in the proposition of an integrative approach to managing uncertainty that distinguishes between short and long-term assumptions, and accounts for several dimensions of how to favor radical innovation.

Keywords: Idea Evaluation • Front End of Innovation • Fuzzy Front End • Radical Innovation • Managing Uncertainty • Integrative Thinking • Mindset • Innovation Jam

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1 Introduction

This section first outlines the theoretical and empirical context for the project. Thereafter, the purpose and research questions are provided, after which the delimitations of the project are outlined. Lastly, the disposition of the thesis is provided for overview.

1.1 Theoretical context and problem definition

Innovation and technological changes constitute the source of firms' competitive advantage and is a major driver of economic progress (Nelson & Winter, 2002). The competitive landscape as of today is vast in many industries. According to Blank (2013), during the last two decades, corporations have focused on increasing efficiency through cost reduction, but this is not sufficient anymore. As Langerak et al. (2004) state, competition has increased and is characterized by shorter product life cycles and more rapidly changing market environments. The key factor for firms to survive and grow is innovation (Tidd et al., 2001). Incremental innovation may be sufficient for large firms to maintain their competitiveness in the short term; however, to ensure long-term growth, radical innovation is required (Leifer et al., 2001; Day, 2007). This is further supported by Hamel (2002), who states that without radical innovation, decline is inevitable. However, Day (2007) states that between 1990 and 2014 the percentage of radical innovations in development portfolios has significantly dropped - almost halved.

With this in mind, it is worthwhile noting that all innovation can be derived from opportunities and ideas. Stated differently, it is through creative ideas firms can innovate, and they can thereby create competitive advantage (Hana, 2013). Although much has been written on the subject of idea generation, less has been written on idea evaluation and selection, in particular of ideas with radical potential. Screening procedures for evaluating early-stage ideas provided by the literature are often readily applicable to incremental ideas, for which data is available and a business case can be built. However, a more significant challenge arises with regards to selecting and managing ideas that lie outside the current frame of reference of a firm (Bessant et al., 2010). These more radical ideas are often also at a very early stage, constituting only fuzzy solutions to problems. Considering the costs of comprehensive exploration and evaluation of an early-stage idea, not all ideas can be extensively evaluated. This highlights the importance of having procedures for evaluating the ideas (Boeddrich, 2004), and the importance of having an approach that supports radical innovation. However, the FEI stream of literature is diverse in its suggestions but appeared to be constituted of mainly two camps. On the one hand, one school of thought has a linear view of idea evaluation, suggesting use of criteria and gates. On the other hand, a second school of thought suggests a more fluent, iterative view, or the view that there should be no pre-defined process for the FEI at all. There appeared to be a gap in that the first school may be too strict to favor radical ideas, whereas the second may provide few concrete guidelines for managing these ideas. The researchers hence hypothesized that an integrative, middle way approach may be more effective for managing the FEI to enhance radical innovation, and set out with the purpose to investigate this further, aiming to provide a contribution to the FEI stream of literature.

1.2 Empirical context

The thesis was initiated as part of an ongoing research project studying an initiative in a Swedish company to implement new procedures for generating ideas - with emphasis on radical ideas. The initiative has been focused on innovation jams, which is a major brainstorming session being conducted in an organization over a certain period of time, and includes the use of a communication platform to enable communication to give feedback and

advance the provided ideas, and provide new ones. The company at hand has conducted three jams of which one is looked deeper into in this thesis, which set the empirical context for the project, and will often be referred to as "the innovation jam", or "the jam". More specifically, it is the ideas that resulted from the jam that are looked deeper into in this thesis, rather than the jam itself. This thesis is not influenced by the specific company in any respect other than that the ideas provided originate from the company's jam session.

1.3 Purpose and Research Questions

The purpose of this thesis has changed over the course of the project. However, the overall purpose has been to make an academic contribution to the FEI stream of literature by proposing theory that may enhance radical innovation through more suitable management of ideas.

The final aim of this thesis is to fill a gap by proposing a more holistic, integrative model and approach to idea evaluation in a large firm, considering not only a process perspective, but also other dimensions such as the importance of the mindset of people involved and the social context of innovation. This is seen as filling a gap between the strictly linear models allowing for little flexibility, and the loosely defined and fluent models of the FEI which may provide few practical guidelines.

The project was guided by the main research question:

RQ) How can the idea evaluation process increase radical innovation in large firms?

However, the first phase of the project was relatively open, and started out with the following sub question to support the search:

> **SRQ1)** What type of ideas were generated by the jam, and how can they be evaluated?

Findings then drove the project in a new direction, reflected in the new sub question to guide phase 2 of the project:

> **SRQ2)** How can an idea evaluation process incorporate management of uncertainty to enhance radical innovation?

A more comprehensive description of this process is found in 3.2 *Research process*.

1.4 Delimitations

This thesis is concerned with the innovation process of large, technology based firms with an established NPD process. Concerning the scope of the innovation process, the focus is not on the idea generation process, in which ideas initially are created. Although this process will be very briefly described, it is not discussed comprehensively, and the project assumes sufficient inflow of ideas, including radical ideas, as a given. On the other end of the innovation process, the thesis does not focus on the later parts of development, for example developing and manufacturing a product once the concept is readily provided and the uncertainty is relatively low.

1.5 Disposition of thesis

This section provides an overview of the content of each chapter of the thesis.

Chapter 1. Introduction
The introduction-chapter outlines the context of the thesis as well as its purpose, research questions and delimitations.

Chapter 2. Previous Research
The previous research-chapter outlines theory obtained from the initial literature screening which serves to lay the groundwork for idea valuation. This chapter provides an overview of the two literature streams i.e. FEI and idea management. Lastly, the researchers provide their formerly reflections on the literature.

Chapter 3. Methodology
The methodology-chapter outlines the methods used for the purpose of the thesis, in order to provide answers to the research questions. This includes the research strategy, process and design, as well as data collection and data analysis. Lastly, the quality of the research is discussed with regards to reliability and validity.

Chapter 4. Phase 1 – Investigation of jam ideas
This chapter outlines phase 1 of the research project, in which preliminary screenings of ideas were done. The chapter includes three parts: A first screening with focus on categorizing ideas with regards to functionality, a second screening focusing on assumptions, and a third part with overall conclusions with regards to the previous literature review.

Chapter 5. Phase 2 - Investigation if uncertainty can enhance radical innovation
This chapter outlines phase 2 of the research project, in which the researchers explored literature to manage on the one hand the fuzzy, unspecified nature of many ideas, but also the uncertainty related to their further evaluation and implementation. The researchers realize the importance of including a mindset based on key principles in as a complement to an integrative model which aims to handle uncertainty, and the importance of the social context of innovation and idea adoption in large firms.

Chapter 6. Proposing an integrative model and complementary mindset for idea evaluation
This chapter outlines the mindset and the model built from discoveries from the project so far. First, the mindset is described, and related to the literature. Thereafter, the model, of which the mindset constitutes an integrative part, is first described with regards to its different constituents. After its description, it is motivated and discussed with regards to the literature.

Chapter 7. Discussion
This chapter outlines a discussion with regards to implementing the model and mindset within a large firm, discussing various barriers and problems need to be considered.

Chapter 8. Conclusion
This chapter outlines the conclusions from the project.

2 Previous Research

This chapter provides an overview of previous research within what 'innovation' is, the FEI and idea management. Last in the chapter, the researchers' reflections on this theory are provided.

2.1 Innovation

The purpose of this section is to provide a description of important aspects of innovation, including what it is, and relevant types of innovation and different schools of thought. For the researchers themselves, understanding the notion of innovation was central for the subsequent project. For a reader, this introduction serves as a basis for comprehension of the subsequent theory.

As stated in the introduction, innovation is a major driver of both economic progress and firm competitiveness. However, the term 'innovation', is used differently by different scholars (Garcia & Calantone, 2002) but per definition includes a degree of novelty (OECD innovation strategy, 2015). In one school of thought, innovation is viewed as a noun or object, whereas in a second school of thought it is seen as a process or activity. Hence, it is important to distinguish between the noun and the process of innovation (Garcia & Calantone, 2002), and the process view is further outlined in the next section, i.e. *The Front End of Innovation*-section. This process view includes focus on the process of bringing the idea all the way to the market. Regarding the view of an innovation as a noun, there is a general agreement among scholars that an innovation is an idea what *has* already been commercialized (Garcia & Calantone, 2002), and this view can hence be seen as ex post commercialization.

Regarding the 'function' of an innovation, scholars distinguish between several types. These include for example product, process, position and paradigm innovation (Gassmann & Schweitzer, 2014), as well as architectural and modular innovation (Garcia & Calantone, 2002). With regards to degree of novelty, there is a plethora of definitions of different types of innovations, including dichotomies such as radical versus incremental innovation and discontinuous versus continuous (Garcia & Calantone, 2002). As novelty is highly related to uncertainty and challenges (cf. Garcia & Calantone, 2002; O'Connor, 2008), these dichotomies mark important distinctions for firms attempting to evaluate ideas for potential innovations, why they will hereby be outlined.

To begin with, incremental innovations provide improvements of existing products or production systems within existing markets (Garcia and Calantone, 2001; Reid & de Brentani, 2004), and build on the firm's existing resources and capabilities (Reid & de Brentani, 2004). According to Bessant et al. (2010), a business case can be built for an incremental innovation, cost benefits can be advocated and fit with the existing portfolio and strategy can be demonstrated. Radical innovation, on the other hand, distinguishes itself from incremental innovation by the higher extent to which a change in existing strategies and structures is required for the firm according to Cooper (1988). Additionally, radical innovations transform existing technologies and markets (Garcia & Calantone, 2001), and can create completely new markets or change the way of competition of an entire industry (Leifer et al., 2001).

O'Connor (2008) states that discontinuous innovations include high levels of uncertainty, and require organizations to move into unchartered territory, in which relying on past experience or current knowledge assets or present customers who are loyal is *not* an advantage. Utterback (1996: p. 200) provides another definition of discontinuous innovation which points towards the similarities to radical innovation: "*By discontinuous change or radical innovation, I mean change that sweeps away much of a firm's existing investment in technical skills and knowledge, designs, production technique, plant and equipment*". Another statement further

highlighting the similarity to radical innovation is provided by Gioia (1986), stating that discontinuous innovations present challenges since it does not fit the existing frame of reference of the company.

Although some scholars (e.g. Garcia & Calantone, 2002), distinguish between radical and discontinuous innovation, many scholars use the term interchangeably, according to Garcia and Calantone (2002). For the purpose of this thesis, the researchers will follow the view of Veryzer (1998) in that discontinuous innovation is used interchangeably with radical innovation (i.e. as referring to the same phenomenon). This is since distinguishing between these two terms is believed to increase confusion more than it would add value, and since there is already now disagreements with regards to the distinctions. Stated differently, distinguishing between radical or discontinuous innovations on the one hand, and incremental innovation (or the less frequently used 'continuous' innovation) on the other hand, is seen as sufficient for the purpose of marking the dichotomy between innovations that include a high degree of uncertainty and challenges, and innovations that don't.

Regarding the previously mentioned novelty-aspect of innovation, scholars distinguish between new to the firm, new to the market and new to the industry (OECD innovation strategy, 2015). Given the perspective of the firm, which has to evaluate ideas in its front end of innovation, the 'new to the firm'-perspective will be used with regards to the purpose of this thesis, as it best describes the uncertainty and challenges experiences by idea evaluators.

Additionally, the term 'radical idea' will be used for ideas with potential to become commercialized as a radical innovation. These ideas should be seen as having the properties corresponding to an early stage of a radical innovation, i.e. being associated with challenges and a high degree of uncertainty. Conversely, 'incremental idea' will be used for ideas that have potential to become incremental innovations, lies within the current frame of reference and is characterized by relatively low uncertainty.

2.2 The Front End of Innovation

There are many definitions of the Front End of Innovation (FEI); however these definitions share the view that the FEI is the earliest stage of the innovation process (cf. Cooper, 1988; Koen et al., 2001; Nobelius & Trygg, 2002; Reid & de Brentani, 2004; Khurana & Rosenthal, 1998) and is followed by the new product development (NPD) process (Cooper, 1988; Koen et al., 2001). More specifically, Cooper (1998) and Koen et al. (2001) define the FEI as the activities related to an idea prior to initiating the NPD process while Nobelius and Trygg (2002) define it as all activities and time spent before proper resources are committed. Further, Bessant et al. (2010) describe the FEI as an exploratory stage characterized by information seeking and idea iteration.

Adequate management of the FEI is essential for successful NPD (cf. Cooper, 1988; Koen et al., 2001; Reid & de Brentani, 2004). Further, Cooper (1998) concludes that firms focusing on the FEI have a higher degree of success for their new products. Additionally, the FEI does not only impact the NPD but is also a tool for creating competitive advantage (Reid & de Brentani, 2004) and is a key for strategic renewal (Poskela & Martinsuo, 2011). Also, Cooper and Kleinschmidt (1995) argue that the process of how the FEI is conducted is the most important success factor within the FEI and the process is also emphasized by many scholars, why it will be outlined in the next section.

2.2.1 Front End Processes

The original stage-gate model proposed by Cooper (1988) is widely used in the NPD by firms (Cooper, 1994). According to Verganti (1999), the model is one of the more controlled approaches to NPD and most suitable when the environment is known and uncertainty is

modest. The model consists of seven stages; however, only the first three are related to the FEI, and are described as the pre-development stages (Cooper 1998). These three stages are idea generation, preliminary assessment and concept definition. The first stage involves the generation of new ideas and a first screening of the ideas in order to avoid that inferior ideas enter later stages. The second stage consists of a preliminary assessment of the feasibility of the idea with regards to technology and market. The third and final stage of the pre-development is also the final gate before the firm really commits to the idea. This stage is therefore dedicated to define the concept and test it in order to assess the value and benefits in the eye of the customer. The model is illustrated in Figure 2.1.
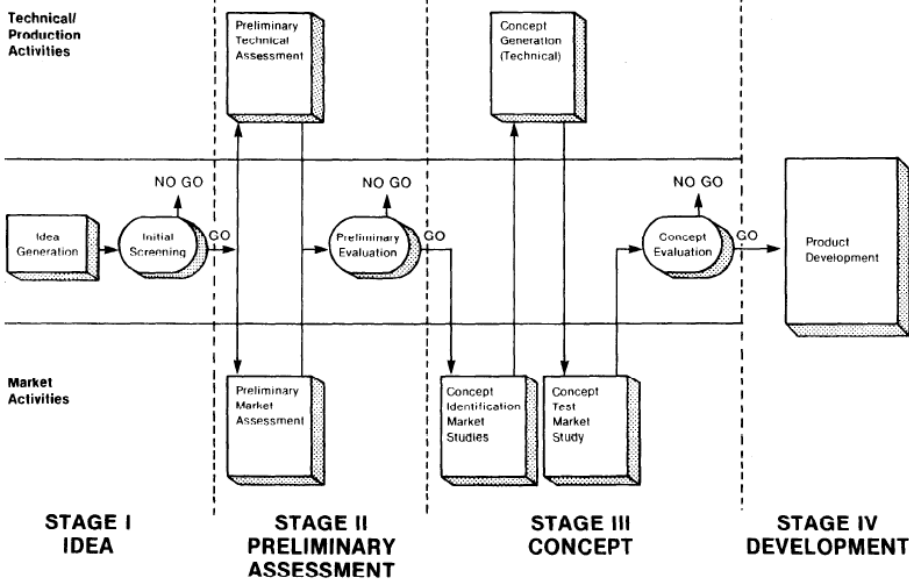
Figure 2.1 The original stage-gate model as proposed by Cooper (1988)

Khurana and Rosenthal (1998) also created a three phase linear model. The authors arguably take a more holistic approach than Cooper (1988) by stressing the importance of strategy and portfolio management in product development. The first phase of Khurana and Rosenthal's model, called pre-phase zero, is where the portfolio and strategy set the foundation that help push the projects forward in the early phases. The first stage is also where ideas are generated through market and technology analysis while stage two and three are similar to the corresponding ones in the stage-gate model. The model is illustrated in Figure 2.2.
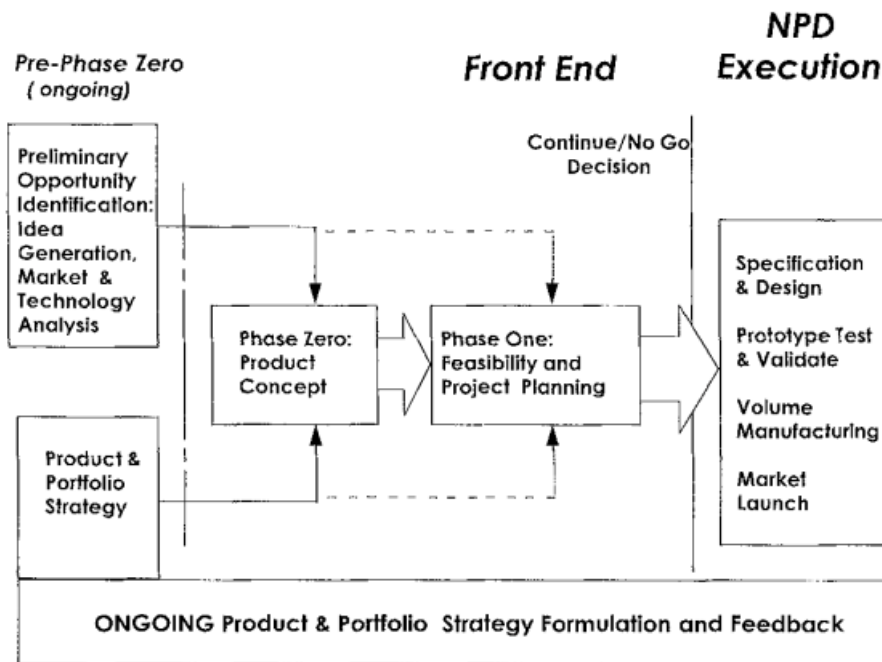
Figure 2.2 Front end model provided by Khurana and Rosenthal (1998)

Since the introduction of the stage-gate, there has been a trend towards a more iterative approach in product development (Cooper, 2014). While the sequential models are transparent and easy to follow (Khurana & Rosenthal, 1998), Gassmann and Schweitzer (2014) argue that there is a risk that linear models do not correspond with reality and that they do not consider creative exchange and feedback loops within the organization. Further, Ayers et al. (1997) argue that flexibility and keeping many options open are essential for a successful innovation management, which is also in line with Cooper and Kleinschmidt's (2007) finding that top companies innovate using a flexible and scalable process.

Koen et al. (2001) studied eight large firms and created a generalized framework to describe their FEI processes. A finding that differs from Cooper's view (1988) and Khurana and Rosenthal (1998), but that is in line with the trend towards more iteration-oriented approaches, is that Koen et al. (2001) view the FEI as an iterative process that can either be initiated by either an idea genesis or an opportunity identification. The whole FEI process is viewed as iterative - meaning that the five elements interact, and ideas may flow, circulate and iterate between and among these elements, which is illustrated in Figure 2.3, referred to as the New Concept Development (NCD) by the authors. The authors also stress the importance of leadership and culture as the engine of all FEI efforts.
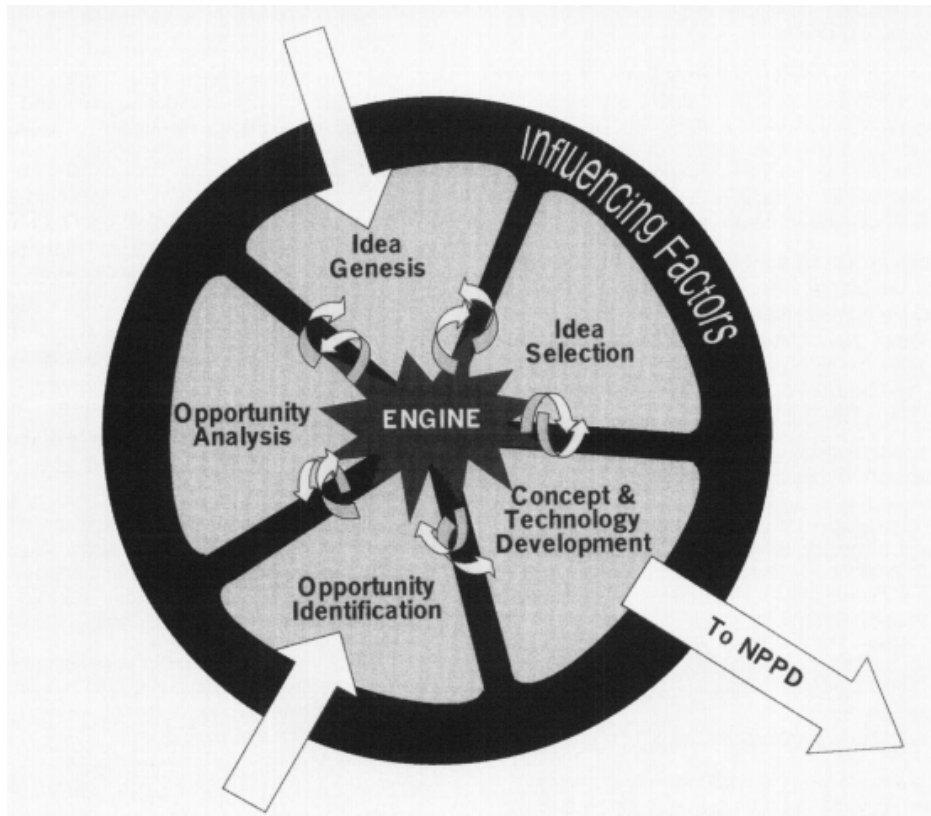
Figure 2.3 The New Concept Development (NCD) model by Koen et al. (2001)

The logic of traditional development processes such as the stage gate is to reduce uncertainty as early as possible and hence increase efficiency (Wheelwright and Clark, 1992). However, Benner and Tushman (2002) concluded that focusing too much on exploitation harms exploration, i.e. focusing too much on incremental gains can imply that this is done at the cost of radical innovation (O'Reilly & Tushman, 2004). This has also been verified by many scholars such as Leifer et al. (2001) and McDermott and O'Connor (2002). McDermott and O'Connor however point out that these uncertainty-reducing processes may be good for pre-defined products, but not for more radical innovations. Rice et al. (1998) propose different methods for managing radical and incremental innovations and state that traditional processes are inappropriate for radical innovation, due to high levels of uncertainty, which is also supported by Reid and de Brentani (2004), Bessant et al. (2010) and Cooper (2014), the latter who proposes revised versions of the stage-gate for different type of projects, see Figure 2.4. Bessant et al. (2010) elaborate on the overall challenge of managing radical innovation, which creates tensions in the organization, and state that it is important for Firms to make an explicit decision to engage in this type of innovation. The decision then allows for selection of appropriate methods for the firm. More specifically, the decision on whether to manage radical or incremental ideas impact the screening, evaluation and selection process (Rice et al., 1998; Bessant et al., 2010).
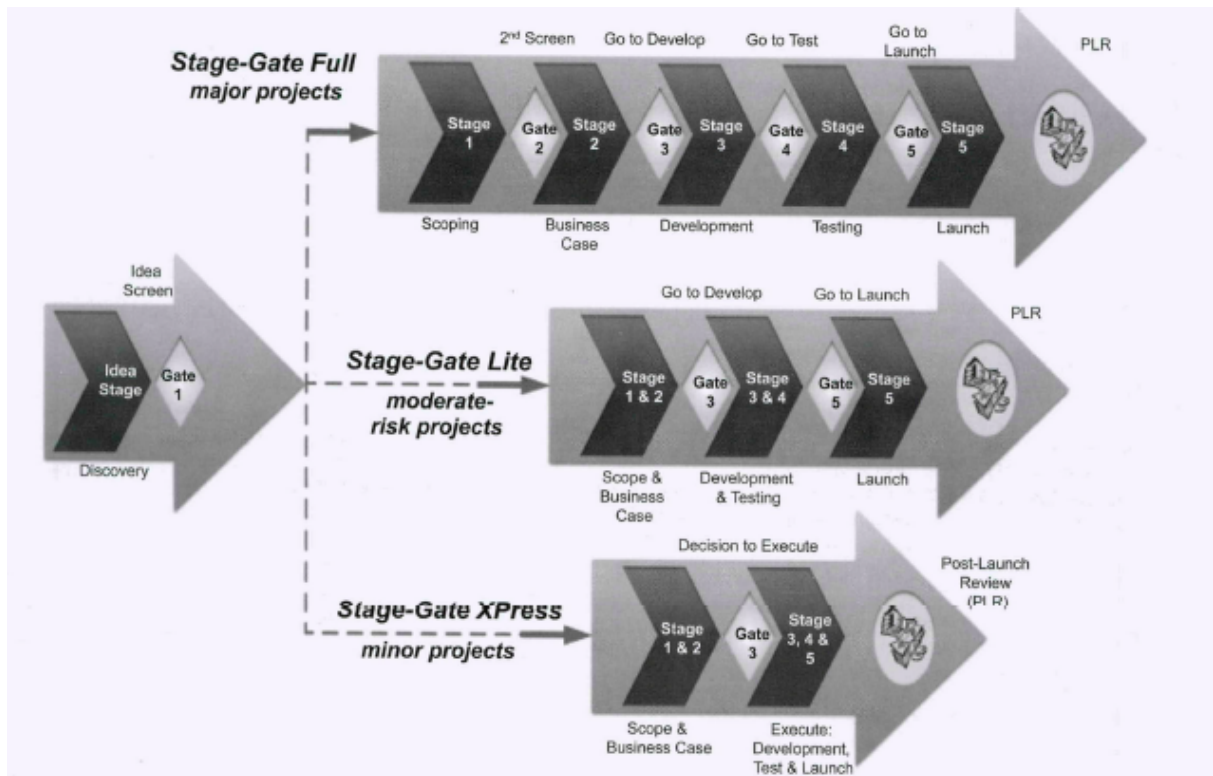
Figure 2.4 Revised stage gate model provided by Cooper (2014)

As discussed above, several scholars advocate structures that differentiate between radical and incremental innovation by employing different evaluation criteria and processes which is further verified by Sandström and Björk (2010). However, these authors state that such a structure may lead to excessive bureaucratization, and Frishammar and Florén (2010) note that it is important to have an adequate degree of formalization in the FEI. Further, Van Aken (2004) stresses that structuring the FEI is a delicate matter - while too much formalization hurts the ability to innovate, too little formalization is also inadequate. Further regarding this trade-off, Gaubinger and Rabl (2015) state that it is essential to find the right balance between flexibility and structure as well as control and creativity. Herstatt and Verworn (2001) can be seen as elaborating on the matter by stressing that the right balance between flexibility and structure depends on the situation.

Nobelius and Trygg (2001) takes an even more skeptical stance towards the traditional generic process models and state that trying to make a generalizable one-size-fits-all model for the FEI is pointless, since different projects in the FEI require different set ups. Accordingly, the authors recommend tailoring the FEI process to the type of project at hand and stress the importance of managerial flexibility. Backman et al. (2007) support this view and argue that the FEI should be seen as ad-hoc and then be coupled to the firm's existing processes. Also, Gassmann and Schweitzer (2014) state that more than one approach is needed in order to satisfy the need for creativity in the FEI-process. However, the authors also state that flexible models are often hard to implement due to their abstract nature and not presenting any concrete recommendations for employees. On the other hand, as stated previously, while sequential models may be easy to follow they may not reflect reality very well.

The researchers' main take-aways from front end processes

- Many firms use stage-gate processes to organize new product development
  - Several models propose that uncertainty in ideas should be reduced linearly

- However, there is a trend in firms towards more iterative processes
- FEI processes require a balance between structure and flexibility, as well as between control and creativity
- Different types of ideas require different processes, according to several scholars
- Flexible processes may be hard to follow in practice while linear processes may not mirror reality

2.3 Idea Management

This section first presents idea generation briefly. Thereafter, idea management systems are described, after which the criteria-oriented approach to idea evaluation is brought forward.

2.3.1 Idea generation

Innovations originate from ideas and ideas may originate from internal or external sources to the firm (Gaubinger & Rabl, 2015). However, only a few among provided ideas become successful innovations, usually less than ten percent of ideas can be taken further (Gaubinger and Rabl, 2015). Such a view implies that there is a need for a large number of ideas (Björk et al., 2014), but also point towards the importance of idea management (cf. Gaubinger and Rabl, 2015). Collaborative idea management systems are often used in order to utilize ideas to a larger extent (Nilsson et al., 2002). Gaubinger and Rabl (2015) state that while most external and internal sources of ideas often have minor contribution by themselves, the ideas gathered may be coupled with creativity techniques, and so their contribution may be greatly enhanced. As a result, Gaubinger and Rabl (2015) advocate that ideas should be gathered from all sources and then through selection be incorporated into a creative process, and thereby increase the performance of the FEI.

2.3.2 Idea management systems

According to Graham and Bachmann (2004), ideation is the process of generating creative ideas and developing them further. Idea management systems are the structures that support this phase (Sandström & Björk, 2010). An example of an old idea management system is suggestion boxes (Ekvall, 1971), but over time the digital technology has enabled more efficient handling of ideas (Sandström & Björk, 2010). Sandström and Björk also state that some researchers argue that idea management systems may be used as a way of structuring the FEI. Gorski and Heinekamp (2002) state that idea management systems may promote innovation by collaborative exchange of ideas and interaction, as well as the possibility to refine and reuse ideas. While there is no consensus in the field of idea management, many scholars argue that idea management systems mainly produce incremental innovations and seldom produce radical ideas (Fairbank and Williams, 2002; Carrier, 1998). However, other scholars argue that the idea management systems of today are useful to come up with radical new products (Wheelwright and Clark, 1992; Cooper, 2001).

According to Björk et al. (2014), there is an overall shift of focus from favoring individual creative brilliance to focus more on collective innovation. At the same time, web technology, social media and other communication possibilities create opportunities for more effective ideation, and their capacity exceeds that of traditional idea management systems. These authors further state that the most creative ideas are produced from teams consisting of two to three people.

