Moving into the Unknown

- A Study of How a Newly Established FEI Department Within a Structured and Linear Environment Can Manage Venture Prioritisation

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Abstract

Title: Moving into the Unknown - A Study of How a Newly Established FEI Department Within a Structured and Linear Environment Can Manage Venture Prioritisation.

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Problematisation: In order to stay ahead of competition, pursuing radical innovation is highly important for companies with mature technology. The front end is the first phase of developing radical innovation. The front end is characterised by high uncertainty and a different working process compared to that of incremental innovation. Large mature product companies with mature technology pursuing radical innovation can do so by establishing a FEI department. In order for a newly established FEI department to choose the right ideas for radical innovation, they need to Figure out how an appropriate prioritisation method for their environment can be designed.

Purpose: The purpose of the study is to create a framework describing a prioritisation method for newly established FEI departments within large product companies with mature technology.

Method: A single case study was carried out using an abductive approach and a qualitative research strategy. A pre-study was carried out including both a literature review and interviews. The empirical findings were coded through a comparative analysis with the theoretical framework, created in the main literature study. This led to a summary of findings being created. The summary of findings and the prioritisation models, presented in the literature review, were then analysed in order for a recommended prioritisation method to be described.

Conclusion: This study contributes with a categorisation of front end theory using: Process, Uncertainty, Decision, Leadership and

Teams. Through a comparative analysis, characteristics of newly established FEI departments at large product companies with mature technology were identified; this is the second contribution of this study.

The final contribution is the recommended method, which includes the Hierarchical fuzzy TOPSIS model. The method will give FEI departments the initial structure and planning needed in order for the employees to feel comfortable with a more chaotic work process. It includes fuzzy linguistic that will help them handle uncertainty and improve their communication. Through better communication opportunistic behaviour will be reduced. Defining criteria and sub-criteria in the prioritisation model will increase awareness and the understanding of strategic value, feasibility and attractiveness. The method is designed to be simple to use in order to prevent old behaviour to come back.

Keywords: Radical Innovation, Innovation, Front end, Prioritisation

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Paulina Winbladh and Karin Österström

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1 Introduction

The introduction aims to give the reader a background to the issue presented in this paper, as well as a problematisation regarding why the issue should be researched. This is followed by the purpose of the study and the research questions. Lastly, the disposition of the paper will be presented.

1.1 Background

The technical revolution and the globalisation have led to increased competition between companies. Cutting costs in existing products is no longer enough in order to stay ahead of the competition. Focusing on continuous learning and having a market orientation increase the outcome of radical innovations which lead to a competitive advantage which is why it has become central in many companies' business strategy (Hitt et al, 1998; Baker & Sinkula, 2002). When companies have failed to innovate their business, new competitors have appeared (Yueh, 2014). From 1973 to 1983, the replacement rate of Fortune 1000 companies was 35%. It means that of all the companies that were on the list in 1973, 35% were not on it in 1983. This rate has increased since, being 60% from 1993 to 2003, and was expected to be 70% from 2003 to 2013 (Furr, 2011). An example of when a company failed to innovate their business was when Nokia failed to innovate the market for mobile phones and Apple entered and innovated the usage of mobile phones with the iPhone. In 2007 Nokia had a market share of 40% and almost half of the smartphone market. 2013 the market share had fallen to 15%, and most of the sales consisted of their cheaper range of phones (Yueh, 2014). In order to avoid being outperformed by more innovative companies, radical innovation could be embraced and developed within companies (Lourdes Sosa, 2011).