Boeddrich (2004) suggests a wide range of requirements for an idea management system to be structured. Although the authors also suggest company-specific requirements, the general requirements are (in the wordings of the author, p. 276):

- Existence of strategic guidelines for innovations

- Installation of a broad idea-collection point
- Systematic idea clustering
- Cross-functionality of the decision-making gatekeepers in the idea management process
- Predefined and transparent criteria for selecting and implementing ideas
- Funnel function for the selection process or implementation of stage gates
- System simplicity – making it easy to manage

One way to generate and find ideas in the early stage is the innovation jam approach. As described in the introduction, the innovation jam method is essentially a major brainstorming session being conducted in an organization over a certain period of time, and includes the use of a communication platform to enable communication flows, including exchange of ideas and feedback. The platform can range from using a basic online forum, to having advanced algorithms for categorizing ideas in different ways. An acknowledged example is IBM's 3-day innovation jam of 2006 described by Bjelland and Wood (2008), which according to IBM's press release was 'the largest online brainstorming session ever'.

2.3.3 Idea selection and selection criteria

For successful management of the FEI, firms need mechanisms for separating strong ideas from inferior ones, which includes screening both in terms of business analysis and feasibility, according to Frishammar and Florén (2010). Bessant et al. (2010) state that without a process for selection, firms would be gambling. This is in line with the view of Cooper (2001), stating that firms without a process for selection run a high risk of failure. Urban and Hauser (1993) conclude that firms and managers realize the need to focus efforts on those ideas that have the highest potential and terminate the others as early as possible, which prevent firms from investing resources into poor concepts. However, to be able to do so requires sufficient knowledge of both the product and the environment (Bessant et al. 2010). As a result, many approaches have been developed in order to support the selection process such as decision rules and criteria (Bessant et al., 2010).

Cooper (1988) suggests that the first screening criteria should be based on factors such as strategic alignment, feasibility, project size, profitability, the advantage of the product and its fit with corporate resources. Rochford (1991) however suggests a less formal approach with two questions regarding whether the idea is doable and whether it is consistent with firm objectives. Further, criteria should according to Rochford be formulated with consideration to limitations such as time, cost and availability of information, but also with regard to the objectives of the screening, and to general success factors of the FEI. The number of ideas being evaluated also impact whether ideas should be screened one by one or in groups, but also the depth of evaluation.

Both Cooper (1988) and Rochford (1991) advocate a deeper second screening that looks more into technological and market feasibility. The second screening also lay the groundwork for deciding what ideas that should be committed to. The technological screening should investigate whether the product can be developed, what solutions that are required in order to develop it, whether the product can be manufactured and at what costs (Cooper, 1988). The market screening should investigate market size, the growth of the market, competition, market segments, product acceptance and how the product can be marketed (Cooper, 1988). With regards to the market screening, Carbonell-Foulquié et al. (2003) stress the importance of understanding the customer needs when building concepts and propose a wide range of marketing research methods such as preference tests, test markets, trial sells and so on. This is supported by Langerak et al. (2004) who point out the need to create value for the customer and therefore advocate extensive market research during the FEI. Rochford (1991) propose similar criteria to that of Cooper (1988), but also add that gut feeling may be used as an additional method in the second screening. Also, rejected ideas may be saved for

later use either when the firm has enough resources or the market or technology has changed in favor of the idea (Rochford, 1991).

There are many scholars emphasizing use of various criteria in idea evaluation. Although scholars such as Cooper (1988), Rochford (1991), Carbonell-Foulquié (2013), Koen et al. (2001), and Poskela and Martinsuo (2009) differ some in their views, there is significant overlap. Standard criteria include novelty, customer utility, financial assessment, strategic fit and how readily the idea can be realized into a product (Björk, 2015). Alänge and Lundqvist (2014) also stress the importance of looking at patentability and freedom to operate in order to evaluate the potential of the idea. Gatignon et al. (2002) also provide a bit of a different perspective by stating that innovations also should be assessed according to whether they require competence acquisition and whether they imply competence destruction.

There is a wide range of evaluation and selection methods, both qualitative and quantitative such as lists of questions (Rochford, 1991), structured scoring models (Henriksen and Traynor, 1999) and mathematical models (Loch et al., 2001). Both Rochford (1991) and Cooper (1988) advocate more qualitative methods and keeping it simple in the early stages while using more quantitative methods in later stages once more information is available. For example, Cooper (1988) states that simple checklists and scoring models are best suited for the purpose due to their ease-of-use in the first screening. However, there is a discrepancy regarding the degree of formality that should be favored with regards to the evaluation. Koen et al. (2002) for example advocate formal evaluation in order to provide fair evaluation while Henriksen and Traynor (1999) advocate informal and open-ended questions in order to enable creativity. It should be noted however that Koen et al. (2002) argue that the evaluation in the FEI should be less strict than in later stages of the project.

Martinsuo and Poskela (2011) showed the complexity of the relationship between evaluation criteria and performance, and that firms must pursue many and often conflicting interests such as competitiveness, future business and strategic alignment. Their study points towards the issue of sub-optimization if one criterion is prioritized over others, and that the FEI require holistic evaluation systems.

The researchers' main takeaways from idea management

- Sufficient generation of new ideas, as well as effective management of these ideas is required for successful innovation
- There are several widely used criteria for evaluating ideas, such as novelty, customer utility, financial and technical feasibility and strategic fit

2.4 The researchers' reflections on the theory

As observed, there are different schools of thought with regards to early innovative processes and how to manage early-stage ideas. One school of thought stresses the use of criteria, and suggests a linear approach to managing ideas and reducing their uncertainty. Another, presumably more modern school of thought sees the FEI as more fluent and suggests an iterative view. There appears to be a trade-off between on the one hand formalization and control, and on the other hand creativity and flexibility. The researchers also see potential challenges in that the linear, criteria-oriented models may risk disregarding ideas with radical potential. For example, the school of thought associated with the stage gate model provided by Cooper (1988) provides such a view, in which ideas are to flow through a process and be subject to criteria-oriented gates while uncertainty is being reduced. However, for more radical ideas, criteria presupposes that data is readily available which it is often not, and the process does not emphasize creatively exploring different concepts for the idea. Iterative models, on the other hand, may provide more flexibility but not such a concrete outline for how to manage ideas.

3 Methodology

This section first outlines the research strategy used. Thereafter, the research process is described, providing an overview of the phases of the project. After this, the research design goes more into the case based, interactive design used. After this, facts about the data collection are provided, after which the data analysis is outlined. Lastly, the quality of the conducted research is discussed.

3.1 Research strategy

The research strategy is according to Bryman and Bell (2007) the general orientation of the study. This thesis was initiated as part of an ongoing research project studying an initiative in a Swedish company to implement new procedures for generating ideas - with emphasis on radical ideas. The ideas had already been gathered within this research project and the overall scope of the project was set. The company will not be named due to confidentiality, but is a technology-based multinational company with heavy R&D. The initiative has been focused on innovation jams, which is a major brainstorming session being conducted in an organization over a certain period of time, and includes the use of a communication platform to enable communication to give feedback and advance the provided ideas, and provide new ones. The company at hand has conducted three jams of which one is looked deeper into in this thesis, which set the empirical context for the project. More specifically, it is not the innovation jam itself but rather, it is the actual ideas that resulted from the jam that are looked deeper into in this thesis. This thesis is not influenced by the specific company in any respect other than that the ideas provided originate from the company's jam session. Initially, the researchers wanted to study the outcome of the jam and more specifically what type of ideas that the jam resulted in i.e. radical or incremental. This however provided some methodological challenges. There are few studies regarding specifically how to evaluate the outcome of an idea generation and seemingly even fewer studies where the authors themselves have evaluated the ideas (cf. Poetz & Schreier, 2012; Gatignon et al., 2002). Once the ideas were studied, the researchers realized, due to the fact that the ideas were at an immature level, that the process of evaluating the ideas was more relevant than the actual outcome of the jam. This realization then guided the next choices of methodology and theory. This thesis contributes to the research project by proposing a model and mindset that may be used to manage uncertainty in other ways than proposed by the traditional FEI literature by leveraging uncertainty in order to support radical innovation.

This report is qualitative by nature. Quantitative research is more oriented around numbers (Punch, 2005), and generally uses more of a deductive approach where hypotheses or theories are tested (Easterby-Smith et al., 2012). But the analysis of ideas will be made using data which describes qualitative characteristics of the ideas rather than strict 'quantities', 'amounts' or for example 'degree' of 'innovativeness'. Qualitative research more often uses an inductive approach, where theories are instead generated with regards to the data (Bryman & Bell, 2007), and can hence be seen as more of a 'bottom-up' approach to theory creation. Aside from deductive and inductive approaches to inferring, there is also the approach of abduction (Yu, 1994). The logic of abduction is concerned with exploring the data, finding patterns and suggesting a plausible hypothesis (Yu, 1994). Stated differently, abductive logic can be seen as representing the logic of what 'might be' (Dunne & Martin, 2006), rather than what 'must be' (deductive logic) or what 'has been' (inductive logic).

The thesis is divided into two phases. The first phase refers to the first literature review described in previous research and the initial hypothesis that followed, which was that the ideas should be analyzed and categorized in order to understand the outcome of the jam. This first phase is therefore characterized by an inductive logic. In the second phase, a deeper literature review was conducted iteratively using an abductive logic and hypothetical

testing on ideas from the jam, to build theory regarding how the process of evaluating and exploring the ideas could be conducted.

3.2 Research process

As described, the research project consisted of three main phases. Figure 3.1 provides an overview of the research process, in which dotted lines indicate boundaries of each phase.

Phase 1 Phase 2

Phase 1	Phase 2	
Initial Literature Review	Literature review(s) and expert interview(s) to answer new research question	Discussion
Data collection: Obtained the 140 ideas	Hypothetical testing on ideas	Conclusion
Exploring the ideas	Building of model	
New research question	Proposed model	

Compared method to literature / *Iteration*
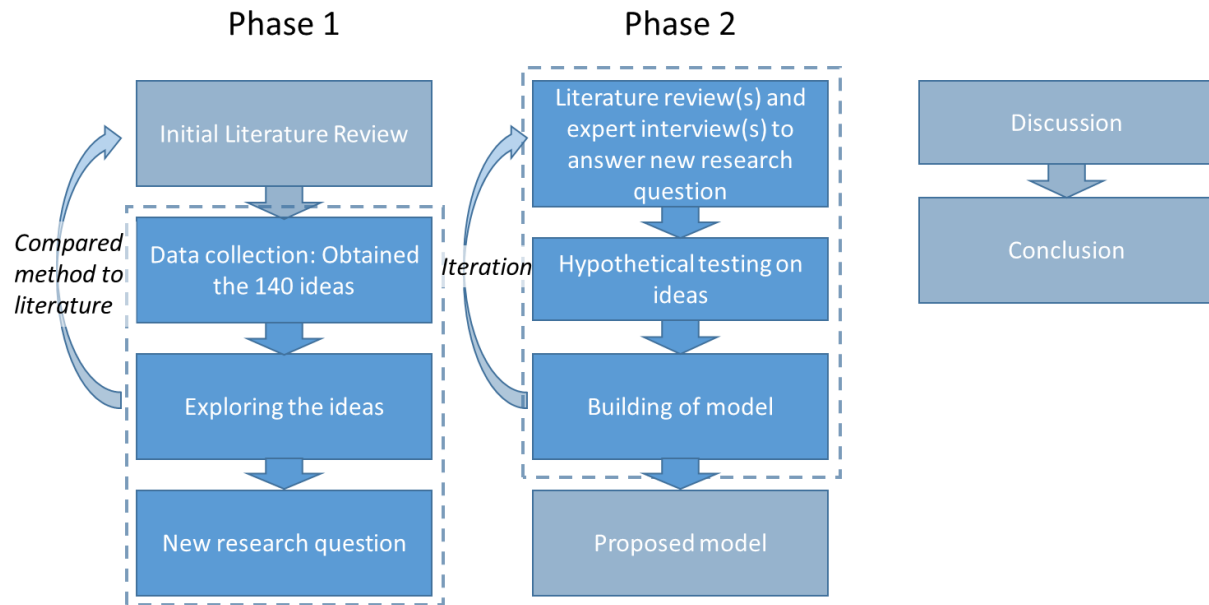
Figure 3.1 Overview of the research process

First, the researchers started out with an initial literature review regarding idea evaluation to provide an overview of previous research. This included two main streams of literature, i.e. idea management and the front end of innovation. As the researchers wanted to investigate ways to contribute to more radical innovation, the overarching research question that was stated was:

RQ) How can the idea evaluation process increase radical innovation in large firms?

However, the first phase of the project was to be a relatively open, exploratory process. Hence, the following sub question was stated to guide the initial search:

SRQ1) What type of ideas were generated by the jam, and how can they be evaluated?

The researchers hence made attempts at exploring and evaluating the ideas, and then compared their practical experience of reality to that of the literature. Although answers could be provided to what type of ideas the jam generated, their evaluation remained a challenge and can hence be seen as unanswered in phase 1. This led to the following research question to guide the search further, which also led the project to its second phase:

SRQ2) How can an idea evaluation process incorporate management of uncertainty to enhance radical innovation?

In this second phase, focus shifted from the ideas themselves, to the idea evaluation process and how to better manage uncertainty. The researchers sought out new literature and interviewed experts to provide preliminary answers to this research question. Proposed

answers were hypothetically tested on subsets of the set of ideas, which also led to the suggestion of a model, which was to provide a proposed answer to the research question. This was done iteratively, with the aim to find favorable elements to include. Over time, the researchers' view of idea evaluation and how to manage uncertainty was widened from focusing only on the process, to emphasizing more of a mindset towards uncertainty, building on identified principles, which was then seen as an integrative part of the model proposed. In addition to this, focus also shifted to include and emphasize the social context of innovation in a large firm.

3.3 Research design

The research design is the structure which is to lead the conduction of the selected method, as well as analysis of the data (Bryman & Bell, 2007). The project started out with an offer to partake in the analysis of the innovation jam ideas. Therefore, the choice of research design was given by the research project the master thesis was part of. Hence, a case study research design was chosen, due to the benefits of a case based approach that will be described below, to analyze the ideas from the innovation jam in order to explore what conclusions could be drawn from the case. Although the initial research question was relatively open, there were also intentions to investigate the opportunity to propose a model based on the analysis of the ideas, and this can be seen as an aim to generate novel theory. As Eisenhardt (1989) states, theory building from cases is likely to generate theory which is novel, testable and empirically valid. The author also claims that case study research, in contrast to what some believe, is *less* prone to researcher bias or stuck in preconceived notions than hypothesis testing research, since anomalies are observed, and their patterns analyzed, which leads to new theory. Hence, according to Eisenhardt, this provides a valuable complement to 'normal science' (cf. Kuhn, 2012). Aside from a case study research design being natural in the context, these statements further point toward suitable and favorable traits of this choice of design.

Maxwell (2012) emphasizes the interactive characteristic of qualitative research design, stating that sequential, flowchart-like models are not a good fit for qualitative research. Instead, the author proposes an interactive model, where the research questions are the 'heart' or 'hub', which informs and is sensitive to the goals, conceptual framework, methods and validity, as shown in Figure 3.2.
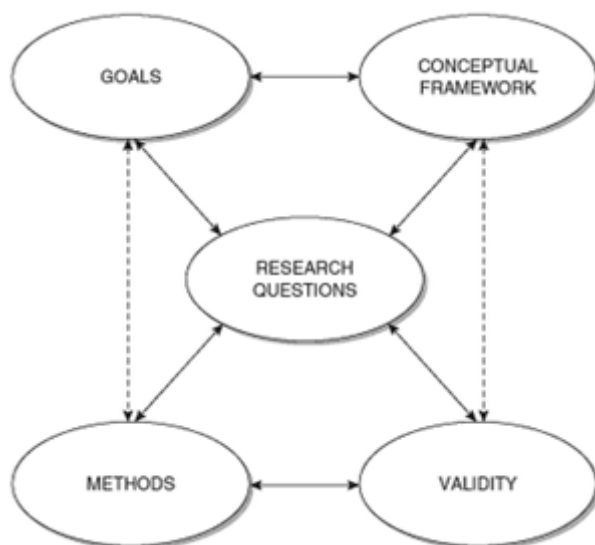
Figure 3.2 An interactive model of Research Design (Maxwell, 2012)

This is well in line with how this research project was carried out, since for example both the research questions, the goals and the methods were updated during the course of the project. In the first phase, iteration was primarily used with regards to evaluating the ideas using different approaches and evaluating the results. In the second phase, iteration was used more broadly, including going back and forth between literature, expert interviews and the ideas.

3.4 Data collection

The project included three sources for data: Ideas from the innovation jam, literature reviews and expert interviews. Table 3.1 and 3.2 provide an overview, and are separated into phase 1 and 2 of the project.

Phase 1

Subject/Object	Data type	Collection method	Source(s)
Innovation jam ideas	Primary data	Web transfer	Swedish firm (confidential)
Literature: Innovation	Secondary data	Online search - Keywords: Innovation terminology, innovation typology, radical innovation, incremental innovation, discontinuous innovation, product innovation, process innovation, paradigm innovation, business model innovation	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database
Literature: The front end of innovation	Secondary data	Online search - Keywords: The front end of innovation, fuzzy front end, stage gate,	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database
Literature: Idea management	Secondary data	Online search - Keywords: Idea evaluation, idea generation, idea screening, +"of large amount/set of ideas", idea screening criteria, idea evaluation criteria, idea selection criteria, idea management, idea management systems, innovation jam, analyzing innovation jams	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database

Table 3.1 Data collection during phase 1

Phase 2

Subject	Data type	Collection method	Source(s)
Managing assumptions	Literature: Secondary data	Online search - Keywords: Assumption categories, assumption surfacing, assumption screening, assumption types, assumption testing, assumption identification, [above using "presupposition" instead of assumption], implicit assumptions, surfacing implicit assumptions, assumption surfacing	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database

		techniques, assumption surfacing methods	
Approaches to manage uncertainty (including assumptions)	Literature: Secondary data	Online search - Keywords: Managing uncertainty, decision-making under uncertainty, intuition, expert intuition, intuition and cognitive biases, real options, real options reasoning, project portfolio management, iterative approaches to handle uncertainty, discovery-driven planning, customer development, lean startup methodology, design thinking, assumption-based planning	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database
Creativity techniques	Literature: Secondary data	Online search - Keywords: Creativity techniques, creativity methods, idea exploration, Concept-knowledge theory	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database
Idea evaluation, front end of innovation and selection of ideas	Interview: Primary data	Semi-structured interview	Mats Lundqvist, Professor, Technology Management and Economics, Chalmers University of Technology
Idea evaluation and idea management systems	Interview: Primary data	Semi-structured interview	Jennie Björk, Ph.D., Integrated Product Development, Royal Institute of Technology
Other important factors in the FEI	Secondary data	Online search - keywords: Champions + front end of innovation, valley of death, Front end of innovation/fuzzy front end + [success factors, key success factors, management support, champions, culture, organizational structure, selection strategies, strategy]	Google Scholar, Chalmers Library Database, Gothenburg University library database, Royal institute of technology library database

Table 3.2 Data collection during phase 2

Ideas provided by an innovation jam

As previously described, this thesis looks at the ideas from a specific jam. The theme was set to mobility and connectivity both internally and externally with the purpose to increase the efficiency of information sharing within the entire company and its value chain. The idea providers were all internal and the result of the jam was 137 unsorted ideas that vary in detail and maturity as they had not been iterated or developed any further than the initial idea. A typical idea implicitly assumes a problem and presents a solution such as an application aimed for customers where you enter the required input data and the application then helps you to select the appropriate product.

Expert Interviews

Expert interviews were conducted in order to get a deeper knowledge from experts within the field of idea evaluation, with the main purpose of guiding the direction of the literature review and triangulate theory, but also to fill gaps in the theoretical framework. In practice, the expert interviews mainly functioned as a way of providing additional guidelines, and verifying the soundness of direction during phase 2, for example while creating the proposed model. Since the more comprehensive literature study during phase 2 combined with hypothetical testing on ideas provided answers to the research question, statements from the expert

interviews are not used extensively. They are therefore not presented separately, and are referenced in the same way as sources from the literature. The experts were chosen by recommendation of the supervisor and the researchers reviewed publications of the expert prior to the interview in order to obtain prior knowledge.

A semi-structured interview is what is considered most appropriate since it will give the interviewee freedom to answer openly but at the same time keep focus in the researcher's area of interest (Bryman & Bell, 2011). Easterby-Smith (2012) states that poor data which is hard to interpret might be gathered if the interviewee is confused about what the researcher actually is asking for. Therefore, guiding topics are of importance since the issue that will be researched upon is complex and there is a need of guiding the respondent, while at the same time leaving enough room to get an in-depth answer. Also, especially because of the complexity and fuzziness of the researched issue one could easily get lost in an unstructured interview, which is why a semi-structured interview is more appropriate. Further, a structured interview is not deemed appropriate as it would not get any in-depth answers which are the main reason for having the interviews in the first place.

3.5 Data Analysis

Eisenhardt (1989) states that data analysis is one of the most essential parts when it comes to producing theory from case studies. However, Bryman and Bell (2011) states that analyzing qualitative data may be difficult since qualitative research often include large volumes of data and no established processes for analysis. In the first phase of this study, the analysis may be viewed as being conducted in accordance with the previous research - seeing as the previous research was prior knowledge of the researchers. The second phase on the other hand was conducted in parallel with the data collection in an iterative manner, which according to both Bryman and Bell (2011) and Eisenhardt (1989) is a normal feature of qualitative research because it allows the researchers to adjust the collection of data and investigate specific areas of interest further. In relation to this, the interviews in the second phase were used to confirm that areas of interest were relevant for further analysis. Also, the findings were always discussed between the researchers in order to establish their relevance.

In phase 1, the aim of the analysis was to understand the empirical data i.e. the ideas and the jam itself using the knowledge from the initial literature review, and this phase aims to answer SRQ1. The analysis included several steps and is described in detail in chapter 4. First, the ideas were read several times in order to get an understanding of the specific ideas and the jam overall, then ideas were categorized in order make the total set of ideas more easy to manage, by using category labels that were based on how the researchers intuitively would describe the ideas most defining attribute. Also, to understand the ideas on a deeper level, the researchers started analyzing critical assumptions that would impact the success of the idea. The researchers then tried to evaluate the ideas but found that this provided challenges since the many ideas were unclear and unspecified (i.e. lacking a clearer concept) or contained uncertainty with regards to further evaluation and implementation (such as if sufficient demand for the solution would be present, if the technology could be developed at all and if so, if the company had the competence and resources to develop the idea). Therefore, it was not possible to evaluate them in this phase. Hence, phase 2 was initiated, instead shifting focus to the more general process of evaluation and managing ideas.

In phase two, the aim of the analysis was to test different frameworks, methods and mindsets to managing uncertainty in order to establish whether they were useful for evaluating and taking the ideas further in the process. These are described in detail in chapter 5. This phase also serves to build the foundation for the discussion and conclusion and to answer SRQ2 as

well as the overall RQ. As a result of the many different literature streams, this analysis was divided into several steps that will be described below.

The researchers first explored the ideas from phase one further using the creativity technique C-K in order to bridge the unspecifiedness and create more concrete concepts that could be more readily evaluated. The C-K theory was used by establishing concepts based on the given ideas and then generating new knowledge through iterations between concept and knowledge i.e. using the researchers' imagination of what possible related concepts and then converting these concepts into current knowledge. Regarding the knowledge-space, while no comprehensive investigations into knowledge of whether a concept would be 'doable' was within the scope, the researchers used their current knowledge as a base, and identified the assumptions related to the lack of knowledge (e.g. 'the assumption that technology X can be developed within a year'). Through this iterative process, the researchers could provide a more ready-made concept with radical potential, which could also be more comprehensively assessed with regards to assumptions using various frameworks (to be described), and be further analyzed for example using assumption-based planning (to be described). A more full description of the C-K theory is also provided in appendix A.

The iterative approaches lean startup, customer discovery and discovery driven-planning were analyzed using the conceptualized ideas to fill in the starting points of the methods such as a business model canvas (described in detail in chapter 5.1) to see if the conceptualized ideas (after C-K) could be applied in these methods and if the methods themselves provided any additional insights, which they did by highlighting ways to manage more short-term assumptions. The iterative approaches were not tested further in practice than creating business model canvases because these methods have been proven to work for implementing various types of ideas and were therefore not deemed to be in need of further testing in building the theory, although they will need to be tested in future research.

Design Thinking does not explicitly promote working with assumptions but also suggests an iterative approach. The main contribution of this approach is seen by the researchers as lying in its emphasis on mindset, and using alternative logics. The researchers here analyzed the methods presumed fit for dealing with uncertainty and in boosting innovation, including radical innovation. This analysis was purely conceptual seeing as the method already has significant support for use in the FEI (cf. Gassmann and Schweitzer, 2014), and since the aspects of the approach that would be applicable in the scope of the thesis (primarily 'ideation') can be seen as closely related to creativity techniques, one of which was instead applied in the project. (Aspects such as building empathy for a need of users described in one of the jam ideas did not seem applicable or appropriate, since these users were not readily available, and this process would be too time consuming.) Design Thinking was both seen as well suited for managing uncertainty and for boosting innovation due to emphasizing empathy, deep understanding of user needs and use of creativity and alternative logic to go beyond trade-offs (more on this reasoning is provided in chapter 5.1.2). Applying the method in reality would imply several activities such as building empathy for users or customers and investigating their needs more deeply, which was not an option for the provided ideas and seen as out of scope.

Assumption based planning was explored using the conceptualized ideas (after C-K) by applying the full framework of the approach, i.e. identifying assumptions that may impact the 'plan' of the idea, and then signposts, shaping actions and hedging actions for these assumptions. Over time, it was realized that it was the more long-term assumptions that were relevant for this approach, (and short-term assumptions were more suited for the iterative approaches such as lean startup) which provided an important insight. Additionally, aside from realizing the value of also managing these long-term assumptions, this analysis resulted

in the categorization of long-term assumptions into assumptions about constants, events and trends.

In the process of learning about the iterative approaches and assumption-based planning, it was realized that a more systematic way of surfacing assumptions was desirable. Aside from the business model canvas, the researchers investigated other surfacing frameworks, and this was done by applying them on ideas from the jam, and comparing them to each other and to the assumptions surfaced through general brainstorming.

Real options theory was analyzed by testing the framework on the conceptualized ideas (i.e., after having applied C-K). Real options are quantitative, but the researchers were more interested in the mindset behind real options and therefore analyzed real options as a qualitative mindset as is also proposed by McGrath (1999). The qualitative reasoning is however seen as reflecting quantitative values, and more quantitative calculations can be done when data is available – the difference is conceptualized benefit versus concrete numbers of the same benefit. This analysis resulted in insights regarding the value of flexibility and openness.

The different methods and theories were then analyzed to see how well they match, for example real options reasoning was compared with assumption based planning to see whether they complemented each other, and were aligned for use in the model and with a similar mindset. Seeing as assumption based planning includes long-term assumptions while the iterative approaches were found to include short-term assumptions, these two were also compared with regards to the mentioned aspects, and were seen to favorably complement each other and align with the proposed mindset.

3.6 Quality of research

Regarding the quality of qualitative research there are different views. Some scholars state that validity and reliability are good quality measures for qualitative research (Saunders et al., 2012; Roberts et al., 2006) while other scholars such as Eisenhardt (1989) propose different methods of evaluating qualitative research. Eisenhardt proposes looking at *parsimony*, *testability* and *logical coherence*. Regarding parsimony, Eisenhardt states that in building theory from case study research, given often rich data, this can often lead to an inclination to include everything, and therefore result in a lack of simplicity of overall perspective. Over the course of the project, the researchers have attempted to both have a sense of perspective, and to distill what is important. This is hopefully observed on the one hand in the emphasis on mindset in phase 2 as a result of this attempt, but also in providing overall principles and cornerstones of this mindset to provide simplicity and overview, rather than long sweeping arguments. Additionally, the researchers have prioritized what aspects to include in the final model, and hence made pragmatic considerations not to fall in the mentioned trap of 'including everything'. Going on to testability and logical coherence, the researchers have attempted to provide transparent arguments and explicitly state assumptions made. For example, this is shown in that trade-offs in the design of the proposed model is stated explicitly for the reader to consider. The following sections will also discuss aspects related to how transparency and testability is met.

3.6.1 Reliability

Reliability refers to whether the operations of the study can be repeated yielding the same results. Yin (2013) states that documentation of utilized procedures increases reliability, and Easterby-Smith et al. (2012) emphasizes the importance of transparency in procedures, ideas and explanations. In this thesis, the transparency is strengthened by the inclusion of the researchers' line of reasoning throughout the process. Hence, the reader can follow the thought process and conclusions drawn by the researchers. However, the ideas from the

innovation jam cannot be provided due to confidentiality, but the outcome of the jam is deemed by the researchers to be quite generic problem-solution ideas related to the given topic. This is seen as increasing reliability, as similar conclusions could be drawn from another jam, assuming it provides relatively 'fuzzy', early-stage ideas. Additionally, the later parts of the proposed model, after the ideas have been more readily conceptualized, can be seen as less related to the initial data of the jam, as ideas were creatively explored. The impression from this is that the proposed model would be applicable to other sets of ideas as well, and this can be readily tested by practitioners by applying the proposed model and its included framework. The process of searching literature is also outlined in order to increase replicability.

3.6.2 Validity

Validity is the single most important criterion for research according to Bryman and Bell (2011) and refers to whether the conclusions drawn in a study are legitimate and whether the suggested indicator of a concept readily measures that concept. Triangulation may be used to improve validity and reliability according to Bryman and Bell (2011). The study has been triangulated by looking at many different sources of information in the literature review, and also complementing these with expert interviews. Although the jam had a pre-selected theme, it can also be said that 137 ideas can provide for some degree of triangulation in itself, providing unique data points from several sources, i.e. several different employees.

The external validity regards to what extent the result of the study is generalizable (Bryman & Bell, 2011). Since this study mainly concerned a single 'case', i.e. that of the innovation jam described, this may be seen as reducing the strength of analytical generalizability, which is the type of generalizability suggested for case studies by Yin (2013). However, the purpose of this thesis is concerned with generating new theory, implying that this theory would need to be validated. Related to this, as previously discussed, the ideas in the data seem to represent generic challenges such as 'uncertainty', and the model suggested aims to be applicable for large firms in general. The conclusion from this is that while inferences about the generalizability of propositions and the proposed model could not be drawn in any strong sense in the thesis, they are *potentially* generalizable to various large-firm applications and this can be worthwhile testing in future research.

4 Phase 1 - Investigation of jam ideas

This section will provide the findings from phase 1 of the project, in which the ideas from the innovation jam were analyzed inductively. This was done in order to further the search of an answer to the overall research question (RQ), but more specifically also to answer the sub question used to guide the search in this phase, i.e.:

SRQ1) What type of ideas were generated by the jam, and how can they be evaluated?

However, as will be seen, the latter part of the research question will mainly be left unanswered, for further investigation in phase 2.

4.1 Initial screening and understanding phase

The researchers began with screening the 137 ideas in order to obtain an initial understanding and overview. This was experienced as somewhat overwhelming initially, but over time patterns were observed in the ideas - some were geared to solve similar types of problems. The researchers hence began to illustrate observed patterns using ad hoc labels for ideas which focused on their purpose and function. Over time, these categories were standardized, and around 30 useful, distinct categories were obtained. The top ten most occurring are described below:

- Efficiency: ideas with the purpose of creating higher efficiency
- Information: ideas that make "generic" information of some sort more readily available
- Standardization: to denote ideas aiming to standardize a process
- Data on demand: ideas where some sort of input is given in order to produce relevant data
- Branding: ideas where company branding is a major driver
- Appification: an idea that makes a currently available function available as an app
- Customer education: idea that aims to educate the customer regarding something related to the company
- Communication: ideas aiming to enhance communication internally or externally
- Customer acquisition: ideas focused on making the process of acquiring customers easier as well as just acquiring customers in general
- Customer retention: ideas focused on retaining current customers, for example keeping them satisfied through add-ons to existing products

This categorization was very helpful in reviewing the ideas, since having ready-made, mental boxes for the ideas greatly reduced the experienced 'fuzziness' while screening. The categories were *not* mutually exclusive. On the contrary, several categories had significant correlation, such as standardization and efficiency. However, since for example efficiency can be reached through other ways than standardization, eliminating overlap did not seem neither possible nor desirable at this point. This 'clustering' of ideas also provided much better overview of the complete set of ideas. For example, categories of ideas could be visualized in diagrams, to illustrate the outcome of the jam as themes. See Figure 4.1 for visual illustration of the top ten occurring functional categories from the jam.

Top ten occurence of function labels

●	Efficiency
●	Information
●	Standardization
●	Data on demand
●	Branding
●	Appification
●	Customer education
●	Communication
●	Customer acquisition
●	Customer retention
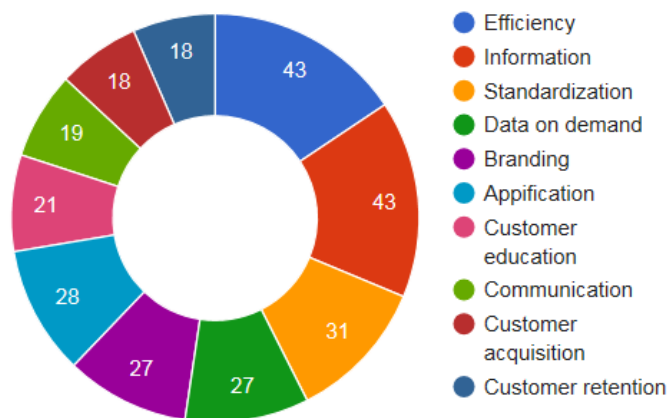
Figure 4.1 Top ten functional labels ascribed for ideas in the jam

Additionally, clustering by using the labels allowed for observing significant overlap between many ideas. In some cases, there were more or less direct duplicates present. Many ideas were at a very early, immature stage and did not seem to have been developed significantly throughout the jam, which sometimes made them hard to understand. However, the fact that they were early stage ideas might have increased the potential for consolidation - the researchers identified many ideas with potential to consolidate. This can be related to the IBM innovation jam described by Bjelland and Wood (2008), in which an algorithm was used to cluster the ideas throughout the jam to enable overview. The ideas were also carefully gone through, refined and sorted by a team of managers and professionals and were also plucked and combined with related concepts which resulted in that new visions emerged. The plucking and combining was greatly enabled due to the previously mentioned clustering, according to Bjelland and Wood (2008). As this jam was seen as overall successful, this can also point towards the advantage of clustering and categorization for overview.

The researchers' main takeaways from the initial screening

- Clustering greatly enables overview of a large set of ideas and makes the process of identifying duplicates, overlaps and synergies between ideas much easier

4.2 Second screening - Diving into assumptions

As many ideas were observed to be at a very early stage of development, this made it challenging to draw conclusions with regards to their potential. More incremental ideas, for example representing add-ons to existing products could however have been evaluated by the company seeing that incremental ideas would be within the firm's field of competence. However, for very unspecified and/or radical ideas, traditional "criteria" seemed more or less inapplicable due to uncertainty. It was observed that many ideas contained *two types* of uncertainty:

(1) Uncertainty with regards to the idea itself not being specified, e.g. including more exactly what the intention was and more specifically how this was intended to be achieved

(2) Uncertainty related to further evaluation and implementation - i.e., even though an idea was somewhat specified, criteria such as "Will this be profitable?", "Is it technically feasible?" would yield "maybe" or "it depends"-type of answers due to various uncertainties, for example lack of available data related to more radical ideas.

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Regarding the first type of observed uncertainty, an example of a generic, very vague idea may clarify the challenges:

"*The idea is to use system X to provide the possibility Y*"

Such a description does not specify for example:

- *Why* is this possibility important, i.e. what is the 'possibility to Y' assumed to lead to?
- To *who* is this possibility targeted?
- *How* would system X be used to create the presumed 'possibility' - there are no specifications?

If there are no apparent answers, evaluators may be left to guesswork or making rough assumptions to evaluate the idea in its current state. Although some of these issues may be solved by contacting the idea provider, it may be the case that the provider currently only has a vague idea. Although proposing required criteria for specification of proposed ideas can help reduce fuzziness of provided ideas, it also highlights an important risk, i.e. the risk of prohibiting entrance of ideas that may need to be initiated in a more fuzzy state, which may be the case for several types of radical ideas. For example, if a significant but previously unrecognized *problem* in the organization is highlighted during a jam, the highlighting or discussion regarding a problem would not meet a suggested requirement of suggesting *how* it is to be solved, but may lead to other jam participants with complementary knowledge coming up with creative solutions. This hence highlights a potential trade-off between reducing fuzziness of provided ideas, and remaining open to a wide range of ideas.

Primarily with the second type of uncertainty in mind, i.e. uncertainty relating to further evaluation and actual implementation (given that the idea is sufficiently specified), the researchers began analyzing assumptions related to the ideas as a way to explore them further, and with the hypothesis that this would provide insights about managing this type of uncertainty. Hence, critical assumptions for a successful implementation were identified, which was done in a brainstorming-manner considering various implicit assumptions with regards to development and implementation of the idea. Over time, categories of assumptions were standardized, as the working hypothesis was that there would be synergies to obtain in managing "clusters" or categories of assumptions together. This resulted in around 20 labels for the different identified types of assumptions. The top ten occurring assumptions in the jam are described below; see Figure 4.2 for a visual illustration:

- App-format assumption: assumes that an app is a suitable format for the purpose, when that seems questionable
- Value-add assumption: assumes that the idea would add value, when it may be questionable while accounting for various direct or indirect costs
- Input assumption: assumes that input parameters will be readily available when this is questionable
- Software-technology assumption: Assumes that sufficient software technology can be readily provided to implement the idea
- Data-structure assumption: assumes that the data required for the idea could be structured or integrated, for example when the idea included combinations of different types of data streams
- Hardware-technology assumption: Assumes that sufficient hardware technology can be readily provided to implement the idea
- Output-relevance assumption: assumes that the intended user would deem the output of the idea relevant when this is questionable

- Touch-input assumption: assumes that the touch input format is sufficient for the purpose of the idea
- Admin assumption: assumes that the administration of the idea can be handled efficiently, cheap or is even possible
- Tech-fun assumption: assumes that technology-related ideas are perceived by the "receiver" of the idea with the enthusiasm of the idea provider, for example regarding technical "games" for marketing purposes

Top ten occurence of assumptions
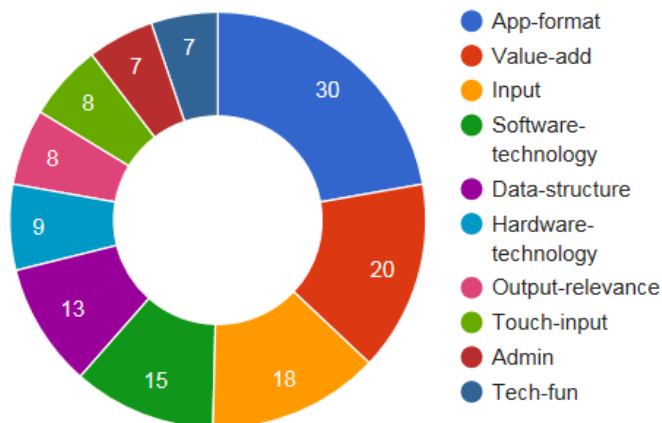
Figure 4.2 Top ten assumption labels ascribed for ideas in the jam

This in turn provided the opportunity to illustrate the vulnerability of the overall idea portfolio towards a specific type among the identified assumptions, and clearly shows the impact of the set direction of the jam. While having ready-made categories of assumptions helped to identify patterns and similar potential issues with ideas more easily, the researchers also suspected that this type of standardization can lead to omitting many less generic assumptions that may be more challenging to surface. Further, the researchers realized the potential value of identifying assumptions and that it can be valuable in identifying critical aspects of an idea. However, with very early stage ideas, identifying assumptions was not deemed to yield anything of particular value to go forward with since the vagueness of the ideas was seen as a more significant problem at this early stage, which also prohibited identification of assumptions that would arise with more specifications. It was therefore hypothesized that identification of assumptions is more appropriate and may provide value at a later stage, once the ideas are more conceptualized.

The researchers' main takeaways from the second screening

- Identification of implicit assumptions using brainstorming can surface potential vulnerabilities and deal-breakers of ideas
- However, it is not possible to identify all assumptions related to implementation of an early-stage, fuzzy idea without further conceptualization
- Identification of assumptions may not be appropriate as the very first step of idea evaluation, and there may be other relevant approaches to identification than brainstorming

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4.3 Comparison with literature and reflections

In summary, it was observed that clustering with particular regard to labels for characteristics of ideas was very helpful in reducing the fuzziness of the set of ideas as a whole, as it provided significantly enhanced overview. This is also in line with the view of Boeddrich (2004), stating that 'systematic idea clustering' is one of the requirements for having a structured idea-management system in the FEI. However, clustering did not alleviate the fuzziness of many of the individual ideas themselves, which were observed to include uncertainty both with regards to lack of specification, but also with regards to further evaluation and implementation. Although many assumptions related to the latter uncertainty could be identified, this did not itself solve the problem regarding how to evaluate the ideas. Furthermore, it was observed that unspecified ideas forced the researchers to make assumptions *about* the idea i.e. how to interpret it, in order to identify assumptions *included in* the idea. Going on, it appeared as though identifying assumptions this early on did not yield any specific additional insight on the actual potential of the ideas, but rather insights about possible deal-breakers.

Another issue when evaluating the ideas was that the researchers did not possess the knowledge of the company's capabilities and hence could not determine whether the ideas would match the NPD-process or not. Also, due to limited technological knowledge, it was sometimes hard to determine if the ideas had radical potential or not. The researchers believe, however, that a better preliminary assessment would be possible with more knowledge of company capabilities and through interaction with the idea provider who could then develop or explain his/her thoughts. As stated though, some ideas appeared to be incremental in nature, being add-ons or incremental improvements of existing products or services, and these could likely have been evaluated further by the company. The main challenge, which presumably would have more or less remained despite more of the company's capabilities available, was observed with regards to the ideas seeming more radical in nature.

Going back to the literature, the criteria-oriented school of thought provided little help with regards to the challenges with ideas including high uncertainty, as it was observed that criteria-oriented questions would yield ambiguous "maybe" or "it depends"-type of answers. The school of thought related to the stage gate process seemed to assume more mature ideas that could be subject to various criteria. Additionally, it seemed to assume a linear approach to reducing uncertainty in ideas, which is *not* very focused on learning and exploration, including a mindset in which uncertainty is viewed as something inherently negative rather than providing opportunities. This did not seem like a suitable process for ideas with radical potential, which may need to be 'explored' rather than 'assessed'.

The more fluent, iterative view of the FEI appeared to be more in resemblance to the process used by the researchers, who iteratively built categories for the ideas as a sense-making activity. However, Koen et al. (2001) mention with regards to the NCD model that creativity techniques can be used to explore ideas, but do not specify how, to what type of ideas or what the process should look like. Stated differently, this view did not provide any concrete directions with regards to how the uncertainty of these ideas should be managed in order to go forward and to be able to select which ideas had high potential. Still, inspired by scholars such as Nobelius and Trygg (2001) and Bessant et al. (2010), the researchers believed that ideas with high uncertainty do not belong in the linear uncertainty reducing environment. As a result of this, the researchers came to the conclusion that a wider perspective beyond the criteria-oriented, linear perspective is required while going further with these uncertain ideas. This also led to a major shift in the focus of the research, from the focus *on the ideas,* to the *process of evaluating and selecting uncertain ideas*. As observed, ideas were uncertain in that they (1) lacked specification and a more ready-made concept (e.g. the idea is intended to do more exactly what, in what way, to provide what benefit to whom?), and (2) uncertainty

related to further evaluation and implementation (e.g. presence of demand, presence of sufficient competence, stakeholder reactions and so on).

Hence, part of the first research question was left unanswered as many ideas could not be readily evaluated given their high uncertainty. The new sub-research question was derived from this observation and the realization that uncertainty may be handled in other ways than those hitherto suggested. Hence, the second sub question was stated:

SRQ2) How can an idea evaluation process incorporate management of uncertainty to enhance radical innovation?

5 Phase 2 - Investigating if uncertainty can enhance radical innovation

During this chapter, the following research question was used to provide guidelines for the search:

RQ2) How can an idea evaluation process incorporate management of uncertainty to enhance radical innovation?

As a result of the insights from phase 1, the project entered its second phase focused on how to manage uncertainties related to ideas, and doing so while simultaneously supporting radical innovation. This phase can hence be seen as more closely related to the overall research question (RQ) guiding the project.

Uncertainty is an important factor within the FEI and idea evaluation as the literature in the previous research chapter shows. For example without uncertainty one could relatively easily choose the most favorable ideas. However, most literature within the FEI view uncertainty as something that should and can be reduced linearly, and seems to assume that uncertainty is inherently negative. As described in phase 1, there are also iterative suggestions of how to manage the FEI, but these provide few guidelines with regards to more specifically how to manage and select ideas, and assumes that after initial uncertainty can be reduced, the idea can be implemented in the NPD process (cf. Koen et al., 2001), which may create significant challenges (as will be further discussed). Uncertainty may on the other hand also provide opportunities seeing as uncertainty inherently implies that something has not yet been set in stone. The researchers therefore decided to investigate alternative ways to handle uncertainty in order to better capture the potential positive aspects of it.

Importantly, this phase followed a very iterative process in accordance with the research design. It was realized over time that the '*mindset*' towards uncertainty of idea evaluators, providers, management and other involved can play a central role in managing this uncertainty in idea evaluation and bridging the 'valley of death', referring to challenges in the gap between an idea and its market launch (cf. Koen et al. 2002; Meyer et al., 2011). Although a mindset can be used by single practitioners, sharing a mindset at the company level enables communicating with a similar alternative logic and attitude.

Although there are different definitions of the term mindset, the following definitions provided by The American Heritage® Stedman's Medical Dictionary (2015) seems particularly illustrative for the purpose:

(1) A fixed mental attitude or disposition that predetermines a person's responses to and interpretations of situations
(2) An inclination or a habit

This points towards that that (1) having a certain mental attitude impacts how different situations are interpreted, and the behavior of the subject, and (2) that this mental attitude is not predetermined - is changeable, just like habits are. Hence, if one has, or builds, the attitude and belief that there are substantial opportunities contained in uncertainty, this can significantly impact whether those opportunities are *perceived*, which makes it possible to leverage them, which in turn is of direct relevance for the research question. With this in mind, several aspects (including methods and principles) of the proposed mindset can be seen as increasing the perception of possibilities to use uncertainty to the firm's advantage, to increase competitiveness by managing it strategically and to boost radical innovation.

More specifically, the traditional mindset of more linear uncertainty reduction was not deemed to fit with more radical innovation, while mindsets within other fields such as entrepreneurship and real options reasoning could provide insights for managing this type of innovation within the FEI. As a result, the researchers combined aspects of mindsets from different fields to create a more holistic and innovation-friendly mindset. To accompany this mindset, the researchers also created a model for managing the FEI. Therefore, the chapter has been outlined both with the purpose of creating a proposed 'model' for organizing idea evaluation, but also with the aim of mapping a presumed mindset that complements this model by promoting radical innovation, and references to 'the mindset' will hence be used to emphasize this.

Having introduced the theme of this chapter, the content more specifically includes the most relevant literature found in order to provide answers to the research question. As mentioned, the phase was iterative in nature, and having considered different structures for the chapter, the researchers came to the conclusion that a conceptual structure was to prefer. That is, this was seen as more appropriate to describe the mindset, rather than chronological structure (given the iterative procedures of the project), or a structure viewing idea evaluation as very linear (e.g. starting out with a narrow focus on alternative selection methods without the context of the mindset). Figure 5.1 serves to provide a conceptual overview and to clarify the line of thought around the structure of the chapter.

Figure 5.1 Conceptual overview of phase 2
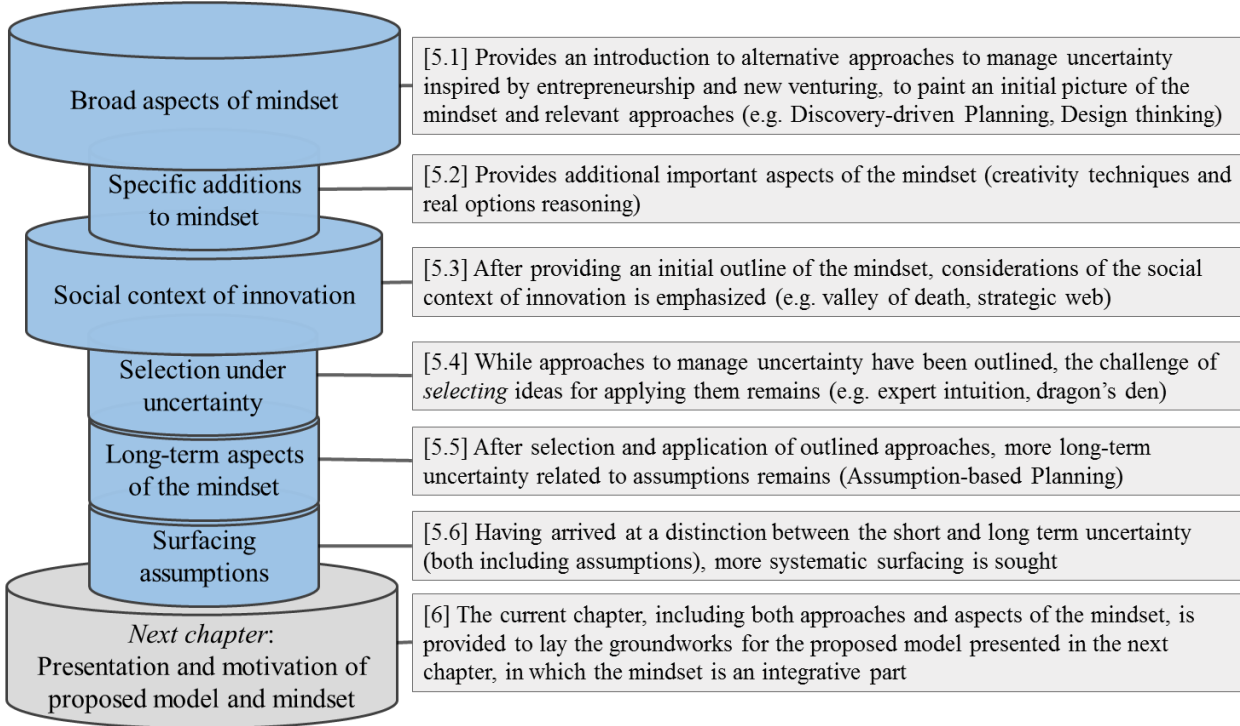
In order to provide an overview of the constituents of the proposed mindset (including constituents of which will appear in the theory of this chapter) the identified cornerstones (including methods) and principles are mapped in Figure 5.2. (However, the model, being relatively detailed, is seen as more confusing than clarifying to present prior to the theory of this chapter.)

3 Cornerstones of the Mindset		
(1) Learning-oriented and Iterative	**(2) Flexible and Strategic**	**(3) Open and Creative**
Can include: • Discovery-driven Planning • Customer Development • Lean Startup • Design Thinking	Can include: • Real options reasoning • Assumption-based Planning	Can include: • Creativity techniques • Design Thinking

5 Principles of the Mindset
(1) Uncertainty is a source of *opportunities*, not only *threats* (2) Radical ideas are *creatively explored*, not *linearly reduced* (3) Experiments provide *learnings*, not *failures* (4) Constraints and trade-offs are exciting challenges to be *overcome*, rather than *blindly accepted* (5) Empathy is a source and promoter of *innovation*, not merely an act of *altruism*

Figure 5.2 Cornerstones and Principles of the mindset proposed by the researchers

5.1 Iterative, learning-oriented aspects of the model and mindset

As Bessant et al. (2010) state, some firms are experimenting with alternative approaches for decision-making when higher uncertainty is involved in market, technological or other dimensions. Additionally, the authors state that instead of using stage gates with simple pass/fail-decisions, learning loops are used, and at each loop, a discussion is held about what is known and what needs to be explored further. What is common with these approaches is that learning is seen as a goal in and of itself. Additionally, regarding investigation and implementation of radical ideas, these situations are closely related to creating a new venture in which uncertainty is high, and several approaches described here are concerned with these types of high-uncertainty new ventures. Hence, this literature was seen as filling a gap in complementing the previously outlined FEI literature, and Bessant et al. (2010) also highlight the potential of these methods in the FEI, and state that as uncertainty is a big part of the problem in selecting radical ('discontinuous') innovation ideas, and that such probe and learn-methods allow firms to take small steps into the unknown, and hence into a new frame of reference, rather than making a 'one and for all' commitment. They are hence seen as highly relevant.

Hence, this section serves to go deeper into this subject by providing approaches derived from, and highly related to 'discovery-driven planning'. Initially, the contribution of the original concept will be outlined. Thereafter, the contributions of 'customer development' and 'lean startup' will be provided. Lastly, the highly related concept of 'design thinking' is described.

5.1.1 Introduction to Discovery-driven Planning

Discovery-driven planning was originally brought forward by McGrath and McMillan (cf. McGrath & MacMillan, 1995) and has been a major source of inspiration for both Blank and Ries (Blank, 2013) in their respective development of the customer development approach and lean startup methodology. As stated by the authors (McGrath & MacMillan, 1995: p. 115), the approach offers *"a systematic way to uncover the dangerous implicit assumptions that would otherwise slip unnoticed and thus unchallenged into the plan"*. The approach is geared towards 'corporate entrepreneurship', in which an existing firm creates new business. The term has been defined as "the process by which members of an existing firm bring into existence products and markets which do not currently exist within the repertoire of the firm" (Venkataraman et al., 1990: p. 488). McGrath and MacMillan (1995) state that failure is

common in such contexts, but could be significantly reduced if senior managers applied the right planning and control tools.

The original discovery-driven planning approach included four documents to impose discipline on the process:

1. A 'reverse income statement' modeling the basic economics of the business
2. A 'pro forma operations specs' laying out the operations needed for running the business
3. A 'key assumptions checklist' used to ensure that assumptions are checked
4. A 'milestone planning chart' specifying what assumptions is to be tested at each project milestone

The authors (1995) state that as the venture unfolds, new data is discovered and each document is updated. Additionally, the authors state that the assumptions and these documents are revised iteratively over the process, and suggest that it is wise to designate a 'keeper' of assumptions.

5.1.2 Lean Startup, Customer Development and Design Thinking

This section goes through the headlined approaches, and thereafter compares them and discusses combining them.

Lean startup and Customer Development – Declaration of overlap

Blank and Ries were both inspired by discovery-driven planning. Both provided their own view of how an iterative approach should be outlined, and Blank packaged his approach as the 'customer development' process, whereas Ries named his contribution 'the lean startup methodology'. Ries was a former student of Blank, which may be one explanation to the major overlap between the methods. The customer development process is seen as a subset of lean startup by several authors (e.g. Müller and Thorin, 2012; Blank, 2014a). As Müller and Thorin (2012) state, lean startup was trademarked by Ries and combines customer development with inspiration from agile software development, open source software and lean management.

Customer development

Inspired by the discovery-driven planning approach, Blank (2012) developed the customer development process, originally targeting startups. Blank and Dorf (2012) states in *The startup owner's manual* that there is a significant difference between startups and large companies. The authors state that the linear new-product development is a good fit for a larger company when customers are known, markets are well-defined, competition well understood and when the product features can be specified upfront. However, these criteria are not well met in the case of a startup. Therefore, (and highly related to discovery-driven planning) Blank and Dorf propose an iterative approach of *hypothesis testing* and *learning*. Related to this, startups are stated to be in 'search mode', whereas large companies are in a process of execution of what is to a larger degree known. Various types of creative 'experiments' to test hypotheses are therefore used, in order to enable fact-based rather than faith-based decisions while moving into unknown territory. The approach also emphasizes 'getting out of the building' in order to meet potential customers and learn about their realities including actual needs, finding a 'painful problem' or a sufficient gain of the presumed customer or user. Also, a 'minimum viable product' is generally used to validate the presence of a favorable market fit for the identified opportunity.

The overall process is outlined in Figure 5.3.
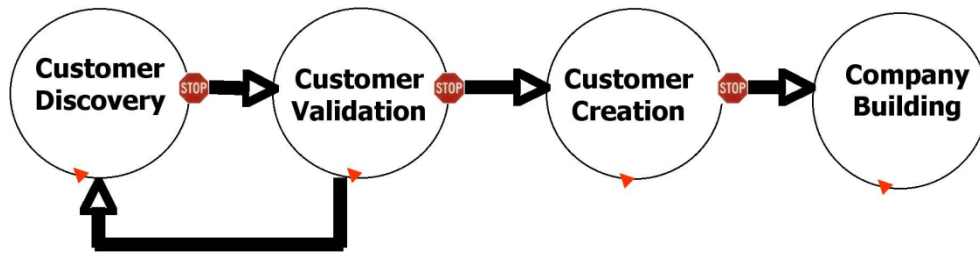
Figure 5.3 Overall Process for a startup (Blank & Dorf, 2012)

As seen, the startup starts out in a phase of customer discovery, where the 'founders vision' is converted into a set of hypotheses representing the business model, and the authors advocate using the 'business model canvas' brought forth by Osterwalder (2004), and presented in a refined manner in a well-known publication by Osterwalder and Pigneur (2010), see Figure 5.4 (layout here changed for increased readability).

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
	Key Resources		Channels	
Cost Structure			Revenue Streams	
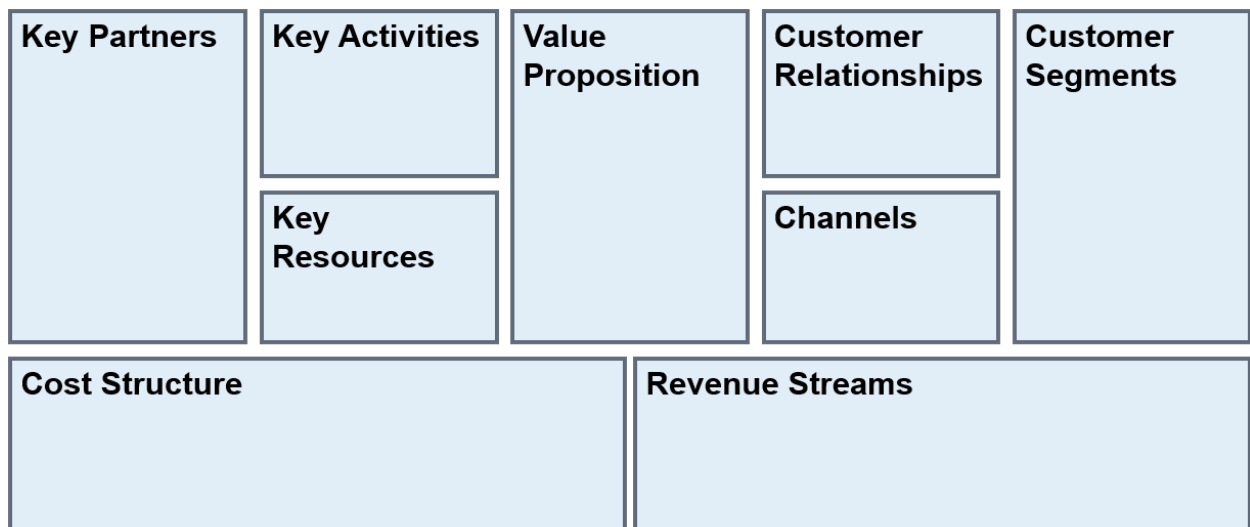
Figure 5.4 Business model canvas (Osterwalder & Pigneur, 2010)

Thereafter, in the customer validation phase, tests are performed to see if the proposed business model is repeatable and scalable. If not, the process pivots back to customer discovery. If the tests are passed, the process enters customer creation with a focus on execution. Herein, end-user demand is created by filling sales channels in order to scale up the business. Lastly, if this phase is successful, the process enters the phase of company building where the startup transitions into a company now focused on executing the validated model. (Blank & Dorf, 2012)

Lean Startup

One of Blank's students, Eric Ries, further developed concepts derived from discovery-driven, adding techniques based on experiences from the startup scene in U.S. As noted however, there is major overlap with the customer development approach such as the use of the business model canvas, minimum viable products and an iterative, agile learning process (cf. Ries, 2011), why the lean startup will not be outlined in detail. The build-measure-learn process is seen in Figure 5.5 and closely resembles the early phases of the customer development process, although there may be more emphasis on quantitative measurement of customer reactions.
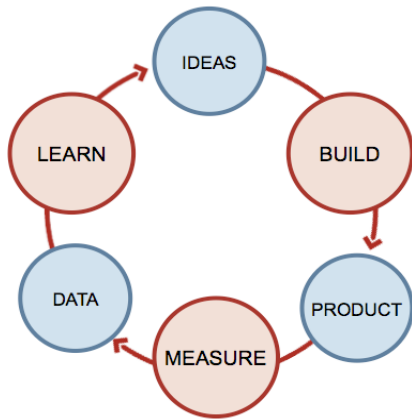
Figure 5.5 Build-measure-learn (Ries, 2011)

Design Thinking

Another approach which does not have its roots in discovery-driven planning but which have major similarities to its iterative approach to reduce uncertainty is 'design thinking'. According to Gassmann and Schweitzer (2014), design thinking is a powerful methodology for innovation which has emerged from design thinkers and engineering in Silicon Valley, and the method integrates human, business and technical factors within problem forming, problem solving and design. Carlgren (2013, p. 47) states that there is a range of perceptions surrounding the DT-concept, including "*methods, tools, process, mindset, principles, culture or a mix thereof*". As the author states, the mindset aspect is often seen as including the view of *learning* from failure, and openness to the unexpected (Carlgren, 2013).