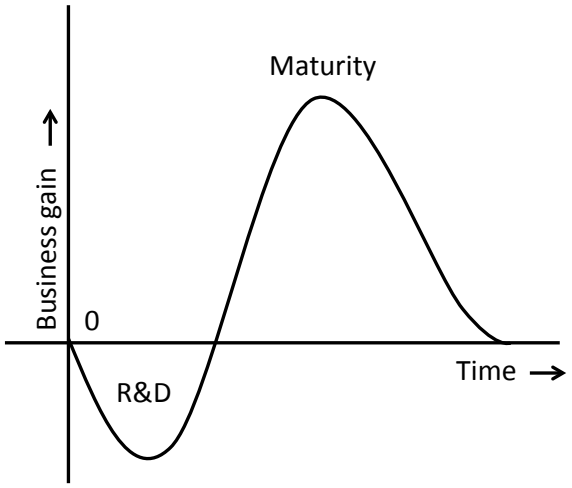

Figure 1: S-curve (Foster, 1968)

For technologically mature companies most processes are optimised to suit high production levels (Dougherty & Hardy, 1996; Christiansen, 1992). Technologically mature companies often focus on incremental innovation development (Garcia & Calantone, 2002). This stage can be described by the s-curve, seen in Figure 1 (Foster, 1968), a model describing the development of a company's technologies (Garcia & Calantone, 2002). In the end of the s-curve, when technological maturity is reached, a new s-curve needs to be initiated in order to stay ahead of competition. To initiate a new s-curve means starting over from the first stage again, the emerging technology stage, where radical innovation is pursued (Brown, 2002).

Developing radical innovation means creating new technologies and market infrastructure or changing the existing ones radically (Garcia & Calantone, 2002). The initial stage of developing radical innovation (Koen et al. 2001) is often referred to as the front end of innovation (FEI)[1] or simply the front end (Backman, Börjesson & Setterberg, 2007; Belliveau, Griffin & Somermeyer, 2004). If a company establishes a specific FEI department to handle this development, the department should according to Freeman and Engel (2007) be separated from the structures and processes of the core business of the company. Both radical innovation and the front end often exist in uncertain environments with unstructured processes (Kim & Wilemon, 2002). Nagji and Tuff (2012) differentiates between two types of radical innovation, transformational and adjacent. While, adjacent innovation activities can benefit from having close ties to the core business, transformational innovation activities benefit from being separated from the core business. For example, the financial funding should be separated from the annual budget cycle, and instead be directly funded by the CEO.

Two important tasks for the front end are selecting the right opportunities and preparing well defined product concepts that help to guide the development of products (Kim & Wilemon, 2002). Khurana and Rosenthal (1998), Verwong and Hestatt (1999) and Garcia and Calantone (2002) argue that in the front end environment, it is difficult to handle the two tasks successfully. However, if the front end to some extent fails to complete the two tasks, the overall development outcome could be inhibited by venture delays, increased costs and performance problems (Kim & Wilemon, 2002).

Companies have to deal with a limited budget, hence there is a need to make the right resource allocation to stay ahead of competition (Meade & Presley, 2002). Vast research done on the subject, highlights the importance of resource allocation (Brenner, 1994; Martino, 1995; Tidd & Bodley, 2002; de Lima & de Sousa Damiani, 2009). Unsuccessful resource allocation may result in waste of scarce resources (Martino, 1995), an example could be not closing down projects once they have begun, even if they turn out to be failures (Kahraman, Büyüközkan & Ateş, 2007). It is therefore necessary for companies to understand how to allocate resources to the

[1] See Appendix I for a list of definitions.

right opportunities, which could be helped by prioritisation. Prioritisation can be done in many different ways. In environments where multiple criteria affect the prioritisation, multi criteria decision-making models are preferable (Meade & Presley, 2002; de Lima & de Sousa Damiani, 2009). Consequently it is possible that different models and criteria are suitable for different companies. Which model and criteria that is the most suitable can depend on the opportunities to be prioritised, but also on the environment, which can differ.

According to Nobelius and Trygg (2002) research regarding the front end has emphasised too much on trying to develop a general front end process. Nobelius and Trygg (2002) say that each front end process is different and that one generalised process for the front end can not be created to be used for all pre-development ventures. Khurana and Rosenthal (1998) claim the process needed depend on the product, market and organisational contexts of the company. Because of this, researching the process and the way prioritisation can be done within the front end should, and will in this study, be done for a narrowly defined subjective.