When DT is outlined in relation to NPD or other innovation-related activities, it generally focuses on the FEI (Martin, 2009a). Although there are differences in how DT is illustrated, a generic DT process is typically outlined as shown in Figure 5.6.
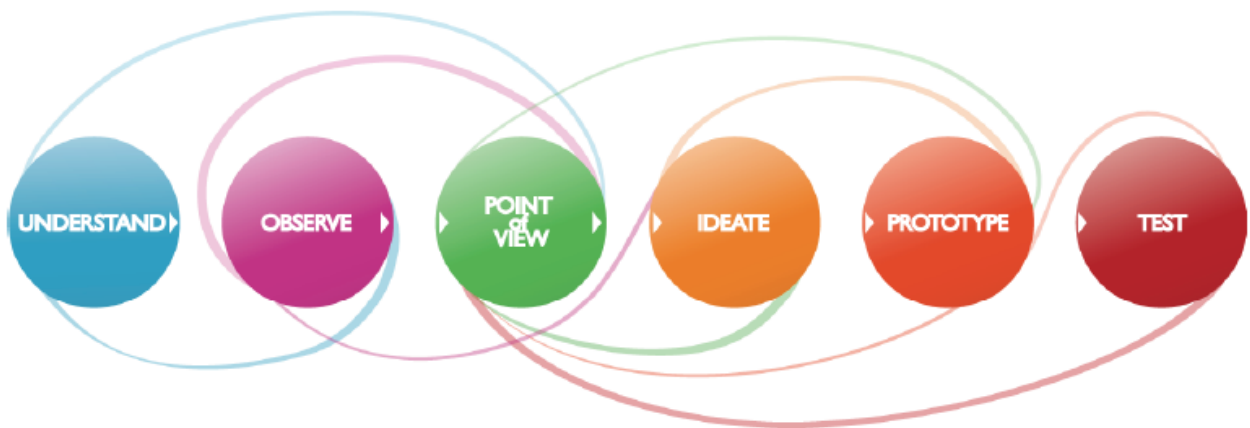
Figure 5.6 *Overview of typical DT process (Stanford d.School, 2009)*

More specifically, the process starts with understanding the prerequisites of the problem, for example the market, the technology or perceived constraints. Thereafter, observations of users in real life situations are conducted using various methods from ethnography in order to develop empathy and understanding of these users. After this, a 'point of view' is created for reframing the problem. In the ideate phase together with prototype phase, ideation and

prototyping of several alternatives is done in short iterations. These are then tested for feedback, then modified, and if required, also iterating the problem formulation (i.e. 'point of view'). (Kelley and Littman, 2001; Brown and Wyatt, 2010).

It is often emphasized that DT should hence not be considered a linear process, but rather highly intertwined, as a project or idea can move back and forth between different phases. (cf. Brown, 2009; Liedtka and Ogilvie, 2011). Another aspect which is emphasized is to have a dedicated space for creativity and visualization (Brown, 2009). Related to this, it bears mentioning that the perception of DT differs; many practitioners perceive DT as more of a *mindset* and a *culture*, and also as a toolbox, rather than a strict process or step-to-step plan (Carlgren et al., 2014). Based on her studies, Carlgren (2013) can be seen as elaborating on this, suggesting that while the use of design thinking is depending on the mindset and innovation capabilities of a firm, it can also help change the mindset and build innovation capability (IC), as the three interact, as suggested in Figure 5.7. (While 'innovation capability' is not in focus in this thesis, it is defined by Carlgren, 2013: p. 48, as a firm's "*ability to be competitive through systematic innovation, including reconfiguration of the firm's resources and processes as well as the values that influence how decisions are taken in the organization (mindset)*")
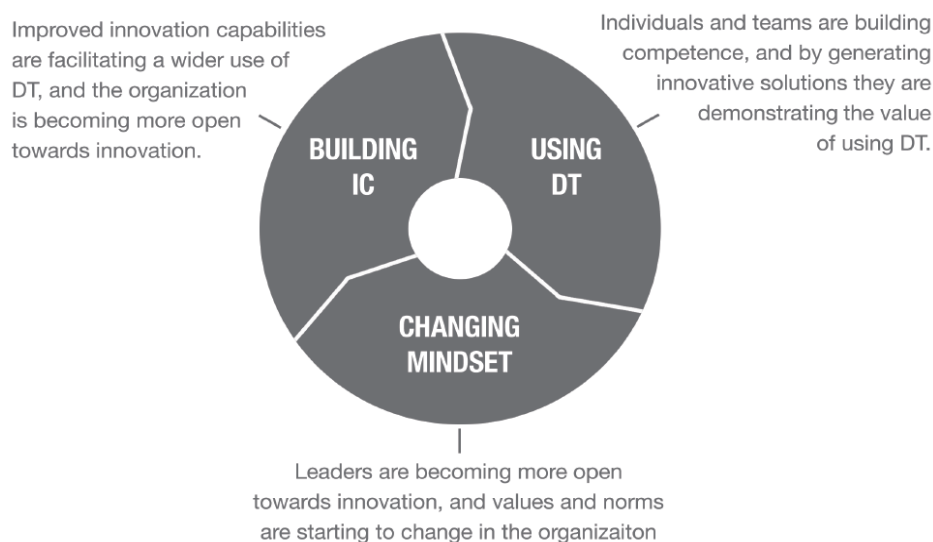
Figure 5.7 *Interplay between IC, mindset and use of DT (Carlgren, 2013)*

There are several proposed advantages of DT. According to Brown (2008), firms using DT can expect to achieve greater innovation output. In particular, solutions that are creative alternatives going beyond aesthetics, which are satisfying and meaningful, can be generated. It is also argued that implementation of DT can improve aspects of the innovation and NPD processes, through for example enhancing collaboration and motivation with higher degrees of empathy and knowledge sharing due to the prototyping (Dunne & Martin, 2006; Brown, 2008). Gassmann and Schweitzer (2014: p. 141) also state that they believe the method can help the FEI to innovate faster, provide better market fit, and *"generally create more radical innovations"*. These authors view the method as a prospect to 'dance with ambiguity', implying that ambiguity and uncertainty can be leveraged in order to create better innovations faster, using this iterative approach rather than focusing on concrete but potentially ill-fitting requirements. Carlgren (2013) concludes that DT is suited for *both* incremental and radical innovations, and that the method is aligned with innovation practices highlighted by several scholars. Although both types of innovation are essential (Carlgren, 2013), Beckman and Bary (2007) argue that DT enables both teams and organizations to

learn, and state that an increased understanding of meaning-based user needs can lead to more radical innovation.

Considering the method's hype, it may be worthwhile to also mention some potential challenges. One critique of the method includes that it may be more challenging to implement than described, since there may be clashes of logic between the more analytical and rational versus the more interpretive and intuitive that is part of the method (cf. Rylander, 2009; Edeholt, 2007). Another challenge regards the required competence; according to Johansson-Sköldberg et al. (2013), design tools often require years of training and is embodied in designer, but the method is often presented as a simple 'pick and choose' as part of a toolbox.

Going further into the mindset and logic of DT, Dunne and Martin (2006, p. 518) provide a quote that highlights a characteristic of the mindset: *"In conventional management thinking, constraints are seen as an undesirable barrier to the generation and implementation of ideas; for a designer, however, constraints are embraced as the impetus to creative solutions."*

Leavy (2010) relates design thinking to the original concept of discovery-driven planning by referring to the type of logic used. The author states that managers predominantly use deductive and inductive reasoning. But when it comes to exploration of new knowledge, design school theorists believe that a third type (as mentioned in the methods section of this thesis), *abductive* reasoning, is required (Leavy, 2010). This is a type of 'informed conjecture' and can only be verified through *generating new data*, which is generally done by prototyping and testing. And this is similar to the logic of discovery-driven planning, emphasizing that the data to reduce uncertainty for such contexts is not available a priori but is created over the process (Leavy, 2010). The view of Dunne and Martin (2006, p. 513) provide another quote which highlights this logic and attitude: *"The designers who can solve the most wicked problems do it through collaborative integrative thinking, using abductive logic, which means the logic of what might be. Conversely, deductive and inductive logic are the logic of what should be or what is. In traditional organizations do you get rewarded for thinking about what might be? Encouraged? No . . . these firms can only do what they know how to do and constraints are the enemy—as opposed to the design firm, where constraints bring challenge and excitement."* It is also stated by the authors that this relates directly to integrative thinking; the non-integrative thinker readily accepts unpleasant trade-offs, whereas the integrative thinker rather seeks to generate creative solutions to resolve the tension. Related to this, Brown (2008) states that as design thinkers use integrative thinking, this includes *not* only relying on an analytical process, which tends to produce 'either/or' type of choices.

As integrative thinking is highly relevant for the mindset, the working definition proposed by Martin (2009b: p. 15) is hereby provided: "*The ability to face constructively the tension of opposing ideas and, instead of choosing one at the expense of the other, generate a creative resolution of the tension in the form of a new idea that contains elements of the opposing ideas but is superior to each*". The author also states that having interviewed over fifty leaders with outstanding success records, the conclusion from this was that there was only one trait shared by all, i.e. that of integrative thinking.

The researchers of this thesis also want to bring particular focus to the emphasis on empathy in DT. Brown (2008) states that design thinkers have empathy and the ability to imagine the world from several perspectives, including that of colleagues, clients, end users or customers. They are described as attentive to detail in a way that others are not, and use insights from such observations to inspire innovation. What the researchers conclude from this is that empathy can be seen as an important aspect of a mindset on its own.

Combining Lean Startup, Customer Development and Design Thinking

Müller and Thorin (2012) discuss how lean startup (seen as *including customer development*) and design thinking can be used to complement each other to provide a stronger, more customized approach. The authors state that lean startup is more customer-oriented and geared towards managing unclear customer problems. DT, on the other hand, is user-centered and geared towards solving wicked problems. Regarding integration, the authors state that the quantitative testing in lean startup can be complemented with the more qualitative one of design thinking. Design thinking provides advantages in more emphasis on ideation and creativity tools in the early phases, and also provides approaches such as ethnographic research methods to understand the user more deeply. However, it is suggested that it could use the more frequent testing, as in the process design of lean startup, according to the authors. The authors even suggest a combined approach, 'Lean Design Thinking' (see appendix C for an overview of differences and the suggested integration, according to the authors) for this purpose (Müller & Thorin, 2012).

Blank (2014b) takes a different view. Customer development (while having major overlap with Lean startup,) starts with *having a technology or product*, and the question of *whom to sell it to*. Design thinking, on the other hand, is stated to *start with the need to understand customer needs* and iteratively generate *prototypes* until a technology and/or product is found that satisfies that need. Furthermore, according to Blank, lean startup is geared towards speed and 'good enough', whereas design thinking is geared towards getting it right before making 'big bets'. In relation to all these methods, Bessant et al. (2010) can be seen as supporting that they are well suited for dealing with radical innovation due to their way of handling uncertainty.

The researchers' reflections on iterative approaches

The overall conclusion the researchers draw from these approaches is that they seem significantly more appropriate than the linear view of idea evaluation. In particular, it is worth emphasizing the difference in mindset observed between these approaches and the linear view. The linear school appears to view uncertainty as something inherently negative. The approaches derived from discovery-driven planning, while managing uncertainty systematically, also see its opportunities, in particular opportunities for *learning,* and this can be seen as a more *experimental* rather than *failure-avoiding* mindset. This also holds for design thinking, but design thinking has less emphasis on explicitly testing hypothesis in a (presumably) more scientific manner, and more emphasis on creativity and truly understanding the users. Furthermore, it was described that the *mindset* is often seen as *central* in design thinking. In addition to having more of an abductive logic compared to the linear view, it also emphasizes constraints and trade-offs seen as exciting challenges to be overcome creatively rather than blindly accepted.

While the most favorable application of tools certainly depends on context, the researchers suggest that the discovery-oriented approaches such as lean startup and design thinking can both provide useful elements for an overall mindset for firms, which is more suitable for managing high uncertainty. These approaches also seem more suitable as a way of managing this uncertainty rather than for example simply subjecting more radical ideas to gates, and having those ideas that pass the initial gates be implemented in a linear NPD process which may undermine the idea's potential.

However, it is important not to use either excessive over-engineering of methods or combine mindlessly. For example, qualitative understanding of user or customer needs may be more suitable than using an excessive degree of metrics and hypothesis testing. Related to this, blind hypothesis testing and optimization can lead to finding only 'local maximums', while only scratching the surface of user or customer needs rather than exploring them more deeply. This can also be related to the classical quote by Henry Ford, i.e. "If I had asked people what they wanted, they would have said faster horses" (cf. Vlaskovits, 2011). Here,

this is seen as also pointing to the risk that using for example design thinking without proper reflection on actual, sometimes unconscious needs, it can lead towards incremental rather than radical innovation. The researchers suggest that empathy as a mindset can play an important part in really understanding for example customers or users, thereby having a better chance of innovating towards a global maximum.

Nonetheless, understanding needs also leads to the question of *whose* needs? Implementing design thinking and starting with user needs rather than an idea may lead to locking in focus on current users or customers of the company. This highlights the importance of maintaining some perspective, and also that customer development or lean startup may provide a complement, being more geared towards finding *new* customers. Additionally, implementing the 'process' of design thinking in and of itself may be less favorable since the approach is often seen as dependent on having the right mindset and culture (which will be further discussed). Depending on if radical idea is to be implemented inside the company or as a separate venture, this also impacts choice of elements from the methods. If for example it is run within the company, the 'company building' phase of customer development becomes inapplicable and so on. This discussion points towards that it is important that practitioners obtain the relevant competence for using the approaches, and that management includes a critical review before implementation of the method(s) and maintain perspective on their use and context.

The researchers' main takeaways from iterative approaches

- Discovery-driven planning is a systematic way to uncover dangerous implicit assumptions and manage uncertainty
- Derived from discovery-driven planning, customer development and lean startup includes the business model canvas and is customer-oriented
- Design thinking puts more emphasis on creativity and ideation, and is more user-centered
- While having several similarities, the approaches also include significant differences
- Some scholars see lean startup/customer development and design thinking as complements, whereas others see them as substitutes
- Methods can be combined but should not be done so mindlessly, without proper education or without maintaining perspective on the purpose
- Several potential aspects of a proposed mindset have been identified across the methods
  - Emphasis on *discovery* and *learning*
  - Emphasis on *experiments* and *iteration* to test assumptions and generate new data
  - Emphasis on *empathy* for understanding customers and inspiring innovation
  - Emphasis on *creativity* and creative solutions, including use of *abductive logic* and *integrative thinking*

5.2 Additional aspects of the model and mindset

This section outlines additional, specific aspects of the suggested mindset. First, literature on creativity techniques is provided. Thereafter, results of applying a creativity technique (i.e. C-K) is discussed, and the researchers provide their reflections. After this, theory and reflections on real options reasoning is provided.

5.2.1 Literature on Creativity Techniques

Creativity techniques are highly related to a mindset that goes beyond the linear view of idea evaluation. As Alänge and Lundqvist (2014) emphasize, it is important for idea evaluators to keep an open mind, to be curious, humble and non-judgmental towards ideas, and keep in

mind that ideas are also important opportunities for *learning*. This is particularly relevant for ideas with a high degree of uncertainty. Gassmann and Schweitzer (2014) discuss creativity techniques with regards to the FEI, and state that creativity is the basis of innovation, including the ability to rethink and combine existing solutions with solutions from other fields, or imagine completely new ones. Creativity techniques can be utilized in a wide range of scenarios, including exploring directions and further development of a given idea. However, for a given problem, some techniques are more appropriate than other, and sometimes it's favorable to find single solutions whereas other times a wide range of potential solutions is desirable in order to overview the possible solution space (Gassmann & Schweitzer, 2014). As previously mentioned, Gaubinger and Rabl (2015) state that while most sources of ideas often have minor contribution by themselves, the contribution of ideas can be greatly enhanced if they are coupled with creativity techniques, which further highlights the relevance of considering these techniques.

In this thesis, Concept-Knowledge Theory (C-K) has been used to explore ideas as advocated by Agogué et al. (2014)**,** why this method will be outlined more comprehensively in appendix A in order to increase the transparency for the reader. In short, the method is based on the distinction between the knowledge space or 'K-space', and the concept space or 'C-space', both of which can expand over the design process. Stated differently, according, design is seen as a cognitive process in which a concept generates other concepts, which are iteratively converted into knowledge about what is doable.

Additionally, there is also a plethora of other methods, but while it is beyond the scope of this thesis to provide outlines of these numerous methods, a list is found in appendix B.

Result of application
The use of C-K theory as a method for exploring relatively unspecified, presumed radical ideas proved to be very useful as a tool to explore the ideas' potential. By trying out different 'directions' for an idea, several intriguing opportunities for further explorations could be highlighted. Although these often included major uncertainty as well, the possibility to specify the intention of the idea more specifically allowed for much more comprehensive identification and analysis of assumptions (more on this in section 5.6). Hence, the researchers propose that creativity techniques provide useful tools to creatively explore the potential of ideas, and can be particularly useful for radical ideas, being more open-ended, and that this allows for better possibilities for identifying relevant assumptions.

Admittedly, the general proposition about the usefulness of creativity techniques (other than C-K) rests itself on the assumption that this proposition can be generalized across other creativity techniques, which however does not seem unlikely, provided that these are appropriately selected.

Lastly, throughout the process of applying C-K as a creativity technique, the researchers made a presumed important self-observation with regards to cognition and cognitive convenience. An inherent inclination to direct ideas towards incremental solutions was observed, and the conclusion was that this was more convenient, seemed more 'feasible', and provided easier identification of uncertainties and assumptions. This may be an important finding, since it can indicate that discipline may be required on the parts of idea providers or idea evaluators not to turn a radical idea into an incremental idea and thereby constituting a bottleneck themselves, leading to losing much of the 'radical potential' for innovation in the creative process. Hence, the researchers propose that in a phase of creatively exploring ideas, there may be an 'incremental bias' present, i.e. an inclination to influence the direction towards more known, convenient cognitive territory. Vigilance towards such a bias may be required of participants in order to maximize innovative potential.

However, this tendency may differ significantly across different personalities. For example, managers, may be less prone to use abductive reasoning (cf. Dunne & Martin, 2006), and therefore less suited to realize the potential of radical concepts than trained design thinkers, who may be more prone to try out directions of an idea that lie outside the current frame of reference.

The researchers reflections on theory and application of creativity techniques

The researchers conclude that while it was outside the scope to go into a range of creativity techniques, they seem to be well aligned with the proposed mindset, as creativity provides for a more explorative and open-minded approach to uncertainty, viewing uncertainty in ideas as filled with potential rather than threats to be removed. Additionally, it seems favorable that creativity techniques not only provide for brainstorming and general creativity, but can combine this with systematic analysis, which seems highly related to the notion of integrative thinking (as proposed in design thinking, e.g. Brown, 2008). For example, in C-K, practitioners can try out 'crazy' concepts in the concept space, and then systematically gather knowledge for the knowledge space to test what is doable. The researchers suggest that applied appropriately, this type of approach can likely be an enabler of more radical innovation.

Since there is a plethora of different methods, experience, knowledge and skills is required for making an educated choice. Depending on the firm, it may be more or less favorable to keep it simple.

The researchers' main takeaways from creativity techniques

- Creativity techniques provide useful tools to creatively explore the potential of ideas, and can be particularly useful for radical ideas, being more open-ended
- Creativity techniques provide useful tools to arrive at a more finalized concept, which in turn enables more comprehensive analysis of assumptions
- In a phase of creatively exploring ideas, there may be an 'incremental bias' present, making awareness of such tendencies important to promote the full potential of the idea
- Creativity techniques can also be seen as related to an inherent mindset, implying that uncertainties of ideas contain potential to be explored, rather than hindrances to be removed

5.2.2 Real Options Reasoning

Considering the context of seeking an approach or mindset more suited for high uncertainty, the concept of 'real options reasoning' as suggested by McGrath (1999) was found highly relevant by the researchers. The author states that real options reasoning can provide a more balanced view of entrepreneurial failure (including new ventures of established firms) and decrease biases. Going on, it is stated that variance in the future is to a real option what volatility is to a financial option, i.e. *value increasing*. Uncertainty should hence be seen as *positive* for a real option, and this type of reasoning can counter several biases leading to avoidance of 'failure', or 'anti-failure bias', according to the author. Set in this context, this can be used to mitigate bias towards 'safe' incremental innovations, and increase support of radical innovations. Although the availability and quality of data for radical ideas can be a problem for using real options quantitatively, the type of logic implied in real options reasoning is seen as relevant for highlighting the value of flexibility and arising opportunities, why theory on various types of real options is seen as relevant.

Real options are particularly applicable to the FEI according to Vanhaverbeke et al. (2008) due to the fact that they are favorable for coping with its inherent uncertainty. Lecou et al. (2011) also state that real option is a common evaluation technique for high risk

environments. Further, Trigeorgis (1996) states that traditional evaluation techniques are failing because they cannot capture flexibility and therefore not adapt to changes in market developments or capture strategic values resulting from a new technology. Real option valuation is a technique that quantifies the value of flexibility, and can account for future opportunities while limiting losses. Trigeorgis further states that the value of an option lies in having the right but not the obligation to exercise chosen option. There are many different type of real options such as option to defer, staged investment option, option to alter operating scale, option to abandon, option to switch output and growth options. Most real life projects involve a collection of several of these options in order to enhance the upside and protect against downside. Three types of real options are by the authors deemed to be of particular interest for this thesis, i.e. options to defer, growth options and staged investment options:

An option to defer is an option that allows the firm to invest the outlay if conditions are considered benign but does not force the firm to commit if conditions are considered malign. An option to defer investment is beneficial when experiencing uncertainty whether to invest or not (Trigeorgis, 1996).

Growth options are considered to be of significant strategic importance in R&D for example. Trigeorgis (1996) further states that the value of a growth option lies in the potential growth opportunities that arise from an initial project such as access to a new market or strengthening of the firm's core capabilities. The growth potential may stem from infrastructure, experience or by-products that in turn allow the firm to for example produce cheaper or better products and thus gain competitive advantage. Put more concretely, a first generation of a new product may not in itself be a huge success but may in turn pave way for more advanced or cheaper-to-produce future generation products or spin-offs that may be of huge success. Thus, early projects may be seen as linkages in a chain of interrelated projects.

Staged investment options are another type of real option that are of importance to R&D intensive industries and startup ventures (Trigeorgis, 1996). Staged investment options are based on a series of outlays that creates an option to kill the project if unfavorable information arises.

The researchers' reflection on real options reasoning
The conclusion that the researchers draw from theory on real options is that these different types of real options may arise as a consequence of further evaluating or implementing an idea. When for example a radical idea requires financial investments, this can be done in increments to test assumptions, and can be more accurately evaluated with a real options reasoning mindset, since it highlights opportunities that may open up during such an investment. Also, real options reasoning is highly related to viewing ideas as opportunities to learn. For example, if a radical idea requires the employment of a team of top-talent researchers in artificial intelligence, this may open up a vast range of indirect opportunities aside from the potential fulfillment of the idea itself, and the value of flexibility and potential to capture arising opportunities from this investment would be accounted for better with such a mindset. In conclusion, real options reasoning adds to the previously described mindset by further extending the openness to testing - by realizing the potential indirect benefits of testing ideas and also de-dramatizing commitment through staged investments.

The researchers' main takeaways from real options reasoning

- Real options reasoning can be used to get a more balanced perspective on 'failure(s)' related to implementation of new ideas, which can be seen as a mindset
- Having real options reasoning as part of the proposed mindset includes emphasizing the value of (1) arising opportunities and (2) having the flexibility to capture them

- There are three types of real options seen as being of particular relevance: options to defer, growth options and staged investment options
- Quantitative use of real options may be challenging when there is little data available (e.g. for radical ideas), but using the mindset can still be useful for early stages while quantitative use may be favorable for later stages once uncertainty has been reduced sufficiently

5.3 The social process of adopting radical innovation within organizations

This section serves to describe the social context of innovation, in which radical ideas are adopted. It also serves to map other critical factors that impact whether an idea passes the gap to commercialization.

5.3.1 The strategic web and the valley of death

Another important aspect to acknowledge is that the process of radical innovations entering organizations i.e. ideas getting accepted is often quite difficult and may be described as a social process that requires anchoring and takes time (cf. Reid & de Brentani, 2004; Backman et al., 2007). More explicit, Reid and de Brentani (2004) describe the process as a social process that requires key individuals to share the information in order for the innovation to be captured within the firm's strategic web. By spreading information regarding the idea, people within the organization get used to the idea and its proposed benefits, and more importantly, how it will impact the current business. This means that new ideas or strategies must somehow tangle with the old to create a new strategic context and only then will an idea be committed to. Further, Backman et al. (2007) showed that nontraditional concepts, in their case non-tech ideas, must gain acceptance often through alternative channels in order to get attention and thereby being adopted by the organization. Koen et al. (2002) also illustrate the need to build support of an idea by describing the gap between having an idea and market launch as the 'Valley of Death', see Figure 5.8. It is called the valley of death due to the hardship of passing, and the valley needs to be bridged in order to launch a successful innovation (Meyer et al., 2011). Koen et al. (2002) propose that champions of an idea need to build support in order to get critical resources for the project. Koen et al. stress that the presentation of vision within the firm is an iterative process and must often be repeated many times. All these studies point towards the importance of active framing of an idea, building support of it as well as influencing the right stakeholders. The valley of death and related aspects will be further investigated in the coming sections.
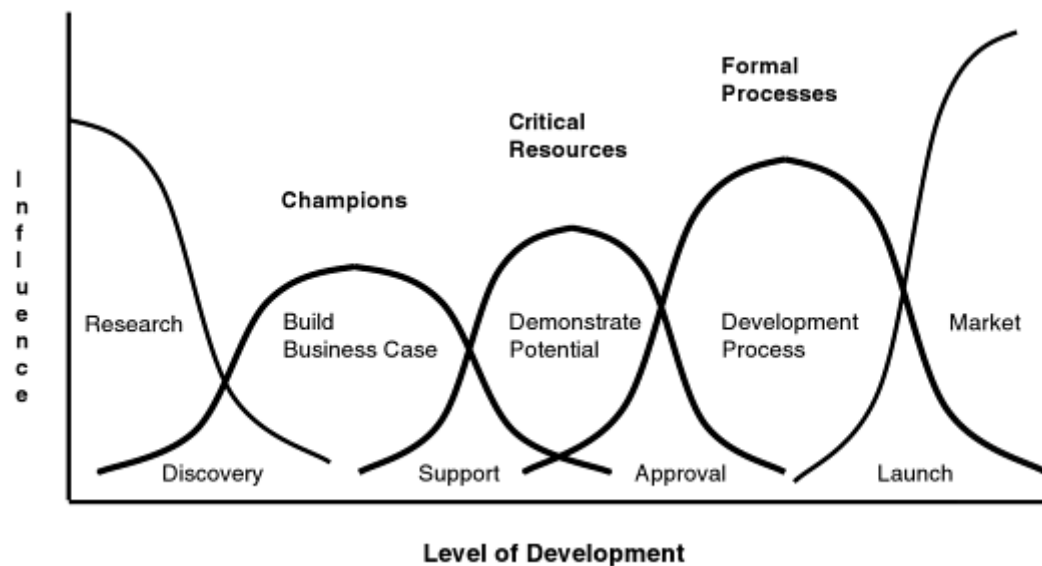
Figure 5.8 The Valley of Death as provided by Koen et al. (2002)

Champions and resources

Koen et al. (2002) state that there is a need for champions throughout the process of crossing the valley of death. Burgelman and Sayles (1988) define champion as an emerging individual within an organization that actively promotes an idea throughout the innovation process. Also, Frishammar and Florén (2010) state that the presence of idea visionaries or product champions plays an important role in overcoming inertia and drive the idea forward. Both Backman et al. (2007) and Reid and de Brentani (2004) confirm this view by showing the hardship for non-traditional concepts to enter the NPD process and how champions can help these ideas reach inside the organization.

As previously mentioned, Koen et al. (2002) stress that one of the most important tasks for the champion is to gather critical resources for the idea. Cooper & Kleinschmidt (1995) also stress the importance of resources and state that without resources great ideas will fail. Bessant et al. (2010) elaborate on this importance by stating that resources are essential for the exploration and development of an idea. In relation to resources, Cooper and Kleinschmidt (2007) also state that innovations in general need to be seen as an investment, and advocates a goal-oriented budget so that innovations are not chiefly judged by their cost. This is further elaborated by Backman et al. (2007) who state that there is a dilemma today that many firms, because of high competition, try to cut costs in R&D which in turn lowers their competitiveness in the long term due to lower firm innovativeness.

Organizational structure

Formal processes are mentioned as an important factor by Koen et al. (2002) to bridge the valley of death. However, it has already been reviewed in phase 1, and will therefore not be reviewed again. Nonetheless, both processes and resources are highly related to organizational structure.

Many scholars argue that radical ideas should be separated completely from the core business because operating within the organization will kill the idea (cf. Bessant et al., 2004; Bessant et al., 2010; Christensen & Raynor, 2003). For example, Bessant et al. (2010) argue that radical ideas should be incubated separate from the normal resource allocation system and many firms use alternative funding arrangements such as joint ventures, equity finance and development funding. This is because radical ideas, being an important part of firms' exploration activities, can be significantly constrained by several challenges relating to

organizational structure, misaligned incentives and politics. To start with, radical ideas often directly compete with incremental ideas for attention and funding. Viewed from a management perspective, Smith and Tushman (2005) state that trying to balance the previously mentioned exploration with exploitation leads to conflicts of interest between the two, which can be challenging to handle as they represent contradictory logics and therefore provide challenges for the management team. According to the author's, exploration is rooted in variance-increasing activities and learning by doing, whereas exploitation on the contrary is rooted in variance-decreasing and disciplined problem solving.

Going on, as several scholars such as Bessant et al. (2010) state, radical ideas often create tension and conflict in the organization. Radical ideas are associated with high uncertainty, in particular since it can lead to reallocations and layoffs, and changes in relative power, status and salaries of individuals and so on. As Buchanan and Badham (1999) state, radical innovations may cause change in organizations and possible change in organizations often lead to political behavior - actively working against the change - by those who believe that the change would impact them negatively. This is also in line with the view of Pettigrew (1974), stating that the higher the risk and uncertainty, the more people will engage in political behavior In relation, several scholars such as O'Reilly and Tushman (2004) advocate that firms should venture outside of the organization by creating 'ambidextrous organizations'. The concept was originally brought forward by Duncan (1976), in which the company ought to balance the previously mentioned exploitation with exploration (O'Reilly & Tushman, 2004). According to O'Reilly and Tushman (2004), exploitation and exploration require very different strategies, structures processes and cultures. Related to this, Smith and Tushman (2005) states that it is often advocated keeping the explorative activities as a separate unit of the organization, making it less restricted by the rest of the organization.

Stakeholder mapping
Considering the perspective of an idea team or a champion trying to acquire resources and promote the idea, stakeholder mapping can be a highly relevant tool. Since stakeholder mapping is a relatively generic and well-known technique, it will not be outlined further (cf. Maylor, 2010; Smith, 2015). Its relevance is also highlighted by the previously provided statement of Buchanan and Badham (1999), emphasizing that radical innovations may cause change in organizations that can lead to political behavior, making negatively affected individuals actively work against the given change, here seen as referring to attempts to undermine a radical idea.

Management support and culture
Management support and culture is ultimately what allows a champion to rise within the organization, to gather the necessary resources and to bridge the valley of death. Bessant et al. (2010) state that firms should engage management within the selection process in a planned manner instead of spontaneous acts of support. This can be achieved through formal links with management that becomes sponsors for radical projects which ensures awareness and involvement by management (Bessant et al., 2010). Commitment and support from top management is essential for successful innovation management (Cooper & Kleinschmidt, 1995). Other success factors according to Cooper and Kleinschmidt (1995) include clear message of the importance of NPD and commitment to risk taking.

Culture can be seen as an important enabler in the FEI, and lack of an open, innovative culture can certainly hinder innovation and the adoption of radical ideas. For example, as Carlgren (2013) saw in a study, organizational culture was a factor perceived to hinder 'full' use of the design thinking approach, thereby resulting in only incremental improvements. This points towards the importance of the culture while implementing radical innovation. As previously mentioned, Koen et al. (2001) describe culture as part of the 'engine' driving the FEI, thereby highlighting its importance. Firms should have open culture with regards to innovation, while also giving employees the space to work on innovation at their own pace

(Cooper and Kleinschmidt, 1995). This is further elaborated by Burgelman and Christensen (2009) who state that the organization should have an entrepreneurial climate characterized by informality, tolerance for errors and possibility to make fast decisions. An entrepreneurial culture is also advocated by Bessant et al. (2010). Also, Frishammar and Florén (2010) state that a creative organizational culture allows the talent of employees to be captured and provides a steady stream of ideas feeding the FEI.

Further regarding culture, Gassmann and Schweitzer (2014) also stress the importance of managing people, which they consider more important than process management. Managing people means having the right people and enabling them through networks and coaching. Intrinsic motivation and finding meaning is key to innovation according to the authors. Griffiths-Hemans and Grover (2006) also concluded that intrinsic motivation and access to relevant and diverse knowledge is key to the FEI, and hence derived that firms should stimulate the forming of informal bonds between individuals in the firm. The literature further emphasizes the need to create learning capabilities with regards to the FEI (cf. Ahmed and Shepherd, 2010).

5.3.2 The importance of 'packaging' the idea

With the diffusion within the strategic web in mind, packaging of ideas becomes an important issue to better enable the social process of radical innovations entering the organization. An important aspect in why there is a need for packaging within firms is that most managers, because they are more focused on exploiting the current business than exploring new businesses, use inductive and deductive logic (Dunne & Martin, 2006) and because radical innovations often are outside their frame of reference due to being abductive, and hence there is a need for managers to understand and get used to a radical idea.

Alänge and Lundqvist (2014) emphasizes that it is important to explore the ideas within idea evaluation, and that the process can be seen rather as 'idea appreciation'. Also, for an idea to be realized, it needs to *gain momentum and attract resources and stakeholders*, why the authors emphasize the use of a 'packaging approach' to highlight the potential of the idea. The authors also take a broader perspective on utility than several other scholars, advocating the use of three categories of utility, namely societal, customer and business utility. This packaging approach includes picturing the idea in a *future favorable situation of use*, while simultaneously being very realistic and clear about the ideas' current state. Stated differently, the authors recommend a combination of visionary packaging and realism in order to inspire stakeholders and lower entrance barriers for anyone with an interest in taking the idea further. The researchers hence note that framing functions like this one can provide important bridges across the 'valley of death', for a radical idea.

Additionally, Alänge and Lundqvist (2014) emphasize the 'dual techno-market insight', referring to the importance of both creative technical and market reasoning in the packaging of the idea, and later in the more analytical process of breaking down and testing the idea. Furthermore, these authors emphasize the importance of idea evaluators to keep an open mind, to be curious, humble and non-judgmental towards ideas, and ideas are stated to provide important opportunities for learning (Alänge & Lundqvist, 2014). All in all packaging seems favorably aligned with the suggested mindset, according to the researchers.

Cognitive framing: A brief description

With the packaging approach in mind, framing becomes an important issue as depicting the innovation in its most favorable yet truthful way will aid the process of the idea being adopted by the organization. Framing is interesting because the same information presented in different ways can lead to different interpretations and evoke different emotions in the subject (Kahneman, 2011). An example may serve to illustrate this phenomenon: "The odds of survival one month after surgery are 90 %", and secondly, "mortality within one month of surgery is 10%". Both imply the same probability, but with different frames. The first is likely

to evoke a more positive response (Kahneman, 2011). More related to idea evaluation, Hodgkinson et al. (1999) discuss framing in strategic cognition and decision making. The authors conduct a study showing that framing a *business situation* differently can cause both *risk aversion* and *risk seeking* tendencies.

Further, as Kahneman (2011) states, people are generally risk averse and often more responsive to negative stimuli than positive. More specifically, as stated by Wolf (2012), our pain of losing is generally more powerful than the pleasure of winning, and we are therefore 'really risk-averse' to gains, but more risk seeking when it comes to avoiding future loss.

A conclusion the researchers draw from this is that radical ideas can be framed on the light of 'avoiding future loss', i.e. pointing towards the risks of omitting radical innovations and therefore lose competitiveness and thereby create a sense of urgency. This can include 'classical disaster examples' such as the failure of Kodak to innovate and maintain competitiveness during the introduction of digital photography. The researchers argue that this should not be seen as a 'cognitive trick', or 'cynical move', but rather as a pragmatic approach and a legit argument to tackle the bounded rationality associated with insufficient radical innovation often observed in firms.

5.3.3 The researchers reflections on the social process of adopting radical innovation

Aside from switching the focus from mainly on processes and approaches to an overall mindset, this section of the theory represents a significant realization on the part of the researchers. The previous view held saw the decision of a firm to select an idea, investing in it and committing to a deeper exploration of it, as consisting of a single moment in time of pitching the idea, for example to a board of managers. This perspective is now seen as likely to be less favorable for radical ideas, since it provides more of a mental 'punch in the face' for decision-makers, may lead to more resistance and less opportunities to proactively anchor the idea in the organization. Interaction with knowledgeable individuals in the organization who are likely to support the idea can, aside from advocating it and help protect it from special interests, also provide useful feedback on the concept. However, for highly controversial ideas, the approach after stakeholder mapping may instead include working undercover for a time together with one or few supportive stakeholders, rather than actively 'diffusing' the idea.

Several other important aspects of the valley of death have been covered, but many of these are seen as entangled in the social context of diffusing the idea. For example, finding and communicating with potential supporters of the idea can be very helpful for obtaining management support, a management-level champion or resources. However, all these factors are also seen as entangled with the culture, why culture aside from mindset has also been suggested as an integral part of the model to be presented.

The researchers' main takeaways from the social process of adopting radical innovation

- Non-traditional or more radical ideas often need to pass the 'valley of death' (referring to challenges in the gap between the idea-stage and commercialization)
- Critical factors for crossing the valley includes champions, resources and development process which in turn are affected by organizational structure, management support and culture
- Additionally, diffusion and anchoring of an idea occurs in a social context and happens over time, requiring sharing of information between key individuals in the strategic web
- Packaging and framing of a radical idea can be very helpful for this diffusion in the strategic web and ultimately in crossing the valley of death

5.4 Selection under uncertainty

Even though ideas are creatively explored, so that more specified proposals are provided, the challenge remains of knowing which idea to select, i.e. invest in further exploration. This particularly holds for more radical ideas, for example targeting new markets for which there is no available data, or including radically new technologies which are only partially developed. Under such circumstances, standard criteria for selection may be less appropriate. With these type of challenges in mind, the researchers reviewed alternative ways to select ideas. This section provides the result of this literature screening.

Martinsuo and Poskela (2011) state that it is not the evaluation process that create innovation performance, but instead how the evaluation process helps in understanding the concept and its associated factors. Consequently, the authors question the use of formal evaluation criteria especially with regards to radical innovation, since more informal criteria allow for more flexibility and to seek new knowledge when it is needed. This is supported by Ettlie et al. (1984) and Bessant et al. (2010) who state that innovations need to be assessed depending on if they are radical or incremental, and also Rice et al. (1998) who conclude that traditional techniques are inappropriate for radical innovation due to the high uncertainty and that radical innovations require fundamentally different management practices. As a result, many firms use parallel or alternative selection structures for assessing radical innovation (Bessant et al., 2010). This points toward the relevance of having alternative selection approaches for radical ideas, which is hereby described.

5.4.1 Alternative selection approaches

For the selection process of radical innovation, Bessant et al. (2010) advocate using an expert board of managers who may support and provide resources to evaluate radical ideas or methods that rely on integration of larger evaluation groups. These integration methods build on *wisdom of the crowds* and *crowdsourcing*. Expert evaluation methods include Dragon's Den inspired by the TV program model of presenting pre-screened business ideas to a group of investors and Presentation Rounds which is similar to Dragon's Den with the difference that no pre-screening is conducted and thus all sorts of ideas may be pitches including incremental ideas. Integration methods include internal idea markets where employees outside of R&D are included in the selection and innovation contests where customers are included in the selection process. What is common with all of these different selection processes is that they bypass the formalized decision making routines.

Further review of expert intuition
Since the expert board of managers and dragons den approach can both be seen as building on *expert intuition*, this was seen as relevant to investigate further. Lecou et al. (2011) state that radical innovations contain uncertainties on a multidimensional level and all techniques

are dependent on the quality of the data, which means that using techniques for forecasting and evaluating data may lead to poor decisions. As a result, intuition has received more attention as a decision technique. The authors further state that intuition is one of the few common qualitative evaluation techniques that are used in high risk environments. Intuition is also as previously mentioned also advocated by Rochford (1991) to be used in the second screening.

Sadler-Smith and Shefy (2004) define intuition as consisting of two interrelated facets; as an expertise that is manifested as a subconscious decision heuristic and also as a gut feeling that connects mind and body. Rules of thumb or heuristics are responsible for producing gut feelings and need only minimal information to solve a problem (Gigerenzer, 2008). However, due to the inherent subjectivity of intuition there is a risk of bias from cognitive blunders such as ignorance or overconfidence, which might mislead evaluators to lock on to potentially misleading views (Day and Shoemaker, 2004). Consequently, Sadler-Smith and Shefy (2004) suggest that intuition and idea assessment techniques should be seen as complementary and mutually reinforcing. Together, intuition and idea assessment techniques can lower a decisions vulnerability to bias (Lecou et al., 2011).

It is worth noting that as Magnusson et al. (2014) state, the degree of confidence in expert intuition can be seen as dependent on school of thought. The natural decision making (NDM) researchers view intuition as a cumulative skill that is built from gathering experience from previous decisions, thereby adding knowledge and ability for future decision-making. NDM includes pattern recognition as a cornerstone, and aims to demystify the presumed cues experts use in their decisions. As further stated by these authors, the heuristics and biases (HB) perspective, on the other hand, although also seeing intuition as experience-based, emphasize that intuition uses rule-of-thumb inferences in order to speed up the process of identifying 'good enough' solutions. Kahneman and Tversky provide a quote highlighting this aspect (1974, p. 1124): "people rely on a limited numbers of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations". While both the NDM and HB school of thought share the view that intuitive decision-making is automatic, unconscious and effortless, HB has a lower level of confidence in intuitive decisions (Magnusson et al., 2014).

In exploring expert intuition further, Kahneman concluded that it works well when situations are sufficiently regular to be predictable (Easterly, 2011). Stated differently, this type of unconscious pattern recognition works well for chess, but does not apply to prediction of Middle East politics (Easterly, 2011). Additionally, while also taking the HB view on expert intuition, Kynn (2008) discusses how to improve intuitive probability assessments by experts (which is relevant since heuristics in expert intuition are seen as simplifying probability assessments to rules of thumb which can bias conclusions). The author group biases with regards to intuitive probability assessment in categories of consistency (i.e. internally consistent/coherence, externally consistent/calibration and self-consistent/reliability), and provides ten concrete guidelines for eliciting expert knowledge to remedy the effect of heuristics and biases, and these recommendations are provided in appendix D.

The researchers' reflections on alternative selection approaches
Regarding *wisdom of the crowd* and *crowdsourcing*, the researchers once again emphasizes that while such approaches may provide useful insights, critical thinking is advocated not to bias innovation towards what is within the frame of reference of the crowd, and hence innovating towards a local rather than global maximum (e.g. making that 'faster horse', again).

A conclusion the researchers draw from the theory on *expert intuition* and the suggestions by Kahneman (2011) that it may be more suited in contexts that are regular and predictable, is that it *may* be more suited for assessment of incremental innovation, but vulnerable to

several biases in assessment of radical innovations, which per definition have higher uncertainty and are less related to previous patterns. For example, a paradigm-changing, radical innovation may be incorrectly dismissed while assessed unconsciously under the premises and patterns of the current technological paradigm.

However, the degree of confidence depends as stated on school of thought, and for example Bessant et al. (2010) suggested that expert boards are favorable for evaluation of radical ideas.

The researchers hence suggest that pattern recognition should not be underestimated, and state that experts may be able to apply patterns from one area of application to evaluate an idea in another application area, and including known elements from the first area may still provide for a *radical* idea when *applied in the second area* of application. Therefore, it seems inappropriate to dismiss the potential of using expert intuition, but more appropriate to emphasize critical thinking, including attempts at awareness of current paradigms, mental lock-ins and important biases, while using it. The standpoint of the researchers with regards to using expert intuition (including use of previously mentioned expert boards) is hence positive, but with emphasis awareness of mentioned aspects. This also points towards the importance of sufficient competence and knowledge of those managing the expert evaluations, for example including strategies to mitigate risk of biased assessments.

The researchers' main takeaways from alternative selection approaches

- Alternative approaches such as the dragons den, expert boards and wisdom of the crowds can provide favorable alternatives for evaluating ideas with high uncertainty
- Using the wisdom of the crowd, the researchers propose that practitioners should be cautious not to innovate towards a local maximum and stay within the current frame of reference
- Expert intuition can provide a useful complement in idea evaluation, as pattern recognition can guide decisions and save resources
- Expert intuition may on the other hand also lead to bias in decisions, and can be seen as building on knowledge from the *past*
- Critical thinking and awareness of the characteristics of expert intuition is vital when using it

5.4.2 Strategy and portfolio management's impact on selection

In relation to selection under uncertainty, strategic fit and portfolio management is two highly related concepts that may affect the selection, why strategy and portfolio management will be outlined in the following chapter in order to create an understanding of these fields of research. Strategy impacts numerous aspects with regards to managing the FEI, such as the openness to ideas which are not aligned with the set-out direction. Since radical ideas can also lead to required changes in strategy, or the emergence of new strategies, the degree of rigidness in the strategy sets a context for evaluation. Hence, in the following section, the reader should keep in mind that descriptions such as 'emerging strategies' are highly related to the selection of radical ideas.

Gaubinger and Rabl (2015) state that a clear and transparent innovation strategy is the foundation for effective innovation management. The innovation strategy and its goals are dependent on the firm's strategy and overarching goals. The goals of the innovation strategy are then what defines the innovation portfolio i.e. what type of ideas that are selected. The authors also stress that innovation strategy must be viewed as an essential part of the long term business strategy with the aims of realizing long-term innovation objectives. The authors also advocate that innovation strategy should be conducted as a meta strategy - integrating all company functions - to promote synergy and avoid functional isolation. As the authors state, a meta strategy is accomplished through communication and coordination. To

ensure long-term success, a firm must monitor the internal and external environment and be able to adapt to changes.

As mentioned, the goals of the innovation strategy are what defines the innovation portfolio and sets the context for idea selection. Several scholars argue for the importance of project portfolio management (PPM) in the FEI (cf. Frishammar & Florén, 2010; Cooper, 1998; Gutierrez, 2012). PPM is important because firms need to balance the idea portfolio (Frishammar & Florén, 2010) with regards to for example risk exposure, but also in order to align projects with strategies and optimize the utilization of limited resources (Gutierrez, 2012). PPM consists of an active revision of development projects - new projects are evaluated, selected and prioritized while existing projects may be reprioritized (more/less important) or shut down. Killen et al. (2008) advocate that adopting and improving PPM management and processes should be a priority for innovative firms.

Strategic fit of a portfolio equals how well the business strategy is reflected in the sum of all projects in the portfolio (Meskendahl, 2010). A common method used for achieving strategic fit is Strategic Buckets (Cooper et al., 1998; Verbano & Nosella, 2010). The Strategic bucket method allows firms to create spending categories from business strategies and assign them a proportion of the portfolio (Gutierrez, 2012). Projects are then selected to fill all categories - in the right proportion. The same method is also used for proposals in order to avoid suboptimization as a lack of proposals in a specific category could lead to inferior options (Gutierrez, 2012). In relation to strategic fit, Cooper et al. (2001) advocates a strong strategy that allows for strategic alignment toward goals. Gassmann and Schweitzer (2014) on the other hand argue that while such strong strategies may aid in finding target-oriented innovation they may at the same time hinder strategies that are not aligned. The issue is that in dynamic environments a company might need to change core competences in order to stay successful, and a rigid strategy such as advocated by Cooper et al. (2001) might kill off emerging strategies that would have been more successful than the old (Gassmann & Schweitzer, 2014). This is highly related to radical ideas as those ideas may not be aligned with current strategies, but can create substantial upsides. Further, Nagji and Tuff (2012) suggest three approximate golden ratios of how resources should be allocated in relation to the nature of the idea as a result of a study of successful firms. However, the authors state that these are only guidelines and specific firms may benefit from other ratios. These golden ratios are shown in Figure 5.9, transformational and adjacent is what the researchers refer to as radical innovation.
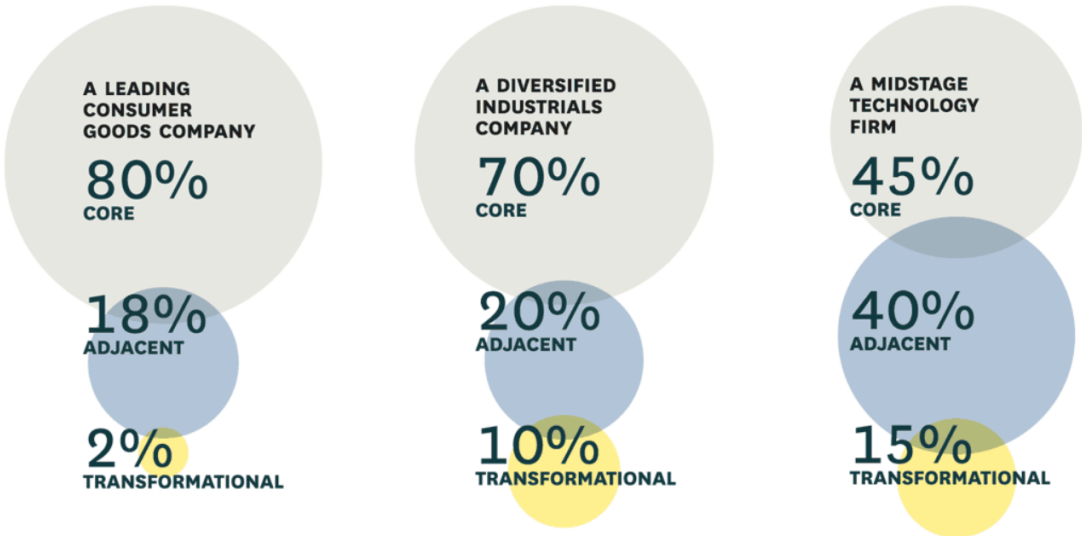

Figure 5.9 Three types of golden ratios for different type of firms (Nagji and Tuff, 2012)

Balancing the portfolio is essential to achieve the appropriate mix of short-term profit and potential long-term competitiveness or exploitation of current knowledge and exploration of new knowledge (Cooper & Edgett, 2003; Geraldi, 2008). Also, balancing the portfolio is important because an undiversified portfolio can lead to negative consequences such as cash flow issues or an imbalanced risk profile (Archer & Ghasemzadeh, 1999). However, O'Connor (2008) states that diversifying a portfolio consisting of high-risk innovations may be challenging, since for example if the firm decides on a direction for competence development to enable a category of radical innovations, other innovations will also tend to correlate with regards to that direction. Further, in PPM there are many different type of ideas which in turn makes evaluation and selection of projects more of a challenge, and creates a need for a flexible decision process (Bessant et al., 2011; Geraldi, 2008; Blichfeldt and Eskerod, 2008). Related to this, Gutierrez (2012) concludes that PPM decisions are often ambiguous which in turn leads to difficulties for managers to choose decision criteria or place ideas in pre-defined categories such as strategic alignment. As a consequence, managers take action and try to gain as much information as possible in order to make sense of the situation and for example be able to find the right criteria (Gutierrez, 2012). This sense making process is often carried out during the course of the evaluation and selection process, which means that classification of ideas is the *output* of a process and not an *input* that decides how the process should be carried out (Gutierrez, 2012). Thus, Gutierrez's (2012) findings question the view that the classification of an idea can be pre-defined.

Reconnecting to the previously mentioned real options, O'Connor (2008) states that real options can be used as a way of managing a portfolio of high uncertainty innovations. This includes for example deciding whether to invest in a technology with highly uncertain future, making the objective of a funding milestone to reduce uncertainty about the opportunity, and hence account for the option value at go/kill gates.

The researchers' reflections on strategy and portfolio management's impact on selection

After the literature review on strategy and PPM the researchers realized that strategic fit and balancing portfolios is much easier in theory than in practice mainly due to the uncertainties generally inherent in more radical ideas that lead to difficulties in defining the degree of strategic fit of the idea. The researchers therefore argue in line with Gassmann and Schweitzer (2014) that looking too narrowly on strategic fit may kill great ideas. Therefore, the conclusion the researchers draw from this theory is that while strategic fit criteria may be suitable for more incremental ideas, firms should let some ideas pass that lack strategic fit, have unclear strategic fit, or have an innovation strategy that allows for new strategies to arise from radical ideas.

The researchers' main takeaways from how strategy and portfolio management impacts selection

- The researchers propose that the innovation strategy should allow for ideas that are not aligned with the strategy in order to create strategic flexibility and hence allow for radical innovation arising from radical ideas that may not be aligned with the current strategy
- Balancing a portfolio is not as easy in practice as in theory because the classification of an idea might not be known ex-ante. However, thinking in terms of the 'golden ratio' can still be helpful in justifying investment in more radical ideas.

5.5 More long-term aspects of the model and mindset: Assumption-based Planning

Methods such as lean startup and customer development build on testing more short-term assumptions in order to find a viable business model for the idea and may be of significant importance when introducing an innovation. However, long-term assumptions are also of importance, especially for strategic purposes (Dewar, 2002). As an example, Bessant et al. (2010) as well as Alänge and Lundqvist (2014) argue that looking at future trends and scenarios are of importance to idea evaluation. More specifically, Bessant et al. (2010) argue that using techniques such as trend extrapolation and scenario building aid firms in developing models of the future that may be used to identify potential threats and opportunities and thereby can aid an organization in realizing the need for selection of radical ideas. This type of logic is used for strategic formulation as well using for example SWOT-analysis (Dyson, 2004). The point is that all of these predictions of the future whether it is a scenario building or a strategy formulation rely on some kind of assumptions and it is therefore of importance to monitor these assumptions as changes in underlying assumptions can completely change the game (Dewar, 2002). The researchers hence note that a strategic approach that accounts for uncertainties with regards to *all* underlying assumptions on the long term can be more comprehensive, or at least complementary.

Originally applied in military strategy, Assumption Based Planning (ABP) is a strategic tool that acknowledges the fact that all plans contain assumptions regarding the future and that some of these assumptions will be critical for the plan's success. Dewar (2002) states that ABP aims to create robustness and adaptability by limiting surprises in any plan, which is done by reducing the risks related to the assumptions. The strength of ABP is that it treats every assumption individually where warning signals and actions that can be taken to help the planners are identified for each assumption. Further, ABP is best used as a post-planning tool and requires an initial plan or concept. The author also states that ABP is particularly well suited for uncertain circumstances because uncertainty means more critical assumptions that may not be identified without the use of ABP. Hence, ABP adds more value the more chaotic the times are.

Dewar (2002) states in any plan/concept there are assumptions regarding what the future holds and whether the plan will play out as desired. Further, firms are generally good at monitoring and shaping whether the plan will play out as desired. However, the more uncontrollable but equally important future does not receive the same attention. ABP is a method to better handle the future. The assumptions that may cause surprises in the plan and therefore are of interest are called load-bearing and vulnerable (Dewar, 2002). Load-bearing refers to the fact that the success of the plan relies heavily on the assumption while vulnerability refers to the likelihood of the assumption to be nullified in the future. Further, the vulnerability of an assumption might be one or two-sided. One-sided means that the failure of an assumption will impact the plan in a harmful way while two-sided describes the possibility that an assumption failing might lead to positive or negative changes of the plan.

Once the assumptions have been identified, Dewar (2002) proposes identifying signposts, shaping actions and hedging actions as seen in Figure 5.10. Signposts are events or thresholds that act as warning signs and are used to monitor the load-bearing and vulnerable assumptions. The signpost will signal if an assumption is weakened or broken and thus need to be dealt with. Shaping actions are actions in order to control the future to the extent that is possible in order to get the plan to play out as desired. Hedging actions are plausible actions in case the assumption would fail. To clarify, shaping actions are actions in order to get the plan to play out as desired and hedging actions are actions that one can prepare for if the plan does not play out as desired. Dewar acknowledges the issue of identifying too many assumptions as identifying signposts, shaping actions and hedging actions is demanding, which is why only load-bearing, vulnerable assumptions are looked into.
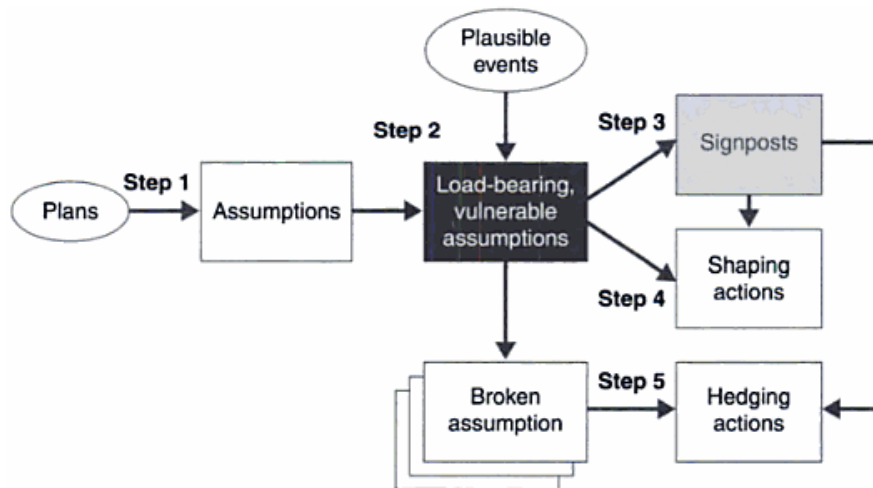
Figure 5.10 Overview of the assumption-based planning process (Dewar, 2002)

The researchers' reflection on this theory

The researchers at this point believed that assumption-based planning has a favorable place in an integrative approach to managing ideas with high uncertainty. Firstly, it provides a valuable complement to the previous methods since it is more geared towards managing long-term. Secondly, ABP was seen as unique in its view of two-sided assumptions, and its rigorous approach to both hedge for the downside but also plan for capturing the upside by systematically monitoring signposts. In particular, the inclusion of accounting for the upside seemed very favorably aligned with the overall mindset proposed, in which uncertainty is not necessary something inherently negative, but something which provides opportunities and can be a source of innovation and competitive advantage.