Characteristics of a large company can partly be explained by the fact that as a company grows, more structure is needed in order to achieve successful development (Freeman & Engel, 2007). The front end is less empirically explored within large companies (Koen, Bertels & Kleinschmidt, 2014). To contribute to the research, this study will therefore focus on the front end within large companies. Since technologically mature companies need to start pursuing radical innovation in order to stay ahead of competition, which can be done by establishing a FEI department, the research will cover newly established FEI departments within technologically mature companies.

Because of the differences between the work process of large companies with mature technology and the work process of the front end, developing research regarding a newly established FEI department at a large technologically mature company is of interest. There are several factors that can hinder radical innovation to be pursued at large and mature companies; organisational routines is one factor and limited search is another. Routines are developed through repetition and the stronger the routines get, the harder it is to change them. Limited search may cause organisational inertia. It is a result of among other things, being satisfied, which means not striving for optimal performance after reaching a satisficing performance level (Grant, 2010; O'Connor & Veryzer, 2001).

A product company has a core business of selling products and not services. For companies developing technical products a critical factor for success is advanced technology (Sasser & Arbeit, 1976). Studies show that R&D investments are more associated with successful performance of product companies than successful performance of service companies (Barras, 1986; Brouwer & Kleinknecht, 1996). This implies that research regarding how to prioritise within the front end of a product

company is more relevant to develop. Limiting the scope to product companies will therefore increase the relevance of the result.

To conclude, the subjective of this study is a newly established FEI department at a large product company with mature technology. In the next sub-chapter a problematisation regarding the potential difficulties of prioritising within the subjective is carried out.

1.2 Problematisation

One reason why it is hard for companies to prioritise in the early stages of development is that the commercial risk is relatively high. It is hard to predict the possible value on the market and therefore also the potential success of an idea or concept (de Lima & de Sousa Damiani, 2009; Verwong & Hestatt, 1999). Another reason is that there are often multiple decision-makers taking part in the prioritisation decisions and some may focus more on proving their point rather than making the best decision (de Lima & de Sousa Damiani, 2009). Using a systematic method for prioritisation could support a FEI department in prioritising between ideas and ventures. A systematic method for prioritisation is defined as a method used by everyone within the department for all ventures. From now on, it will be referred to as a prioritisation method.

The environment around a FEI department can affect how decisions and prioritisation are made (Reid & De Brentani, 2004). Employees within FEI departments often experience difficulties in defining market and technical specifications due to high uncertainty (Steven, 2014), which could require a more flexible prioritisation method to be used. At the same time, employees in the rest of the organisation may not understand the reason for allocating resources to activities that are different from the core business, and lacking clear goals (Nagji & Tuff, 2012). Governance in mature companies often measure success by profit (Wessel, 2012), and might therefore want profit driven criteria to be used in the prioritisation model rather than for example learning criteria. New employees to the FEI department, that have many years of experience from the environment around the FEI department, may be more influenced by their expertise intuition than entrepreneurial intuition. When making decisions and prioritising, experienced individuals might be more trusted and therefore influence the situation more. However, in this type of work entrepreneurial intuition is more important according to Crossan, White and Lane (2004).

Optimised processes and pressured top-down structures are common among mature companies (Wessel, 2012). Putting a technology driven innovation, with high uncertainty, through a long-winded top-down decision process, will risk that a go/kill decision is made for the innovation at the wrong time. Either the decision can be made too early when the potential for the innovation is not yet explored, or too late, when too much resources have already been invested in the project. Hence, a trade

off occurs between adapting the prioritisation method to the way a large product company with mature technology makes decisions and adapting it to the needs of the front end. Due to a long history of stable operations, it can be difficult for mature companies to adapt to new ways of handling operations (Dougherty & Hardy, 1996).