The researchers' main takeaways from Assumption-based Planning
- ABP is a post-planning tool that requires an initial concept
- ABP is well suited for high-uncertainty situations
- The approach includes identifying all assumptions regarding the future which may impact the outcome of the plan i.e. load-bearing, vulnerable assumptions
- ABP uses shaping and hedging actions in order to maximize positive and minimize negative impact from changes in the assumed future

5.6 Surfacing assumptions

In order to provide a holistic model and mindset which provides both creativity and strategic management, the researchers maintained their view that managing assumptions explicitly is favorable, which is also indicated by the approaches provided so far. Working explicitly and systematically with assumptions as part of a holistic approach was also verified in the expert interview with Lundqvist (2015), who stated that this was seen as a modern and attractive. Going on, it was realized that assumptions needed to be readily surfaced as part of this overall approach to idea evaluation, and the researchers suspected that the more ad hoc, brainstorming approach used in phase 1 may not be the most sufficient.

The rationale for going specifically into the lists and frameworks provided in this section is:

1. During comprehensive literature search for exhaustive frameworks and categories of assumptions, relatively little was found
2. The ones provided proved to be practically applicable
3. They also provide examples of tools to be used in the overall model which is suggested by the researchers

5.6.1 Theory on assumptions

The iterative approaches such as discovery-driven planning, but also the more long-term oriented approach of assumption-based planning, require identification of assumptions, and the researchers hence made a new attempt at identification. As stated, in contrast to phase 1, the researchers now used the creativity technique "C-K" to more readily conceptualize ideas in order to identify assumptions of a more ready-made concept (and a description of this technique is provided in appendix A). In order to be able to identify assumptions more systematically, a comprehensive search for assumption surfacing techniques was done.

The original providers of discovery-driven planning, McGrath and MacMillan (1995) provide twelve dangerous implicit assumptions to consider:

1. Customers will buy our product because we think it's a good product
2. Customers will buy our product because it's technically superior
3. Customers will agree with our perception that the product is "great"
4. Customers run no risk in buying from us instead of continuing to buy from their past suppliers
5. The product will sell itself
6. Distributors are desperate to stock and service the product
7. We can develop the product on time and on budget
8. We will have no trouble attracting the right staff
9. Competitors will respond rationally
10. We can insulate our product from competition
11. We will be able to hold down prices while gaining share rapidly
12. The rest of our company will gladly support our strategy and provide help as needed

Going on to a presumably more comprehensive framework, the professional consultancy Vervago (2015) states that identifying assumptions can be difficult. Aside from often being implicit in nature, the challenges increase due to the fact that we generally don't receive a lot of training in identifying assumption. However, the authors claim that the best way to build a skill in recognizing assumptions is to become familiar with common categories of assumptions, and suggest that the following nine are the 'most useful' categories (including examples, providing the original without modifications, p. 1):

1. An **existence** assumption is an assumption that something exists.
   Example: When a person says, "The solution to the morale problem is…" they are assuming that a solution exists. They are also assuming that a morale problem exists.
2. A **uniqueness** assumption is an assumption that there is only one of something. In the above example, it is assumed that there is one solution and one problem.
3. A **measurement** assumption is an assumption that something is measurable.
   Example: Someone claims that they have found the solution to a morale problem. This assumes that there is an accurate way of measuring changes in morale.
4. A **possibility** assumption is an assumption that something is possible, or feasible.
   Example: When somebody says that they are trying to solve a problem, they are assuming that finding a solution is possible, or that under the circumstances it is feasible. It could be that the solution is too expensive, or would take too long to implement, to be a viable solution.
5. A **value** assumption is an assumption that something is good or bad.
   Example: When someone says, "This isn't a problem, it's an opportunity," they are trying to put a positive value on what was assumed to have negative value.
6. In our statements to other people we always make **audience** assumptions. These are often about shared meanings, shared values, or shared background.
   Example: A team is discussing its marketing strategy for target clients. They are unable to agree. Someone asks, "What assumptions are we making about our target

clients?" Suddenly the group realizes that lack of agreement stems from divergent assumptions at this level.

7. Language forces us to categorize. A **category** assumption is an assumption that we have categorized something correctly.
Example: A team leader tells his manager there is a "morale problem" on his team, when it could be that low pay or high turnover is the actual problem.

8. Human thought is guided by similarities or analogies, the vast majority of which are unconscious. These can be expressed in **similarity** assumptions.
Example: A company is trying to create a marketing strategy for Shanghai. Someone says, "As we learned in Beijing…" This assumes that the two markets are not fundamentally different.

9. A **time constancy** assumption is an assumption that things will stay the same over time.
Example: In 1977, Ken Olsen, the founder and CEO of Digital Equipment Corporation, said, "There is no reason for any individual to have a computer in his home." He assumed that the nature of computers would not change with time.

Another way of categorizing and identifying assumptions is to think in terms of the business model canvas, which was previously outlined (5.1).

Additionally, stakeholder mapping that was mentioned in a previous section (5.3) is another approach to mapping various interests, and it can be used for identifying assumptions related to these stakeholders, such as assumptions about customers, employees, suppliers, competitors and so on (cf. Maylor, 2010; Smith, 2015).

5.6.2 Result of application and creation of framework for assumptions

This section outlines results and reflections on applying the theory above on ideas from the innovation jam, including the use of C-K as a creativity technique to provide more specified concepts. The analysis also led to generation of new theory based on experience from the process, including a framework to complement the model to be presented in the next chapter.

Regarding the first provided twelve dangerous implicit assumptions provided by McGrath and MacMillan (1995), these may be seen more as a 'list' than an overall framework. However, the researchers found it useful as an initial checklist in order to start thinking in terms of assumptions, but it should certainly not be seen as exhaustive in and of itself.

Going on to the framework with 9 categories provided by Vervago (2015) the researchers found that this was a useful framework to cover a wide range of assumptions, including both the short and long term. The identified short-term assumptions seemed relatively closely resembling those identified through brainstorming in phase 1, but the method allowed for identifying additional assumptions. Regarding the long term, some identified assumptions would seem more 'philosophical' in nature. These assumptions were nonetheless viewed as important vulnerabilities to the ideas that would be more challenging to identify through brainstorming.

The business model canvas was also tested. With further analysis of this framework, it was concluded that the business model canvas provides a relatively comprehensive and intuitive grouping for short-term assumptions. Additionally, probing with the pre-mortem approach of asking the question suggested by Blank and Dorf (2012) *What would make this business fail?*, here exchanging *business* with *idea*, provided a favorable approach to identify many important assumptions. However, when applying stakeholder mapping as an additional approach, an important lacking was identified in that the categories of the business model canvas does not consider all stakeholders, and their related assumptions. The importance of

this is further highlighted when thinking in terms of crossing the valley of death, as previously described. Customer segments, key partnerships and channels may cover some stakeholders, but not all. For example, stakeholder mapping can surface assumptions regarding how other employers may act as a result of 'competence destruction' related to a radical idea, or assumptions about competitors or current suppliers. Additionally, 'key resources' was found to be very broad, and an analyst or group may want to include subcategories, for example assumptions relating to technology, competence and so on.

The process of creating the framework for assumptions

In addition to the hitherto described ways of identifying assumptions, the researchers also tried various other approaches to identification and categorizing assumptions. It was thereby discovered that dichotomies can be useful in order to identify and categorize different types of assumptions. Problem/solution is a dichotomy suggested by Dewar (2002), and the other ones suggested are generic. The researchers hence tried the dichotomies seen in Figure 5.11.
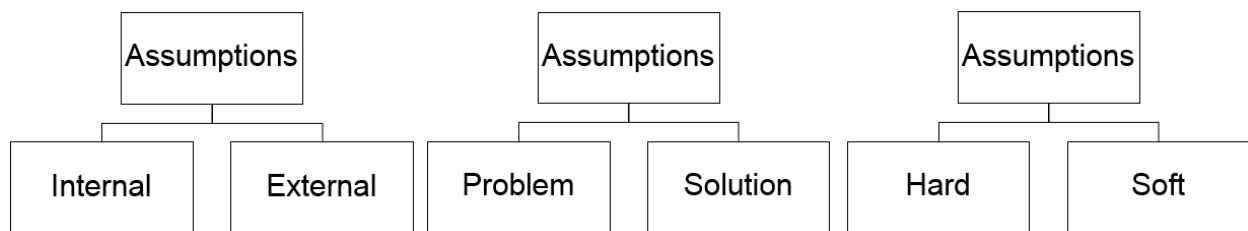
```
┌──────────────┐          ┌──────────────┐          ┌──────────────┐
│ Assumptions  │          │ Assumptions  │          │ Assumptions  │
└──────────────┘          └──────────────┘          └──────────────┘
┌────────┬─────────┐      ┌────────┬─────────┐      ┌────────┬─────────┐
│Internal│ External│      │Problem │ Solution│      │  Hard  │  Soft   │
└────────┴─────────┘      └────────┴─────────┘      └────────┴─────────┘
```

Figure 5.11 Dichotomies for categorizing assumptions

This was also done with the intention of finding a *general framework*, i.e. a tree structure which would branch out in categories which were mutually exclusive and collectively exhaustive (cf. Rasiel, 1999). However, although for example the dichotomy of 'internal/external' may be exhaustive by nature, approaches such as the previously mentioned nine categories, business model canvas and stakeholder mapping were more suggestive and provided more specific mental guidelines. In addition to this, it was concluded that using such a dichotomy may lock in the thinking, and may prohibit the use of other frameworks containing groupings which are less compatible with the dichotomy (i.e. if subcategories appear under both branches, the dichotomous branching may be of questionable value).

Over the process of iteratively testing the described approaches to assumption surfacing, the researchers came to an important conclusion. There is one category of assumptions which are more related to the *short-term* implementation of an idea. These types of assumptions were observed to be closely related to the short-term '*business case*' of the idea, including for example that technology and competence could be provided, and that customers would want the result. These assumptions were also often more 'testable' on the short term, and therefore seen as well suited for iterative approaches such as discovery-driven planning. (This also goes in line with that using the business model canvas tended to result in identification of more short-term oriented assumptions, as mentioned.)

On the other hand, there was also second category of assumptions observed, being concerned with the more long-term implementation and management of the idea, also including the time after it has been realized as an innovation. These assumptions were sometimes more philosophical in nature, but nonetheless included important vulnerabilities to the future potential of the idea. This realization, aside from noticing the nature of assumptions identified in the ideas, was done with inspiration from both Dewar (2002), discussing assumptions related to the future of a plan, but also Bessant et al. (2010) and Alänge and Lundqvist (2014) emphasizing consideration of future scenarios and trends.

As previously mentioned, iterative approaches such as discovery-driven planning and lean startup are less concerned with the more long-term assumptions of an idea, and therefore, assumption-based planning was seen as providing a valuable complement. Going back to the mentioned aim of building a structure for categorizing assumptions, the researchers hence built a framework branching out in the distinction between short-term and long-term assumptions, to reflect this realization, as seen in Figure 5.12.
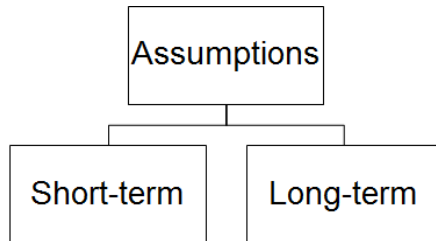
```
        ┌─────────────┐
        │ Assumptions │
        └─────────────┘
              │
      ┌───────┴───────┐
┌────────────┐ ┌────────────┐
│ Short-term │ │ Long-term  │
└────────────┘ └────────────┘
```

Figure 5.12 Distinguishing between short-term and long-term assumptions

In contrast to the short term for which frameworks such as the business model canvas provided suggestions of categories, the researchers did not find a ready-made grouping while searching for literature on categories specifically for the *long* term. However, through analysis, it was concluded that assumptions about the future can be grouped into three categories:

1. *Constants*, i.e. assumptions regarding what will be *preserved* on the long term
2. *Events*, i.e. assumptions about what will (more suddenly) happen in the future
3. *Trends*, i.e. assumptions regarding a pattern (e.g. cycles) or rate of change (e.g. linear or exponential) that will be maintained

Hence number 1 is concerned with preservation, and number 2 and 3 is concerned with two identified types of change. Examples may make these three categories more intuitive: An example of a constant would be the assumption that 'the oil price will stay above $40 per barrel'. Secondly, an example of an event would be the assumption that 'the development of artificial intelligence will *spike* within 10 years'. Lastly, an example of a trend would be the assumption that 'the interest will rise over the 5 coming years', or regarding 'pattern', that 'the interest rate will correlate significantly with business cycles in the future'. Distinguishing between these three types of long term assumptions was also confirmed as relevant in the expert interview with Lundqvist (2015) due to its exhaustive nature.

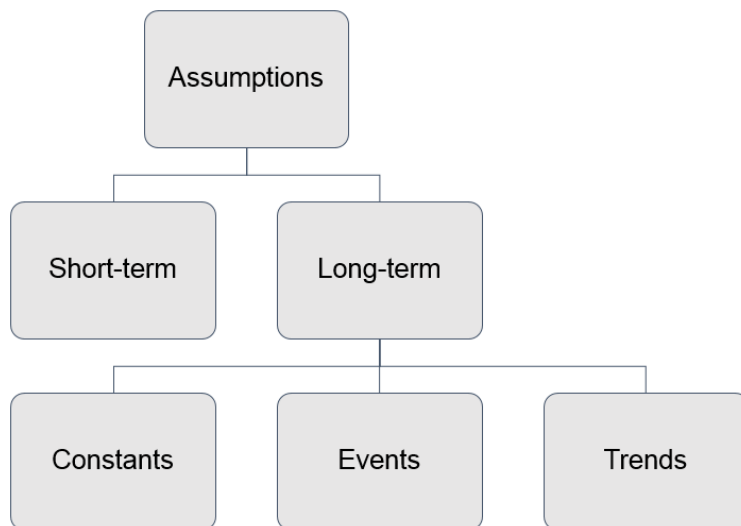Figure 5.13 shows the resulting framework as proposed by the researchers.

Figure 5.13 Framework for assumptions

While the groupings provide some mental guidelines for identifying many assumptions, the recommendation is to use several frameworks such as the ones provided, complemented with general brainstorming to approach identification from several cognitive directions. As mentioned, several business-oriented frameworks seem applicable for guiding thinking for identifying short-term assumptions, such as the business model canvas complemented with other approaches. On the long term, brainstorming in the three subcategories can be complemented with frameworks such as PESTEL and the framework by Vervago (2015). However, it is important that long-term assumptions do not only concern the external environment, but also internal factors such as the retention of required competence. Additionally, it bears mentioning that general business analysis not focusing specifically on assumptions are assumed to be included in the idea evaluation of firms, and it may be the case that unintentionally omitted assumptions are surfaced during that process.

While Dewar (2002) recommend against the use of frameworks due to their limited nature, and the researchers agree in the sense that using only one guiding framework may limit identification. However, the researchers argue that combining several frameworks can be very favorable. The experience throughout the actual identification process was that frameworks for identification were very useful to guide thinking in different directions. For example, the business model canvas was seen as useful providing several important categories to think in terms of, but did not include all stakeholders. Stakeholder mapping was hence seen as complementary, and mapping important stakeholders such as key people in the organization and identifying important assumptions relating to their interests and behavior was seen as useful early on to increase the chance of a radical idea's survival and adoption. Aside from brainstorming in the long-term categories of constants, events and trends, the Vervago framework (2015) with nine categories was seen as useful for guiding thinking; aside from identifying short-term assumptions, it was observed as particularly useful for more philosophical but important long-term assumptions that may be challenging to spontaneously surface without a systematic method.

From the experience, identification became more efficient and intuitive over time, but frameworks still provided favorable guidelines to double-check that important areas had not been omitted. Additionally, for the purpose of building a model in this thesis, the argument is that the distinction between short-term and long-term assumptions is suitable as they require different approaches. Lastly, the researchers suggest that frameworks for further grouping short-term assumptions *can* be favorable to provide structure for a business case before testing assumptions (e.g. business model canvas and complementary categories including

stakeholder mapping), but that practitioners need to be aware of (1) not to miss out on categories of assumptions and (2) potential trade-offs between practical utility of structure, and constraints on creativity stemming from thinking in these structures.

5.6.3 The researchers' reflection on theory on, and testing of surfacing assumptions

Over the process of literature screening on surfacing and categorizing of assumptions, no framework was found that was in itself fully exhaustive yet applicable to the situation. For the purpose of building an integrative model including managing assumptions, the researchers' distinction between short and long-term assumptions, the latter including three types, appears to provide a contribution to this stream of literature.

While it was first seen as desirable to arrive at a single framework for identification, it was later realized that this may put too narrow constraints on the identification process. Stated differently, although exhaustive categories exist, it seems favorable to combine frameworks for a more comprehensive analysis.

The researchers' main takeaways from surfacing assumptions

- The distinction between short-term and long-term assumptions was seen to provide a highly useful way to categorize assumptions, since the two differ in nature and call for different methods
- The short-term assumptions are often more testable, and more related to the business case of an idea
- The long-term assumptions are often less testable, and can be more philosophical in nature
  - The researchers propose that long-term assumptions can be divided into assumptions about *constants, events* and *trends*
- The researchers propose that iterative approaches such as discovery-driven planning, lean startup, customer development and design thinking (its iterative process) are well suited for approaching short-term assumptions
- The researchers further propose that Assumption-based Planning is well suited for managing long-term assumptions, and is also well in line with the proposed mindset
- For identification of these assumptions, the researchers propose the use of multiple frameworks complemented by general brainstorming to approach identification from several directions, and proposed useful frameworks have been provided

6 Proposing an integrative model and mindset for idea evaluation

In this section, the researchers will provide the mindset and model based on the discoveries of the project. First, the mindset is described, together with reflections around its constituents and relating it to the literature. Thereafter, the model is presented. This will be done first without problematization, to describe its design and its constituents. Then, the motivation of the constituents, their connection to previous discoveries and literature, and trade-offs related to the design are provided.

6.1 Presentation of mindset

The mindset is provided once again in Figure 6.1. As seen, aspects of the mindset have been gone through in this chapter. Although for example Design Thinking can be seen as more explicit about representing a different type of mindset towards uncertainty, several of the other approaches or methods are seen as representing an alternative mindset implicitly, by suggesting or implying alternative logics or attitudes.

The proposed mindset is seen as most favorable to implement at the company level, as this would enable sharing a similar type of logic and attitude towards uncertainty among for example idea providers, champions, idea evaluators and management. This section serves to provide the researchers reflections around, and motivation of the constituents of the mindset.

3 Cornerstones of the Mindset		
(1) Learning-oriented and Iterative	**(2) Flexible and Strategic**	**(3) Open and Creative**
Can include: • Discovery-driven Planning • Customer Development • Lean Startup • Design Thinking	Can include: • Real options reasoning • Assumption-based Planning	Can include: • Creativity techniques • Design Thinking

5 Principles of the Mindset
(1) Uncertainty is a source of *opportunities*, not only *threats* (2) Radical ideas are *creatively explored*, not *linearly reduced* (3) Experiments provide *learnings*, not *failures* (4) Constraints and trade-offs are exciting challenges to be *overcome*, rather than *blindly accepted* (5) Empathy is a source and promoter of *innovation*, not merely an act of *altruism*

Figure 6.1 Cornerstones and Principles of the mindset proposed by the researchers

The 3 cornerstones of the mindset
The 3 cornerstones identified is meant to, aside from grouping methods, highlight the integrative nature of the mindset in the sense that open and creative approaches are combined with more strictly analytical and strategic aspects. The three cornerstones are believed to be highly relevant for firms that would like to balance their innovation portfolio more towards radical innovation. The methods included are also closely related to the provided principles.

Learning-oriented and Iterative: The learning-oriented and iterative cornerstone of the mindset is heavily influenced by iterative approaches such as Discovery driven planning (McGrath & MacMillan, 1995), Lean Startup (Ries, 2011), Customer Discovery (Blank and

Dorf, 2012) and also Venkataraman et al. (1990) who argue that these approaches work well for new ventures or innovations that are outside of the current knowledge of a firm. These approaches build on learning and using that knowledge in order to create a better innovation.

Design thinking has also influenced the cornerstone to a large extent with its iterative approach by moving back and forth between phases (Brown, 2009; Liedtka and Ogilvie, 2011) in order to learn from failures and be open to changes (Carlgren, 2013).

As observed in these methods, the value of learning is emphasized, and this in itself can provide for both more openness to radical ideas, but also more effective management of uncertainty. Using an iterative approach also enables dividing larger commitments into smaller steps of testing and going outside the frame of reference (Bessant et al., 2010), which can increase openness of decision-makers and support funding of radical ideas. Additionally, the experimental approach enables generation of new data which is particularly useful for radical ideas as little data may be available. Experiments can hence provide facts for further decisions rather than basing these decisions on blind guesses or faith. The value of learning also implies that even though an idea in itself might be a failure, the learnings might provide insights for other ideas and is therefore seen as valuable.

Flexible and Strategic: The flexible and strategic cornerstone is heavily influenced by assumption-based planning (ABP). As many scholars such as Garcia and Calantone (2002) and Bessant et al. (2010) have concluded, more radical innovations contain a higher degree of uncertainty, which can be set in relation to Dewar (2002) who states that the more uncertainty, the better fit for ABP because ABP then aims to maximize the positive and minimize the negative impacts of changes in the future.

Real options reasoning has also been a major influence for this cornerstone because as Trigeorgis (1996) states, real options capture the value of flexibility in relation to changes in market and technology and thus accounts for future opportunities while limiting loss, and much of the value of real options lie in having the right but not the obligation to exercise an option. Also, this reasoning is in line with Vanhaverbeke et al. (2008) and Lecou et al. (2011) who state that real options are made for coping with high uncertainty. And last, McGrath (1999) states that uncertainty should be seen as positive for a real option and that real options can counter biases that lead to avoidance of failure, which further highlights the usefulness of real options reasoning as part of the mindset. Such countering of biases might be valuable because as Benner and Tushman (2002), Leifer et al (2001), McDermott and O'Connor (2002) advocate, focusing too much on incremental innovation harms radical innovation which in turn reduce a firm's long-term competitiveness (Day, 2007). Additionally, this is particularly relevant as radical innovation in innovation portfolios has seen a general, steady decline (Day, 2007).

This cornerstone also highlights that an integrative mindset should include strategic analysis, including systematically considering what may happen. Real options reasoning and assumption-based planning can be seen as emphasizing 'looking sideways' while looking into the future, not to omit indirect opportunities that may arise, in particular during implementation but also evaluation of radical ideas. Although the two are related, real options reasoning is more related to evaluation and accounting for the value of flexibility, whereas assumption-based planning is more related to long-term strategic planning to manage assumptions to both capture opportunities and attempt to minimize the downside. Complementing the mindset with more rigorous strategic analysis of ideas can both lead to more accurate evaluation, but also more favoring of radical ideas with high potential, having additional tools to manage their uncertainties. It may also lead to firms being open to more flexible approaches, e.g. allowing new strategies to emerge from radical ideas, as ABP allows for a more controlled management of the uncertainty that is related to this flexibility.

Open and Creative: This cornerstone is influenced by Design thinking with emphasis on its creative and open aspects as described by scholars such as Brown (2009) and Carlgren (2013). This reasoning is also in line with Gassmann and Schweitzer (2014) who argue that Design thinking may aid organizations in creating more radical innovations due to its creative aspect and openness to new ideas.

Creativity techniques such as C-K (Agogué et al., 2014) has also had a major influence on this cornerstone by providing opportunities to rethink and combine solutions (Gassmann & Schweitzer (2014) and ability to enhance ideas (Gaubinger & Rabl, 2015) and hence provide both openness to new concepts and creativity.

This cornerstone also highlights that aside from an experimental and strategic aspect of the mindset, it is vital to include creativity and openness. Design Thinking (while also included as an iterative approach) provided several important attitudes related to how designers think, using alternative logics and creative approaches, and creativity techniques have also been highlighted as an approach to explore ideas and realize more of their potential. This cornerstone also emphasizes that creativity and openness is important not to merely provide local maximums (cf. Vlaskovits, 2011) as opposed to global maximums, not to be hostile towards ideas outside the current frame of reference, but also not guide radical ideas into more well-known, convenient territory, instead making them incremental (referring to the mentioned tendency experienced by the researchers themselves).

The 5 principles of the mindset

Uncertainty is a source of *opportunities*, not only *threats*: *The first principle* is derived from a majority of the methods, having an explicit or implicit logic of leveraging uncertainty. For example, assumption-based planning emphasizes the two-sided nature of assumptions, while real options reasoning emphasizes that variance in the future is a value driver for options. This principle is also aligned with the iterative approaches, emphasizing opportunities related to new discoveries. Additionally, application of creativity techniques can be seen as a way of investigating opportunities related to an early-stage idea, rather than merely derive a simplified concept that removes any inconvenient challenges.

Radical ideas are creatively *explored*, not linearly *reduced*: *The second principle* can be contrasted with the linear view of idea evaluation provided in phase 1 of the project. Creative exploration is well in line with the methods in the first and third cornerstone, and the methods in the second cornerstone can be seen as serving to further motivate exploration. The principle is also in line with Alänge and Lundqvist's (2014) emphasis on creativity in idea evaluation. Assumption-based planning can also be seen as a way of 'exploring' what assumptions will hold in the future, and coming up with creative shaping and hedging actions to capture opportunities and manage deviations strategically. Real options reasoning can be seen as a way of 'exploring' indirect opportunities that may arise.

Experiments provide *learnings*, not *failures*: *The third principle*, while highly related to the second, is primarily geared towards attitudes provided by the iterative approaches of the first cornerstone. These methods are focused on hypothesis testing and/or learning from outcomes. However, the principle can be extended to use in other areas as well. For example when experimenting with concepts in creativity techniques, this can be seen as a learning process. Also, this principle is in line with Alänge and Lundqvist (2014), who emphasize the importance of keeping an open mind, to be curious, humble and non-judgmental towards ideas, and keeping in mind that ideas are also important opportunities for *learning*.

Constraints and trade-offs are exciting challenges to be *overcome*, rather than blindly *accepted*: *The fourth principle* is derived from logic stated to be used by design thinkers,

solving 'wicked problems' and generating creative solutions. It encourages questioning what seems like apparent barriers in the current frame of reference, and using integrative thinking to go beyond it and create radical solutions.

Empathy is a source of *innovation*, not merely an act of *altruism:* *The fifth principle* is derived from the emphasis on empathy in Design Thinking (and sometimes customer development). This is an important principle, since the mindset is relatively weighted towards the iterative, experimental approaches; as stated previously, blind experimentation can lead to finding only local maximums (e.g. once again considering the example of Ford making a faster horse rather than a car, cf. Vlaskovits, 2011). It was also stated that design thinkers use empathy and imagining the perspectives of others as a source of innovation (Brown, 2008). The rationale of the researchers is hence that integrating this principle of emphasizing empathy has an important role in understanding underlying needs, and doing so seems more likely to lead to more radical innovation in the process, aiming towards global maximums that may not be perceived by other firms only that may only scratch the surface of customer needs. There is hence also a strategic aspect to this principle. Going on with this rationale, the researchers suggest that empathy may also play an important role in bridging the valley of death, for a radical idea. This is since empathizing with stakeholders may provide for better ways to manage the process. For example, in a company with a major fraction of engineers who are technology oriented, it can be challenging for a market driven idea to be adopted (cf. Backman et al., 2007). A marketing-oriented individual providing an idea would be favored by imagining the perspective of an engineer, and vice versa, and empathy can hence serve to bridge the gap between different perspectives and logics that can otherwise kill a favorable idea.

General reflections on logic and its relation to culture

The principles and cornerstones can also be said to be highly related to abductive logic. Abductive logic, i.e. the logic of what 'might be' (Dunne & Martin, 2006), can be said to constitute an important part for example in the iterative approaches, but also in seeing opportunities within real options reasoning and assumption-based planning. Integrative thinking, i.e. not relying only on analytical processes that tends to produce 'either/or' type of choices (Brown, 2008), can also be seen as an important aspect highlighting the value of combining the cornerstones to fulfill the fourth principle of going beyond presumed constraints and trade-offs.

The mindset in general is also seen as closely related and interacting with the culture of a firm, which together with management support is what allows champions to rise within the organization and gather the resources needed to bridge the valley of death. Cooper and Kleinschmidt (1995) for example argue that critical success factors for innovation management include commitment and support from top management as well as commitment to risk taking, which the mindset arguably favors.

6.2 Presentation of model

The proposed model for organizing an idea evaluation process is seen in Figure 6.2. An important notice is that the arrows are not meant to exclude possibilities for iteration between steps. This is also emphasized in the mindset, which is to be seen as an integrative part of the model. On the contrary, iteration should be used when suitable, and the model should be seen as iterative rather than linear in nature. Another notice is that it may appear as though the researchers imply that ideas with high uncertainty necessarily have radical potential. This may not always be the case, but the correlation is assumed to be high since radical ideas generally have high uncertainty as discussed in the theory section, and since incremental

ideas that still have high uncertainty would likely be omitted earlier in the process (given the presumed unfavorable relationship between potential and uncertainty). The reason for focusing on uncertainty rather than talking directly about incremental and radical ideas is that this distinction is in reality not known a priori. This is also related to that the model should not be seen as linear; i.e. ideas which are selected for implementation in the left flow but later are realized to be more incremental, having lower uncertainty and hence being aligned with the NPD process can then be implemented in the right flow at an appropriate stage in the process.
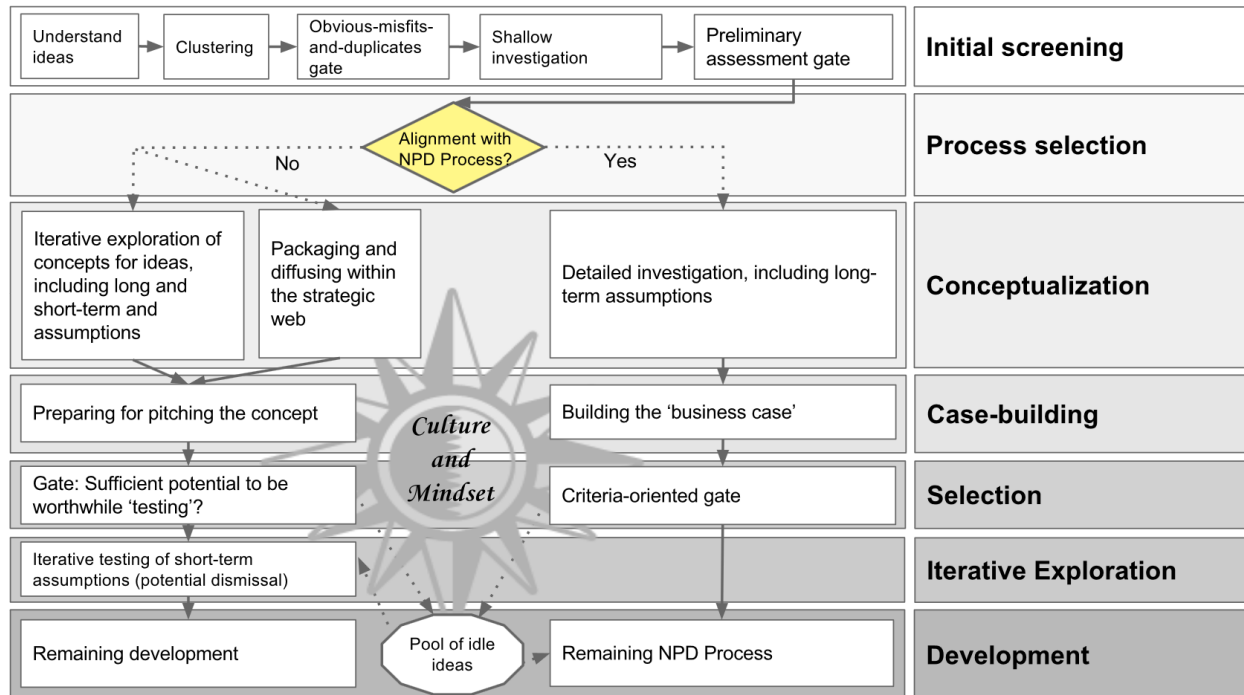
Figure 6.2 The model proposed by the researchers

Additionally, the following table aims to clarify what concepts and approaches are to be primarily used at what stage:

Phase \ Concept	Iterative approaches	Creativity techniques	Real Options Reasoning	Alternative selection methods	Assumption-based Planning	Assumption surfacing techniques
Initial screening						
Process selection						
Conceptualization		X	X			X
Case-building			X			
Selection			X	X		
Iterative exploration	X		X		X	X
Development			X		X	X

Table 6.1 Overview of methods and their primary application stages in the model

6.2.1 Initial screening

In the following preliminary assessment gate, looser assessment is used for ideas with high uncertainty (representing presumed radical potential), not to omit them using strict criteria. For more certain (i.e. presumed incremental) ideas, this gate is somewhat stricter and can be used to prioritize among ideas and select which ones are relevant to investigate further. The selection gate is needed in order to distinguish the ideas that the company would like to assess further, especially seeing as the more certain ideas may be large in numbers. For ideas with lower uncertainty ideas, this gate is seen as relatively straightforward for the firm and typical criteria that could be used involve a qualitative assessment of whether it is in line with company objectives and whether the idea is more certainly doable. However, the firm should not weed out ideas with higher uncertainty based on whether they are strategically fit or not but should instead let an amount (depending on desired risk profile and availability of resources) of more uncertain ideas with ambiguous strategic fit pass, and simply be looking at whether they think these ideas might be doable or not.

In general during this phase, it is proposed that activities can be managed by a front end team (FET) (cf. Nobelius & Trygg, 2002), as the team could be ensured to have the required competence for managing the early phases. Additionally, such a team could over time accumulate knowledge about what works more or less well at the particular company, and introduce potential customizations.

6.2.2 Process selection

In this phase, the decision has to be made regarding if the idea is suited for implementation in the traditional NPD process of the company. The implementation of ideas that are not deemed suitable for the traditional NPD process are hereafter described in the *left hand stream* while ideas that are deemed suitable for the NPD process are described in the *right hand stream.* The previous exploration should be able to provide answers to the questions soon to be provided. However, it is proposed that a FET can improve this capability of selecting the appropriate process over time by observing challenges met by more radical ideas in the organization, thereby providing more company-specific criteria for what should be weighed in this decision. Also, due to the iterative nature of the model, the process selection is not set in stone and may be changed if it is realized that the other process would fit better.

This selection of process is suggested to include answering the following questions:

- Is the idea outside the current frame-of-reference?
- Does it include a high degree of uncertainty which is not suited for a more linear assessment?
    - Is there a lack of data for the idea (e.g. completely new market or technology), making a creative, experimental approach with more abductive logic more suitable?
- Can it lead to competence destruction?
- Does it require competence acquisition?

Ideas that include yes to one or more of these questions are deemed to fit the left hand stream while the rest are deemed to fit the right hand stream.

6.2.3 Conceptualization

Left hand stream

Ideas that do not fit well for direct implementation in the NPD process are managed in the stream on the left hand. These ideas are often more radical in nature and include a high degree of uncertainty. In the Conceptualization-phase, it is proposed that a team of two to

three should be selected to further explore the idea, including an 'idea driver' with responsibility and enthusiasm about driving the development of the idea forward. In this jam, the intended idea driver would most likely be the submitter of the idea. The team then applies a creative and open mindset to explore the idea further, and this can include the use of creativity techniques to generate different concepts. Additionally, it also includes gathering data and doing general business case analysis relating to the idea, and investigating it further. Also, growth options may be used to further explore potential of ideas.

The team should also be aware of potential biases not to bias the exploration towards making the idea more incremental, but on the contrary rather explores more 'crazy' concepts that may break otherwise assumed trade-offs and constraints, and go outside the current frame of reference. Once a concept that has radical potential has been explored, the team works to identify all possible short-term and long-term assumptions, as these assumptions are to be managed later in the process. As suggested by the researchers, the team attempts to identify all relevant assumptions, distinguishing between the short term and long term (since these assumptions are managed by different methods). On the long term, the researchers suggest considering assumptions about both constants, events and trends. On both the short and long term, it is suggested to use various frameworks for identification of assumptions, complemented by general brainstorming.

Also, it is proposed that the team should diffuse the idea within the organization by framing it in its best yet truthful way, spreading the idea to individuals in an order considering different stakeholders. By doing so the team will allow for the idea to more easily mesh within the firm's strategic web and increase its chance of passing the valley of death.

Right hand stream
After the process selection, a more detailed investigation and concept building is proposed before actually committing to the idea. This includes a deep dive into technological and market feasibility. Long-term assumptions are identified to be used for assumption-based planning. Growth options may also be used as a reference to investigate the potential of different possible directions, but is more likely to be beneficial in the left hand stream.

6.2.4 Case-building

Left hand stream
In the left hand stream, the team should prepare for pitching the idea for management, packaging and framing the idea in order to receive initial funding. However, this is done in the context of having first strategically diffused the idea in the strategic web of the organization, accounting for various stakeholders, why the idea hopefully has gained some degree of support already.

As implementation of radical ideas can be similar to or include launching a new venture, and since the process is more iterative, the team can build a pitching deck highlighting how potential is to be explored, and how assumptions are to be tested, rather than making an arbitrary business plan as there may be no credible data for doing so. Options to defer, growth options and staged investment options may be used to illustrate the potential of a radical idea.

Right hand stream
In the right hand stream, based on the detailed investigation, a case should be built to present the idea and its benefits, feasibility and profitability as well as staged investment, growth options and possibly options to defer. However, the options are deemed more central to the left hand stream, in particular options to defer and growth options seeing as those options are more relevant for uncertain ideas. Staged investment options however may be as beneficial in the right hand stream as in the left hand stream.

6.2.5 Selection

Left hand stream

In this phase, management decides on whether to invest further in the idea to explore its potential. This decision can include different practices depending on the company and context. For example, the company may want to use the dragon's den-approach for assessing ideas. While using expert intuition, which maybe a useful tool, this should be done with caution for biases and should not be used without including complementing techniques providing results pointing in the same direction.

Ideally, management has an open mindset to radical ideas, and sees uncertainty as a value driver and a source of radical innovation and competitive advantage for the company. In assessing ideas hence, options reasoning is included in the mindset of idea providers and management, and hence highlights the value of potentially arising opportunities when exposed to uncertainty. For radical ideas which require substantial investment, management may want to use staged investments options to initially only fund a part of the plan for the idea, including for example funding a first iteration of experimentally testing critical assumptions. For these ideas which may still have significant uncertainty, the decision needs to weigh the real option and learning value implied in initial investments and testing of assumptions, compared to costs. For the selection on the left hand stream, it is as previously mentioned argued that strategic fit and portfolio criteria should not be too focused on, but that the firm could decide on a ratio of uncertain ideas that it should allow for in relation to the amount of more certain ideas and aiming for example at one of the golden ratios as described by Nagji and Tuff (2012).

Right hand stream

In the right hand stream, the firm may use criteria related to the technology and market such as feasibility, profitability, customer utility and competition. Also, more quantitative criteria may be used at this stage to better enable comparison between projects and thus ensure choosing the right projects seeing as data should be readily available at this stage which allows for quantification. Further, since these ideas have significantly lower uncertainty, portfolio management criteria may be used such as strategic buckets in order to achieve the firm's desired level of diversification.

For both the right hand stream and left hand stream, a few ideas that were not omitted may be saved for later use when market conditions are more favorable, or technology is further developed, using options to defer and assumption based planning in the pool that will be further described in the development section.

6.2.6 Iterative Exploration

(Only applicable to the left hand stream)

An iterative approach to exploring the idea is further applied on the left hand side, due to the inherent uncertainties of the ideas. Depending on the nature of the idea, this can include for example the design thinking approach, a deeper exploration of demand and use of rapid prototyping. Other potential methods can include customer development or lean startup, or a combination of mentioned methods. Smaller experiments can be designed to test assumptions before making more major investments. Through this process, the aim is to capture potential creatively, while reducing short-term uncertainty. During the iterative exploration, the state of long-term assumptions should also be revised, since changes in an idea's direction and concept affects its inherent assumptions. In the iterative exploration, staged investment options may be used as described in the selection section. Since these ideas can in a sense be said to be under implementation, assumption-based planning is used to monitor long-term assumptions affecting the idea, since although these have been

emphasized to be long-term in nature, can break on the short term as well (e.g. through abrupt 'events'), which might change the game for the idea.

6.2.7 Development

Left hand stream
In this phase, short-term uncertainty of the idea has been reduced, why the process is more concerned with more straightforward execution. However, due to the previous iterative exploration, long-term assumptions might have changed and may therefore need to be re-evaluated.

Right hand stream
The development of the right hand stream is relatively straight forward as it can be done using the traditional NPD-process.

6.2.8 Managing assumptions during 'Development'

As long-term assumptions have been identified for an idea, the proposition is that these are managed strategically during the development phase and also after implementation. In accordance to assumption-based planning (ABP), signposts have been identified, together with shaping actions and hedging actions to manage downsides and capture opportunities if a long-term assumption breaks (which is identified using the signposts). It is argued that ABP, due to the fact that it is a post-planning tool, is relevant only after the selection phase because then the concepts should be mature enough to identify relevant assumptions. Another reason for this is that the ideas and their inherent assumptions may be changing at a rapid pace before the selection phase, why monitoring these assumptions would be a waste of time and resources that may be put to use elsewhere. On a portfolio level, this provides for the possibility to use for example a scorecard to monitor all or the most important identified signposts that impact assumptions, to more systematically minimize the downside and capture the upside of deviations in the future.

6.2.9 Pool of idle ideas

The pool of idle ideas is suggested to provide an alternative to only dismissing ideas with high potential, and to highlight the importance of considering real options as part of the overall mindset. For an idea that was temporarily dismissed due to uncertainty regarding longer term, less testable assumptions, monitoring the identified signposts using ABP can serve as a way to 'trigger' the resting potential of the idea, and bring it up for assessment later. For example if an idea requires a breakthrough in overall availability of faster wireless internet, monitoring of related signposts for specifics of the development can be used to trigger when the idea is worth a new assessment. Idle ideas using ABP and options to defer (e.g. waiting with the development until the market or technology is more favorable) using real options reasoning are very closely related and hence it is argued by the researchers that ABP may complement options to defer by a closer and more systematic monitoring of critical assumptions that may change the value of the option. Importantly, ABP looks at all underlying assumptions related to the idea instead of just looking at market and technology aspects more directly related to the idea which is less exhaustive and therefore might miss critical aspects.

6.3 Motivation, relation to literature and trade-offs

6.3.1 Initial screening and process selection

Starting out with building an initial understanding of the ideas seemed like a natural prerequisite for going further according to the researchers, and is also in line with the claims of Aronsson and Öhman (2009), Bjelland and Wood (2008) and Cooper (1988). Clustering

has been emphasized as a vital part of the FEI by Boeddrich (2004), is also advocated by Aronsson and Öhman (2009), and was seen to have major practical utility in the project of this thesis as an enabler of overview. Sorting out obvious misfits is advocated by Cooper (1988), and removing duplicates is seen as common sense. Consolidation of ideas is in line with the findings by Bjelland and Wood (2008) who state that nip-n-tucking ideas allow ideas to evolve into new, more favorable concepts.

Shallow exploration is aligned with the view of Cooper (1988), suggesting an initial inexpensive assessment of ideas, but in the model, the researchers also add an emphasis on deeming if the ideas are suited for the NPD process or not. The researchers' line of reasoning for the preliminary assessment gate is in line with Rochford (1991) regarding the criteria and also that the firm should consider limitations such as time, cost and availability of information, which is especially relevant seeing as the firm may be handling a large number of ideas and will be lacking information. Hence, the researchers advocate a "loose" preliminary assessment of ideas with high uncertainty and lack of available data (presumed to be more radical in nature), and a somewhat "tighter" assessment of ideas with lower uncertainty (presumed to be more incremental in nature). This means that for more certain ideas with higher availability of information the assessment may be stricter such as whether the idea is in line with company objectives and whether it is doable whereas for ideas with lower availability of information simply asking the question of whether it might be doable could be enough. Cooper (1988) provides criteria that could work well for incremental ideas but seeing as no real distinction has been made between radical and incremental ideas at this stage these criteria are deemed too specific and would likely omit too many ideas with potential by for example looking at strategic fit and profitability at this stage.

The question whether the idea is outside the current frame of reference is inspired by Gioia (1986) and Bessant et al. (2010). The question regarding uncertainty is inspired by Lecou et al. (2011) and Bessant et al. (2010). Lastly, the questions regarding competence destruction and competence acquisition are inspired by Gatignon et al. (2002)

Nobelius and Trygg (2002) are essentially against providing a front end process. However, the researchers only partially share the view of these authors, seeing value in having an overall process which allows for flexibility. Nobelius and Trygg suggest the use of a Front End Team to design front end routes, and the researchers draw on this view in suggesting that a FET can be used to monitor and manage the earliest phases, and staff ideas with two to three employees with appropriate competence and skills in line with Björk et al. (2014), and build the capability to customize more specific aspects in the process to the company and to the ideas. This includes the ability to judge if ideas are suited for the NPD process, and if not, building the ability to foresee specific challenges related to the more radical ideas and their implementation.

Trade-offs and design
The researchers view this early phase as relatively "loose" for radical ideas in its assessment since it is advocated that ideas with high uncertainty and lack of available information should be treated less harshly. This is since it is suggested that the risk of omitting ideas with high uncertainty but radical potential outweigh the additional costs of having a larger number of this type of ideas flowing down the left stream of the process. For ideas with lower uncertainty, for which data is more readily available, the rationale of having somewhat stricter assessment of these ideas early on was based on the assumption that the costs of having a large number of incremental ideas flowing down the right stream would be inefficient, and that these ideas could be more properly assessed early on with regards to feasibility.

The overall choice of having an *alternative process* to the NPD process, and in proposing the use of a front end team, may also be seen as taking a stand with regards to that additional costs of this arrangement would be outweighed by the value created for the firm. Aside from

this, the rationale for having a separate process for more radical ideas with higher uncertainty is seen as conveyed throughout this thesis; For example, Rice et al. (1988), Cooper (2014), Reid and de Brentani (2004) and Bessant et al. (2010) all propose differentiating between methods to handle radical and incremental innovation. Further, Reid and de Brentani (2004) concluded that in order for radical ideas to be adopted, they require champions that bring the ideas into the firm using a social process, further highlighting the need for separate management of these types of ideas. This was further supported by Backman et al. (2007), showing the issue for non-traditional concepts to get adopted in the organization. Also, Koen et al. (2002) and Cooper and Kleinschmidt (1995) argued for the importance of resources for an idea to survive and Koen et al. (2002) as well as Backman et al. (2007) describe the hardship of finding resources for more radical ideas. Further, Bessant et al. (2004), Bessant et al. (2010), Christensen Raynor (2003), O'Reilly and Tushman (2004) and Duncan (1976) all support creating separate or parallel structures in order for the idea to get resources or not be too affected by the organization. The researchers agree with these scholars and argue for the need of alternative structures and approaches for managing radical innovation.

Further, by separating the more radical flow and the more incremental flow the researchers try to balance between flexibility and structure as well as between control and creativity as advocated by Gaubinger and Rabl (2015). Additionally, it is argued by the researchers that the model can be seen as better reflecting reality than the strictly linear ones, while still being iterative in nature, which may be put in relation to the dilemma proposed by Gassmann and Schweitzer (2014) that most iterative models are too abstract while linear models do not reflect reality.

The order of activities also implies trade-offs, but seem justified. For example, shallow exploration could be done before sorting out obvious misfits, but this seems less appropriate, and the current order of activities seems appropriate for the purpose of having a relatively loose entrance. Also, the fact that this model is iterative in nature means that activities may be undertaken more than once as also shown by Koen et al. (2001)

6.3.2 Conceptualization

For ideas in the *left flow*, this stage is essentially built on empirical findings with the realization that conceptualization is needed in order to evaluate ideas i.e., it is a prerequisite for later stages. Conceptualization is also in line with suggestions from scholars such as Cooper (1988) and Koen et al. (2001). Exploring ideas creatively is emphasized by several scholars, for example as Brown (2009), Carlgren (2013), Alänge and Lundqvist (2014), Gassmann and Schweitzer (2014) and Gaubinger and Rabl (2015).

The identification of short-term assumptions is in line with the iterative approaches lean startup (Ries, 2011) discovery-driven planning (McGrath & MacMillan, 1995) and customer development (Blank & Dorf, 2012). Although design thinking has less emphasis on working explicitly with assumptions, it can also be seen as implied in the learning of this experimental approach. Identification of long term assumptions after the conceptualization is in line with Dewar (2002) who states that assumption based planning requires an initial and detailed concept.

Relating to conceptualization, it was observed throughout the project that without a more ready-made concept, only a fuzzy idea, it is impossible to identify all relevant assumptions. That is why these two activities are placed together in the model. The team can generate several creative concepts, gather available data relating to the concept and analyze it, and then identify assumptions for the one(s) deemed most interesting to be taken further in the process.

For ideas in the *right flow*, this stage is essentially in line with the more linear school of thought related to Cooper (1988) which is seen as suitable for more incremental ideas with lower uncertainty, for which data is more readily available. However, long-term assumptions are identified in line with assumption based planning (Dewar, 2002) because these ideas are also impacted by future changes even though the ideas themselves have less uncertainty.

Trade-offs and design

For ideas in the *left flow*, one could argue that identification of assumptions should be done at a later stage. However, identification is seen as favorable for identifying vulnerabilities of a concept, and it is believed that this is favorable for pitching to management, and this view seems aligned with the attitude suggested for idea drivers by Alänge and Lundqvist (2014) suggesting that visionary packaging should be combined with distinct realism about the present state of an idea. While outlining a visionary concept, the team can hence highlight critical assumptions in their pitch, and if applicable suggest ways to test them in order to manage the uncertainty, or suggest hedging or shaping actions to decrease vulnerability and capture arising opportunities. Also, because of real options and assumption based planning are used in the model, a pool of idle ideas could be created as a result of applying them, and hence the identification of assumptions will serve as a selection parameter that is further discussed in the selection section.

For ideas in the *right flow*, the assumption is that it is *not* worth having an explicit process for identifying *short-term* assumptions, since the traditional management approaches to dealing with uncertainty related to these types of ideas are seen as sufficient, including ordinary risk analysis. (Analysis should include general business analysis which *may* include analysis of short-term assumptions, but this is not seen as critical enough for these ideas to be explicitly emphasized in the model.) On the other hand, it is proposed that long-term assumptions should be identified in the right flow, to be monitored at the innovation portfolio level, as major changes for example in the business environment can have significant impact, and including this approach on the long term is assumed to be more value-adding than costly.

6.3.3 Case-building

This phase is a logical follow-up on conceptualization for both flows. It appears evident that both require a case to be built in order to obtain funding and this is in line with the views of Cooper (1988) Koen et al. (2001). For the more venture capital inspired left flow, this is in line with the view of Bessant et al. (2010).

Trade-offs and design

This part of the model rests upon the assumption that time invested into building a business case for the ideas that have passed the process so far is well invested, which appears intuitive and well-grounded. Also, it is assumed that it would *not* be more favorable to include this step earlier in the process, which appears justified as the case building builds on previously gathered data, and including it to early would be costly. Having this step later than the selection phase of the model also seems inappropriate since providing a business case is seen as fatal for highlighting the potential of an idea.

6.3.4 Selection

For the *left flow*, this step is admittedly challenging, since it includes selecting while uncertainty related to ideas may still be high, but some degree of commitment is required to continue with the idea. The researchers line of reasoning is in line with Bessant et al. (2010) that expert board of managers might be a useful way to handle selection of radical ideas, and other suggested approaches include the dragon's den approach, and using wisdom of the crowds through for example idea markets. Also, especially dragons den and expert board of managers in general are in line with Martinsuo and Poskela (2011) who state that the

evaluation process provide innovation performance not by evaluation per se but through how it helps understanding the concepts and it is according to the researchers exactly what methods such as dragons den allow. By preparing for the pitching the team will learn more about the concept themselves throughout the process of preparing for the pitching and perhaps articulate what the concept really means in a more meaningful way for the firm, and hence understand the concepts in relation to the firm. However, it is not only the pitching moment that is important as shown by for example Reid and de Brentani (2004) but the process of diffusing the idea within the strategic web which is highly related to the statement by Poskela and Martinsuo (2011).

The researchers also argue in line with Alänge and Lundqvist (2014) who emphasize the need for resources why they advocate packaging to highlight the potential of the idea. With packaging in mind the researchers also believe that framing as described by Kahneman (2011) stating that a concept may evoke different emotions depending on how it is presented and is therefore important to acknowledge. Also, the framing should be conducted during the conceptualization phase in order to impact the selection and aid in the diffusion.

For the *right flow* the researchers' line of reasoning is relatively aligned with that of Cooper (1988), Khurana and Rosenthal (1998) and Rochford (1991) who argue that market and technology should be further looked into in a more quantitative manner. However, the researchers emphasize in line with Carbonell-Foulquié et al. (2004) and Langerak et al. (2004) the importance of understanding the customer needs in order to create value for them. Such reasoning is also in line with the fifth principle of the mindset regarding empathy that is proposed by the researchers.

In line with many scholars such as Cooper (1998), Gutierrez (2002), Killen et al. (2008) the researchers argue that portfolio management is important. However, the researchers also acknowledge that too strong strategies and too high focus on the portfolio criteria is not necessarily favorable, seeing as it might hinder more uncertain, not strategically aligned ideas such as argued by Gassmann and Schweitzer (2014). Therefore the researchers argue that PPM should mainly be used for more incremental ideas to fill up the quota of these innovations while a certain amount of the PPM should be dedicated to more wild and exploring ideas. Why these ideas should not be specified is mainly due to the fact that the researchers believe in line with Gutierrez (2012) who questions that an idea can be classified in beforehand. Also, as advocated by O'Connor (2008), the researchers believe that real options is a favorable way of managing a portfolio of high uncertainty innovations by using staged investment options that may be used to continually evaluate the ideas. Such reasoning is also in line with Ayers et al. (1997) who argue that flexibility and options are essential for successful innovation management.

Additionally, selection methods can be revised over time, as time provides feedback about what appears to work more or less well. Real options reasoning, as suggested, is advocated by McGrath (1999) to get a more balanced perspective on 'failure' and reduce anti-failure bias. This seems suitable to include in the selection step since radical innovation is a challenge for many large firms and radical innovation as part of firms development portfolios has dropped significantly over the last two decades (Day, 2007) but these type of innovations are required for long term growth and competitiveness (Hamel, 2002; Leifer et al., 2001)

Also, by using two different ways of selection depending on the nature of the idea, the researchers believe that the evaluation system is more in line with what Martinsuo and Poskela (2011) describe as a holistic evaluation system to avoid suboptimization. This is because a high emphasis on strategic fit in the more radical selection would for sure cause suboptimization by weeding out most of the ideas even though they have substantial potential.

The emphasis on learning value in this step is drawing on the view of for example Brown (2009) and Carlgren (2013). Both can be seen as part of the mindset more suited for uncertainty, and the presence of this mindset is important in the selection step to select ideas aligned with the rest of the model.

Trade-offs and design

Including a selection step at this point seems required since the ideas have been explored and sooner or later, management need to take a stance with regards to if the idea should receive funding and other resources needed for further exploration and implementation. For the ideas in the right flow, having lower uncertainty, this seems relatively straightforward and apparent. For ideas in the left flow, one critique of the model can be that it could be worthwhile testing some assumptions prior to pitching the idea to management, if this can be done appropriately without management support and would likely favor the idea. However, this can also be seen as highlighting that the model should not be used mindlessly, but include openness, common sense and allow for customizations depending on the idea and situation.

6.3.5 Iterative Exploration

The use of iterative exploration line with the iterative approaches lean startup (Ries, 2011) discovery-driven planning (McGrath & MacMillan, 1995) and customer development (Blank & Dorf, 2012). Also, it is in line with the view of Bessant et al. (2010), who advocate learning loops instead of a traditional stage gate approach when uncertainty is high, and states that learning hence becomes a goal in itself, which is in line with the iterative exploration phase for more radical ideas. This is further supported by McGrath and MacMillan (1995), stating that iterative approaches are a good fit under high uncertainty, offering systematic ways to test dangerous implicit assumptions. This stage is also chiefly in line with what Blank and Dorf (2012) define as customer discovery and customer validation whereas the development (next phase), stated to be more straightforward execution, can be seen as what Blank and Dorf (2012) would refer to as customer creation and company building, when the latter is applicable for a new venture. The use of for example design thinking is in line with for example the view of Brown (2008), who state that firms using DT can expect greater innovation output, suggesting that empathy and prototyping can contribute to both better collaboration but also to innovation, creating solutions that go beyond aesthetics and that are meaningful. Additionally, as an overall support of including DT, this is supported by the view of Gassmann and Schweitzer (2014: p. 141) stating that it can help the FEI to innovate faster, provide better market fit, and *"generally create more radical innovations".*

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This part of the model rests upon the assumption that it is more favorable to work iteratively with ideas that have a high degree of uncertainty and radical potential. This appears well supported, as discussed above (and also in line with the proposed mindset). Including this phase at this stage of the model is based on the assumption that more extensive iterative exploration, such as testing assumptions of the idea with various experiments, generally requires funding and management support, and may for example require the team to take significant time from ordinary operations and invest it in working with the idea, which would likely require formal support of the idea in the organization.

However, the iterative exploration in the left flow should not be interpreted as though ideas in the right flow cannot use an iterative approach, as important insights in the later development phase may suggest changes in these ideas as well.

6.3.6 Development

The development during this phase is somewhat outside the scope of the thesis as it is considered post-FEI in line with for example scholars such as Cooper (1988), Koen et al. (2001) and Khurana and Rosenthal (1998). Therefore, the specifics of the development itself will not be dealt with in detail. However, real options (Trigeorgis, 1996) and assumption based planning (Dewar, 2002) are used in this phase and because they have been dealt with in this thesis, the researchers would like to motivate their potential (which is more obvious in this stage). The real options i.e. options to defer, staged investment options and growth options used by the researchers are in line with those described by Trigeorgis (1996). The pool of idle ideas contains options to defer while staged investment options and growth options are used for valuation of the project and during development of the project. The use of a pool is in line with Rochford (1991) who argue that rejected ideas may be saved for later use either when the firm has enough resources or the market/technology has changed in favor of the idea. Staged investment options and growth options are part of the valuation and implementation of a project. Additionally, growth and staged investment options are seen as ways to overcome fear of uncertain ideas and to appreciate them. Assumption-based planning as described by Dewar (2002) is also used for monitoring the assumptions within the idle ideas.

Trade-offs and design

As mentioned, this part is somewhat out of scope. However, it may be worth mentioning that with regards to the left flow, it is assumed that it is more appropriate to switch to a mode of execution once uncertainty has been reduced. However, this appears to be in line with common sense, as it includes having found and validated a favorable concept for the idea. Additionally, as the model itself allows for iteration, additional insights during the development phase can still be accounted for, and potential changes in the concept can still be iteratively explored with regards to these insights, if this is deemed feasible.

7 Discussion

This discussion first briefly discusses the relevance of the proposed model and mindset in the context of large firms. Thereafter, goes through the model to discuss potential barriers part by part, with more focus on the left flow which presumably contains more barriers. Thereafter, the analysis zooms out to discuss some more overarching barriers.