A large product company with mature technology has developed strong routines and processes for incrementally improving their core business. This has led to satisfactory performance for many years, during which the technology has matured. Establishing a new FEI department, which demands a new way of working will possibly create problems associated with these routines. If employees are satisfied with the current performance and cannot see the urgency of establishing a FEI department, they might be unwilling to change their behaviour in order to ease the implementation. The high uncertainty of radical innovation also needs to be taken into account. Because of the uncertainty and since FEI uses processes that are different from the surrounding environment, it can be hard for individuals in the organisation to see the sense of urgency of what the FEI department do and produce. People need a sense of urgency to change their behaviour and routines and accept what is new (Kotter, 1995). This can in turn affect the possible performance of FEI negatively, which leads to the question: does the environment in large product companies with mature technology require that the way of working, especially with prioritisation, within a newly established FEI department, is adapted in any way?

For companies that have decided to establish a FEI department, the question is not whether or not to prioritise between ventures (Koen et al. 2002). Because of scarce resources, prioritisation is required. The question is what affects the way prioritisation of ideas and ventures should be carried out within the front end, and how should prioritisation be carried out (Meade & Presley, 2002). This can be identified by analysing needs of the individuals working within the front end. Taking into account that all companies have different histories and values, it is clear that there is not one foolproof way of managing innovation for large product companies with mature technology, but several. In this study, one way of managing innovation through prioritisation will be researched and presented.

1.3 Purpose

The purpose of the study is to create a framework describing a prioritisation method for newly established FEI departments within large product companies with mature technology.

1.4 Research Questions

1. What characterises a newly established FEI department within a large product company with mature technology?

2. What can a prioritisation model look like that satisfies these characterising features of newly established FEI departments within large product companies with mature technology?

1.5 Disposition

The paper starts with presenting the background and the problematisation of the issue, along with the purpose and the research questions in Chapter 1. The methodology, including how the study was carried out, will be presented in Chapter 2. Both Chapter 3 and 4 are literature chapters. Chapter 3 presents a review of the literature regarding the front end and the environment around the subjective; the chapter is ended by a theoretical framework being presented. Chapter 4 presents prioritisation models appropriate for this study. The literature is divided into two chapters to make it easier for the reader to understand the analysis. In Chapter 5 the empirical findings are presented. In Chapter 6 and 7, the analysis of the study is presented. In chapter 6 a comparative analysis of the empirical findings and the literature from Chapter 3 is presented. After each sub-chapter the key findings are summarised. In the end of Chapter 6, a summary of findings is presented. In Chapter 7, the second part of the analysis is presented; the analysis is based on the summary of findings from Chapter 6 and the prioritisation models from Chapter 4. The result of the analysis is a description of a prioritisation method and a framework supporting the description. These results are presented in the end of Chapter 7. In Chapter 8, a short conclusion of the study will be given. Chapter 9 contains a discussion regarding the study, its validity and reliability, and suggestions to further research.

2 Method

This chapter will start with a description of the research strategy and the design chosen for this study and the reason for this choice. After that the research process will be described shortly, followed by a description and motivation of the selected theories, the selected empirical data and a description of analysis method. Lastly, an explanation of the analysis method will be presented.

2.1 Research strategy and design

The purpose is to create a framework that describes a prioritisation method. This method is based on what characterises a newly established FEI department within a large product company with mature technology, and a selection of an appropriate prioritisation model. Empirical research regarding FEI within large mature companies is scarce (Koen, Bertels & Kleinschmidt, 2014). Qualitative research strategies are suitable when exploring an area that is unknown (Edmondson & McManus 2007), it is therefore suitable to use a qualitative research strategy in this study.

The study was carried out as a single case study. Case study is a preferred research design when questions start with when, how or why are asked (Yin, 2009), as it was done in this study. The study consisted of two phases. The first phase, was the most time consuming phase and aimed to create an understanding of the characteristics of a newly established FEI department at a large product company with mature technology. Based on the result from the first phase, the second phase aimed to select an appropriate prioritisation model and created a prioritisation method. The prioritisation method is a result of combining the two research questions and the result describes how a prioritisation method can help a newly established FEI department at a large product company with mature technology to work with prioritisation. Combining the two research questions helps to reach the purpose, by creating the final purpose question: how can newly established FEI departments within large product companies with mature technology work with prioritisation? Since this was a “how-question”, a case study was a preferable research design. A single-case study was chosen over a multiple case study because of the complexity of the area to be studied, which required an in-depth analysis.