The need of an alternative approach is highly relevant since many large companies can be seen as systematically disfavoring more radical innovation by only using the a stage process together with the traditional NPD process, and complying to the linear view in which uncertainty is something inherently negative that needs to be reduced. In addition to this, gearing the FEI towards the NPD process can limit the firm to focus on product innovations, often producing incremental extensions to product lines, and limiting possibilities for other, more radical innovations that lie outside the current frame of reference.

This highlights the relevance of the proposed mindset, which is seen as providing concrete suggestions and principles for approaching uncertainty to favor radical innovation. However, as has been noted, corporate culture may be seen as the main barrier and enabler of implementing both the proposed model and the mindset. Other enablers such as management support and champions for radical ideas can be seen as closely related to culture. However, when in lack of a favorable culture, it is proposed that aspects of the model and mindset can be used to influence the culture over time, as will be further outlined at the end of this discussion.

Going more into the model in detail, sufficient education or prior knowledge is required to successfully adapt the model. This includes knowledge of the various methods included. Going from the '*start*' of the model, practitioners first need sufficient skills to review early-stage ideas and perform the suggested operations such as clustering and assessing the ideas appropriately. It also requires the skill of distinguishing between ideas that have high uncertainty and radical potential, and those that are of a more incremental nature. Having the appropriate mindset is also important at this stage, being open to explore ideas outside the current frame of reference and bear with ambiguity and uncertainty.

After selecting the appropriate process depending on the nature of the idea, the *right* flow is more geared towards current practices in many firms, i.e. their traditional NPD process, why this flow may not provide significant barriers for implementation, and will *not* be discussed in detail concerning barriers for implementation.

Going back to the *left* flow, after selection of that process, practitioners require sufficient skills to explore the idea. This is a critical stage, since it is here the more finalized concept for the idea is generated before the selection (although the concept may later change), and the skills and talent of the team exploring the idea is central. Hence, practitioners should select methods based on current competencies, and the company needs to select a level of ambition with regards to this stage in terms of developing the creative skills of employees, which presumably should not be underestimated.

The packaging and diffusing of the idea in the strategic web requires overview of stakeholders in the organization, skills related to framing the idea effectively, and sufficient social abilities or contacts for diffusing the idea sufficiently. The framing skill is not seen as overly complex, although it can certainly be refined over time; but the researchers believe the fundamentals can be readily taught. Overview of stakeholders and the social aspect including contacts can be seen as related, and it can be taken into consideration while staffing the idea with a team that it can be favorable to include an individual who is well positioned and able to favorably diffuse the concept in the social network of the company.

After having built a concept and diffused it, sufficient skills is required for pitching the idea to management, and thereafter implementing it given that it is adopted. It is suggested here that sufficient knowledge of the iterative methods is central, so that the team can pitch the idea using entrepreneurial logic, and highlight its potential in the best possible way. Additionally, the selection phase of the model also highlights the importance of the 5 principles of the mindset; while these are of overall importance, it is crucial during this selection phase, including committing and investing in an idea, that both the idea team and the decision-makers choosing whether to select the idea, such as an expert board of managers, share the same type of logic, i.e.:

(1) Uncertainty is a source of *opportunities*, not only *threats*
(2) Radical ideas are *creatively explored*, not *linearly reduced*
(3) Experiments provide *learnings*, not *failures*
(4) Constraints and trade-offs are exciting challenges to be *overcome*, rather than *blindly accepted*
(5) Empathy is a source of *innovation and strategy*, not merely an act of *altruism*

For both the selection step, and for subsequent iterative exploration, sufficient knowledge of, or education about the related methods is required, i.e. knowledge about the processes, tools and mindsets included in design thinking, lean startup, customer development and so on.

There are some potential barriers related to implementing aspects of these iterative approaches in a large firm. As mentioned earlier, it may not be possible or desirable to implement the entire process associated with one of the models in a particular context. For example, 'company building' (cf. Blank and Dorf, 2012) is inapplicable if the innovation is launched inside the already established firm (but more relevant if launched as a separate venture).

Another aspect that has to be taken into consideration is that lean startup and customer development was created with the small company in mind. The large company context differs, for example in that it may be more of a challenge to obtain as genuine interviews with customers when meeting B2B, which can lead to a higher degree of formality than when a smaller startup interviews individuals about their needs. The company can hence clarify the purpose of such customer discovery meetings and attempt to reduce the degree of formality by setting up more personal types of meetings. For B2C, this may be less of a challenge, but the large company context may still induce more formality among customers, why the firm may want to re-condition the context for getting to know customers in a genuine way.

Another example is that use of minimum viable products in large companies also has to be done accounting for that a large company often has much more to lose in terms of brand and reputation than a relatively new or unknown startup. However, clarifying for customers and users the experimental purpose, and managing expectations, can likely manage this barrier.

Regarding real options reasoning, which can be seen as critical in the selection step, but also has a general part to play during evaluation and implementation, requires sufficient education of involved parties. For example, implementing it in a technology-oriented firm may provide challenges, for example since engineers may be less familiar with or enthusiastic about economic reasoning. While not emphasizing the quantitative aspects such as discounting, it is however argued by the researchers that the concepts can be relatively intuitive if presented in terms of concrete, practical examples. If it is to be implemented as part of an overall mindset and logic in the firm, it may be pragmatic to de-emphasize the quantitative heritage of the options type concepts in favor of keeping it simple.

Regarding assumption-based planning, laying the groundwork in terms of assumptions, signposts, shaping actions and hedging actions would require education about the concepts and how to apply them, but also sufficient assumption surfacing and analysis. One suggestion is that if the proposed front end team maintains a high degree of competence with regards to this and other methods, it can coach the idea teams in their analysis. On the long term, ABP also requires sufficient monitoring of long-term assumptions, and this presumes that responsibility for this monitoring can be delegated to individuals with access to data regarding the signposts, and who are suited to report relevant changes. One proposed way to implement this is the mentioned scorecard, containing all important signposts related to long term assumptions in the idea and innovation portfolio, and the proposition here is to delegate these signposts over the functional areas of the corporation. For example, the IT division would be delegated the responsibility to monitor signposts related to their division, presumably being most well positioned to access and interpret data associated with these signposts, and would then report when preselected thresholds would be reached (indicating that an important assumption would break or be close enough to breaking to be reported).

The discussion has so far been concerned with the micro level of the model, i.e. that of implementing parts of it in the organization. However, while zooming out, other types of barriers arise for implementing the model and mindset as a whole. The most significant one may be related to the culture of many large firms (why culture was also set as an integrative part of the model, closely related to the mindset). General established routines, procedures and a lack of openness and willingness to change constitute a substantial barrier for the model and mindset.

On the other hand, drawing on the view of Carlgren (2013) who was cited discussing the interplay between the use of design thinking, mindset and innovation capabilities, the researchers suggest that aspects of the mindset and parts of the model can be initially implemented when barriers are high, and be used to demonstrate its presumed usefulness, which can lead to an increased openness in the organization over time. For example, innovators in a company could apply general principles of the mindset while not applying the entire model, and hopefully inspire change and increased openness among others. If on the other hand management decides that a change is necessary, a top-down implementation would certainly allow for more drastic changes. During a more major commitment, the researchers suggest that the firm should see it as a long term investment rather than a quick fix. Providing the sufficient education and implementing the methods would take time, not to mention changing the attitudes and the way employees think. Several aspects of the proposed mindset is related to design thinking, and as indicated by Johansson-Sköldberg et al. (2013), the skills obtained by experienced designers may take several years to obtain. However, this is not to say that the proposed model and mindset may not enable short-term benefits as well. Additionally, the barriers discussed may also indicate an opportunity to obtain an advantage over other large firms, which may be deterred by these barriers.

Furthermore, it is argued by the researchers that there is a logical coherence to the model and mindset, i.e. it can readily be argued *why* aspects should be implemented. For example, it can be readily argued that principles that allows for seeing opportunities in uncertainty would be more common sense to implement than something otherworldly. Methods included also seem to be logically coherent, for example, using an iterative, experimental approach to more radical ideas has already been proved useful in the world of entrepreneurship, and is increasingly being used in large firms. As this may make such an approach less foreign, adding useful tools to the toolbox (e.g. use of prototyping, minimum viable products, customer interviews and so on) may therefore not provide significant additional barriers. This is seen as pointing towards that barriers can be overcome with a certain degree of initial support, such as key individuals in the organization advocating the approach. In addition to this, it is argued that there is a rigor to the model in the sense that it provides a 'system' for managing uncertainty, systematically surfacing assumptions, distinguishing between short

and long-term uncertainty and having methods readily available to manage both to reduce the downside while simultaneously capturing opportunities. This is seen as pointing towards easing implementation in a large firm, as an approach that is rigorous may be more welcomed by managers than one that is not.

All in all, for firms without an explicit aim for radical innovation, implementation bottom up would provide for more of a challenge, but aspects of the model and mindset can nonetheless provide useful insights to be leveraged by individuals, and hopefully drive change over time. On the other hand, for a firm that has made a distinct decision to increase radical innovation, the researchers believe that barriers can be overcome by implementing the model and mindset pragmatically and working with culture simultaneously.

8 Conclusion

In this thesis, the researchers started out with a linear view of idea evaluation, analyzing 137 ideas from an innovation jam and realizing their fuzzy nature and inherent uncertainties. This further led to the realization that initially provided approaches were insufficient for evaluating and managing ideas, particularly regarding ideas with high uncertainty and radical potential. Linear, criteria-oriented approaches such as the traditional stage gate model would not be applicable since the data for meeting the criteria would generally not be available, thereby risking to omit ideas with radical potential. Iterative approaches such as the NCD model by Koen (2001) was also outlined, but did not provide many practical guidelines for how to evaluate this type of ideas further, and suggested that they could be implemented in the NPD process which seemed less appropriate, for example since it may require a different type of logic, and may be opposed by internal stakeholder.

The lack of guidelines for exploring high-uncertainty ideas led the project to its second phase, in which the researchers attempted to take a broader perspective to idea evaluation. Inspiration was obtained from entrepreneurship, new venturing, and the thinking of designers, and the researchers found presumably more suitable ways to not only manage uncertainty, but also boost innovation in the process. Through further investigation, more specific complements were found, including creativity techniques, real options reasoning, Assumption-based Planning and alternative selection techniques. While it was seen as an intriguing opportunity to combine these approaches in an overall, integrative model, it was also realized that a more systematic way of surfacing assumptions would be favorable. The researchers hence developed a suggestion of how to do this, distinguishing between the nature of short and long-term assumptions, and suggesting categories and frameworks for identification. Over the course of iteratively creating the proposed model, additional changes in perspective arose. The researchers realized that an organization's adoption of radical idea should not be seen as a single moment in time, since innovation happen in a social context, why this was reflected in the theory and integrated in the model, emphasizing the importance of the 'strategic web' and the 'valley of death'. In addition to this realization, the importance of emphasizing various attitudes and logics that had been discovered across the suggested approaches was realized. Hence, the researchers created a proposed mindset to become an integrative part of the model, the former of which came to include 3 cornerstones and 5 principles, to synthesize these findings.

In conclusion, the project resulted in a proposed integrative model (as shown in Figure 8.1) and mindset (Figure 8.2), integrating the various finding throughout the project, and

attempting to take a holistic perspective in enabling more radical innovation. Several barriers such as knowledge of methods and culture have been discussed, but do not seem inconceivable to overcome. The researchers however propose that an implementation should in reality be seen as a long-term commitment rather than a quick fix, having pragmatic expectations on the short term. On the other hand, it is important to note that the model and the mindset is to be seen as unvalidated theory, why it has to be tested further to draw conclusions about its actual validity. However, the suggested theory is built on modern literature and hypothetical testing on ideas, and alternative approaches to manage radical innovation are increasingly being applied by firms. These aspects are seen as providing the proposed theory credibility and relevance for further validation or falsification.
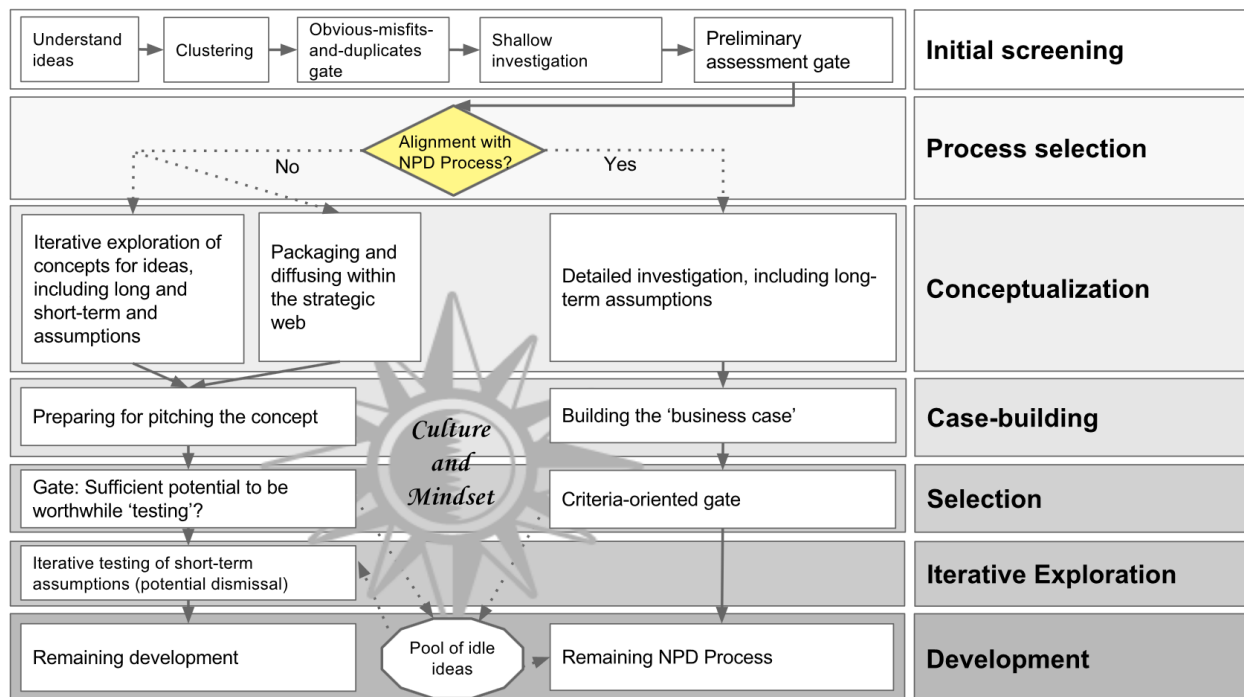

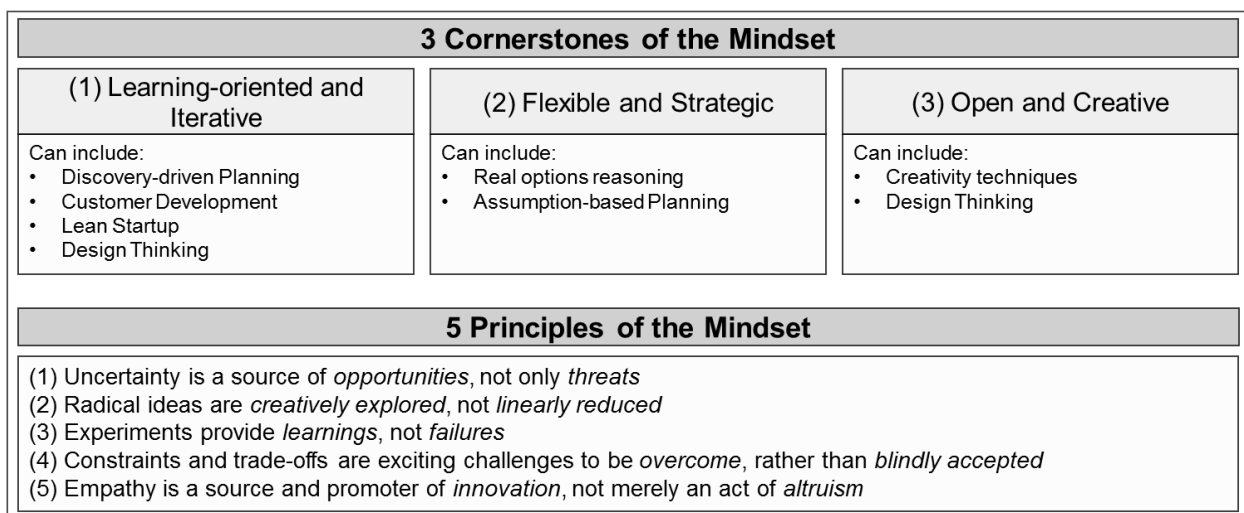*Figure 8.1 The model proposed by the researchers*

Figure 8.2 Cornerstones and Principles of the mindset proposed by the researchers

9 References

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10 Appendix

Appendix A - A more comprehensive outline of Knowledge-Concept Theory (C-K)

According to Agogué et al. (2014), C-K is a unified theory of design derived from an engineering perspective. Aside from being a design theory, it is also a theory for actual reasoning in within design. It is based on the distinction between the knowledge space or 'K-space', and the concept space or 'C-space', both of which can expand over the design process. Stated differently, according to this theory, design is a cognitive process in which a concept generates other concepts and turn into knowledge.

Furthermore, Agogué et al. (2014) state that in the K-space, proposals have logical status in that they are either true or false, for example "all cars I know have wheels". However, the C-space does not have a logical status in the K-space, for example "a car without wheels" as a concept - it is impossible to determine if this concept may somewhere already exist in reality or whether it may exist in the future. The K-space maps the necessary knowledge for succeeding with the project related to the concept, whereas the C-space constitutes of a tree-structure of undecidable propositions. This is visualized in Figure 10.1.
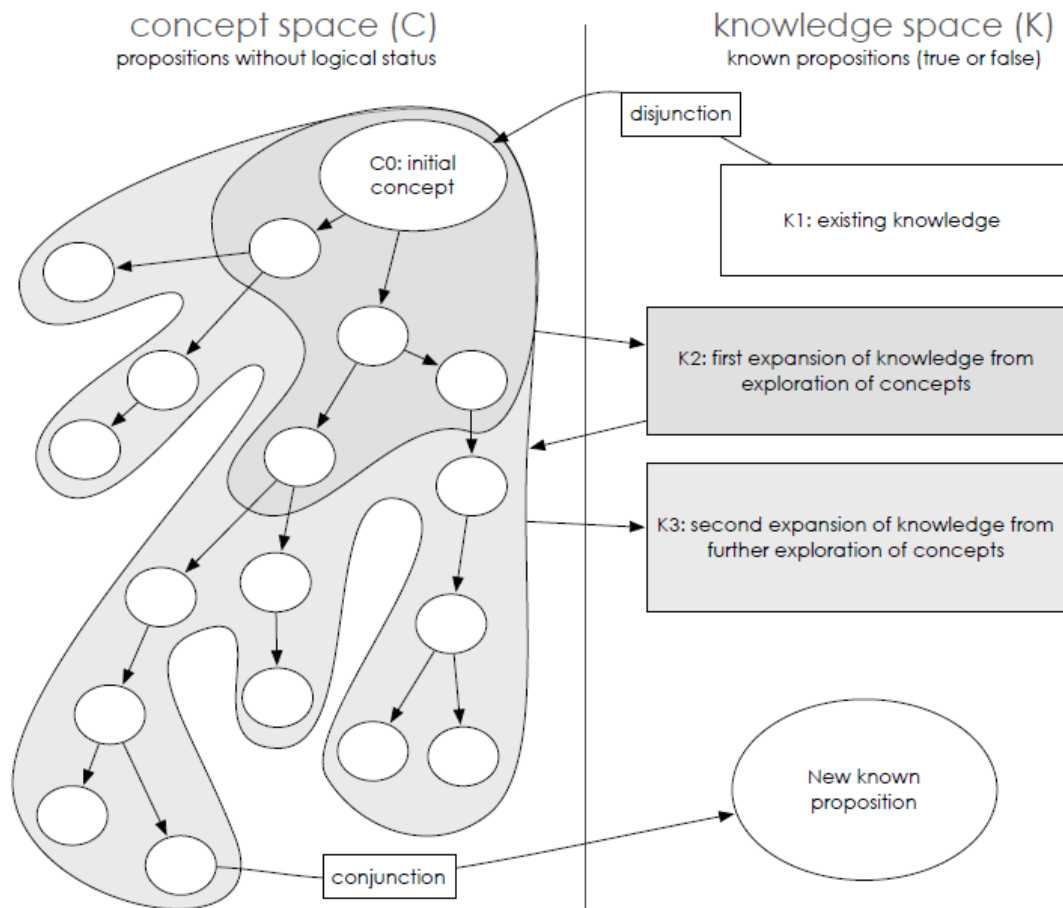

Figure 10.1 Model of the Concept-Knowledge Theory

In a more mathematical sense, there are four possible operators with regards to these two spaces:C→K, K→C, K→K, C→C (Agogué et al., 2014), see Figure 10.2. This also distinguished the theory from the more arbitrary encouragement of 'thinking outside the box',

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which, according to the authors, does not include the vital aspect of knowledge expansion (Agogué et al., 2014).
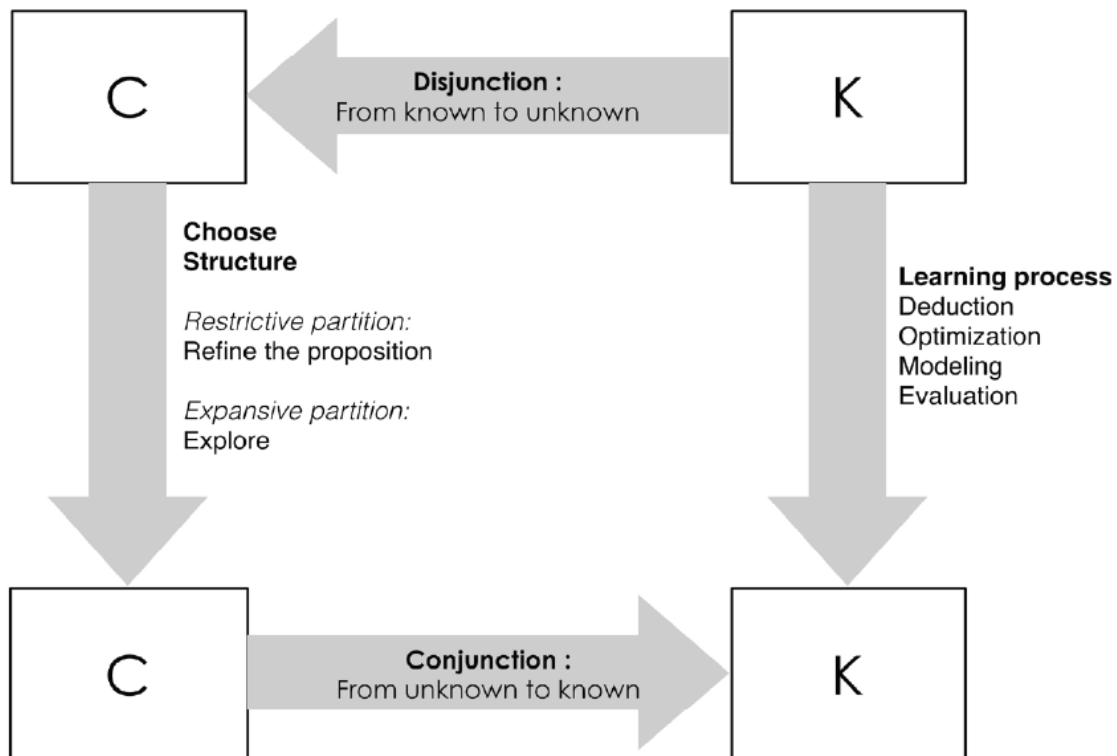

Figure 10.2 The four possible operators (Agogué et al., 2014)

Appendix B - Other Creativity Techniques

This section will provide an overview of some creativity techniques. However, these will not be outlined in detail since, as Herstatt and Verworn (2001) note, this has already been done by numerous authors. The following methods are all described by Gassmann and Schweitzer (2014):

- Synetics
- TILMAG Method
- Spider Meeting
- Six Thinking Hats
- Bisociation Method
- Mind Map
- TRIZ
- Imaginary Brainstorming
- Semantic Intuition
- Morphological Box
- Method 6-3-5
- Gallery Method
- Collective Notebook Method
- CATWOE
- Provocation Technique
- Quick-and-dirty Prototyping
- Five Why's?
- Extreme User Interviews
- Long-Term Prognosis

- World Café

An even wider range of methods can be found through Mycoted (2015).

Appendix C – Lean startup compared to Design thinking and Lean Design Thinking

Lean startup is here seen as including the customer development process by the authors Müller and Thorin (2012).

What	Design thinking	Lean Startup
Goal	Innovations	Innovations
Scope, Focus	General innovations	High-tech innovations for Startups
Approach	User-centered	Customer-oriented
Uncertainty	Solve wicked problems	Unclear customer problem
Testing	Fail early to succeed sooner	Pivoting is at the heart of the 'fail fast' concept. The sooner you realize a hypothesis is wrong, the faster you can update it and retest it.
Iteration	Yes ("Iteration")	Yes ("Pivoting")
Ideation	Ideation is part of the process, solutions are generated in the process	Ideation is not part of the process, product vision is initially provided by company founders
Qualitative Methods	Strong focus: elaborated ethnographic methods, user research, observations, etc.	Not a focus
Quantitative Methods	Not a focus	Strong focus: metric-based analysis; provides matrices, and testing
Business Model	Not a focus	Focus
Adaption of deployments	Not a focus	Five Whys Method
Typical Methods	Shadowing, Qualitative Interview, Paper Prototyping, Brainstorming (with specific rules), Synthesis, etc.	Qualitative Interview, Smoke Test, Paper Prototyping, Innovative Accounting, Split (A/B) Tests, Cohort Analysis, Funnel Metrics, Business Model Canvas, Five Whys, etc.
Hypothesis Testing	Not a focus	Focus
Prototype Testing	Yes	Yes
Rapid iteration	Yes	Yes
Target Group	Users (usually end users, sometimes other stakeholders)	Customers (distinguished between Users, Influencers, Recommenders, Economic Buyers, Decision Makers)

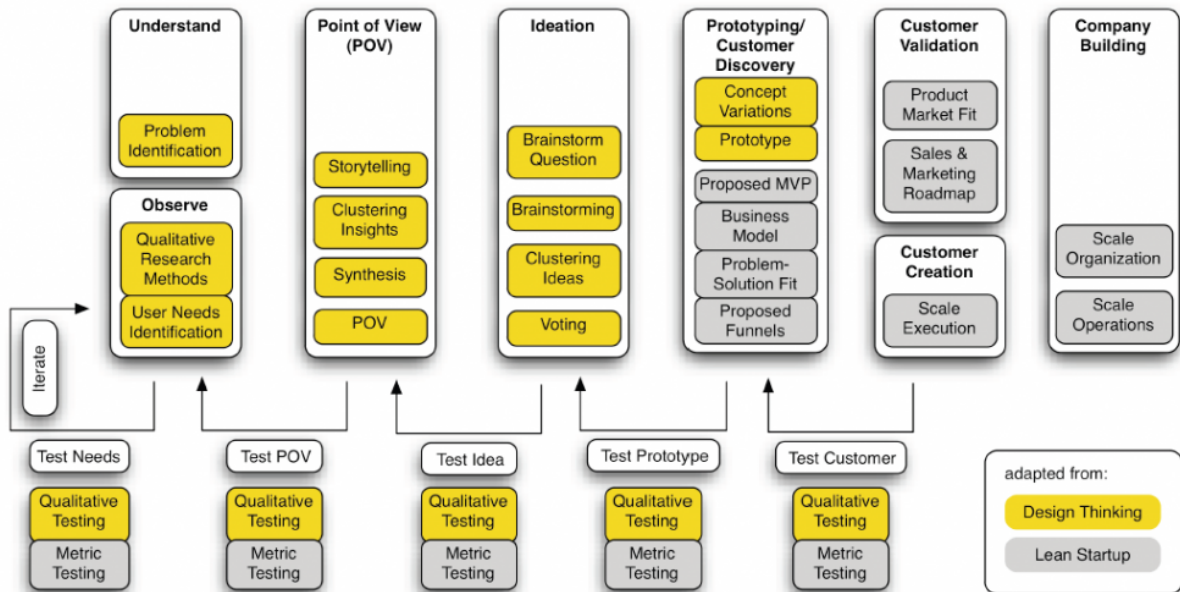*Figure 10.3 Comparing Lean Startup and Design Thinking (Müller & Thorin, 2012)*

Figure 10.4 Integration of Lean Startup and Design Thinking (Müller & Thorin, 2012)

Appendix D -   Recommendations for expert elicitation on probabilities

As originally provided by Kynn (2008: p. 22) in The 'heuristics and biases' bias in expert elicitation, these are the 10 recommendations provided by the author.

Before the elicitation
- In terms of calibration, training questions are valuable only when directly related to test questions. However, this does not negate the benefit of familiarizing the expert with the elicitation process
- Scoring rules can be used as a training device, but they need to be transparent to the expert
- A brief review of basic probability concepts may be helpful

During the elicitation
- Only ask questions from within the area of expertise by using familiar measurements
- Decompose the elicitation into tasks that are as 'small' and distinct as possible. Any assessments that can be combined or computed mechanically should be done with a computer, not in the expert's head. Check for coherency—do not expect the expert to be coherent without aid
- Be specific with wording: use a frequency representation where possible with an explicit reference class or make sure that the set relations within the problem are transparent
- Do not lead the expert by providing sample numbers on which the expert may anchor. Consider the effect of positively or negatively framing questions; if a neutral framing is not possible consider asking the same question in different 'frames' to allow the expert to double-check on assessments
- Ask the expert for, or provide the expert with, specific alternatives to the focal hypothesis; ask the expert to discuss estimates, giving evidence both for and against the focal hypothesis. Consider allowing competing hypotheses to be assessed separately and compared by a ratio

- Offer process feedback about the task and probability assessments; for example, offer different representations of probability (say graphical), give summaries of the assessments made and allow the expert to reconsider estimates

After the elicitation
- If possible, duplicate the elicitation procedure with the same expert at a later date to check the self-consistency of the expert.