Working in an iterative way and basing the results on the empirical case, without disregarding theory can be described as an abductive approach (Alvesson & Sköldberg, 2008).

2.2 Research process

The study was initialised with a pre-study. The main study had two phases. The first phase is illustrated in Figure 2, and the second phase is illustrated in Figure 3. The first part of the main study was a literature study, consisting of two parts. The first part resulted in a theoretical framework that was used in the first analysis resulting

in the Summary of findings. The Summary of findings from the first part together with the second part of the literature study was used in the second analysis. The final result, a prioritisation method, was based on the summary of findings and a prioritisation model. In Figure 2 and 3 the squared boxes in lighter grey illustrate data collection and the boxes in darker grey illustrate the results. The circles illustrate the analyses.

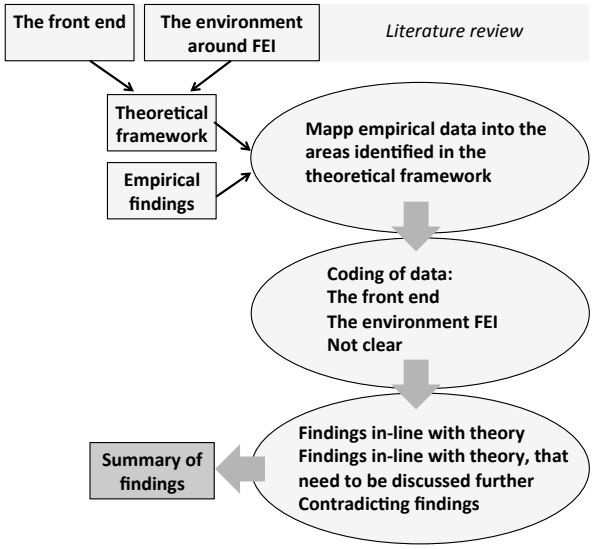

Figure 2: Illustration of the first phase of the research process

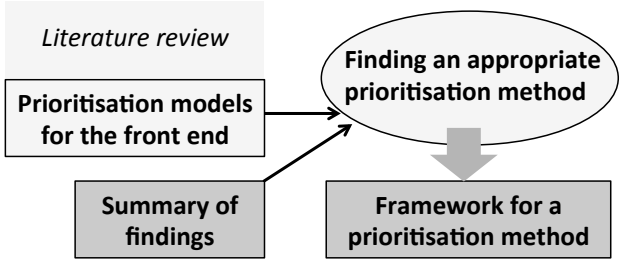

Figure 3: Illustration of the second phase of the research process

Below, the research process is described step by step to create an understanding of the way the study was carried out.

Step 1: Pre-study

A pre-study was used to ease the process of the study and enable the purpose of the study to be more clearly defined. The pre-study consisted of a literature study and an empirical study. The pre-study made it clear that to be able to collect the empirical data effectively, the literature study needed to be carried out first. The complexity of the empirical case and the fact that the people who were interviewed needed more guidance in the interviews than was given during the pre-study. The

pre-study was also conducted in order to create an understanding regarding which theories are relevant to use for the case study.

Step 2: Main literature study

The main literature study covered the front end, theories that could explain the environment around the subjective and prioritisation models. One result of the main literature study, found in Chapter 3, was a theoretical framework categorising literature regarding the front end and theories that could explain the environment around the subjective, into five areas; process, uncertainty, decisions, leadership and teams. Another result of the main literature study was identifying prioritisation models, found in Chapter 4.

Step 3: Selection of interview areas

Based on the literature study, responding expertise areas were identified as: market experts, technical experts, venture leadership, strategy experts and department leadership. Then, interviews were conducted in these expertise areas.

Step 4: Selection of potential respondents

Together with the authors' supervisor at FEI, the employees to be interviewed were selected. All individuals belonged to one of the five expertise areas. Venture leadership was an expertise area covered by venture leaders and the department leadership was covered by the director, who has an overall department responsibility.

Step 5: Confirmation of interview plan

After receiving positive answers from a satisfactory number of employees, the interview plan was confirmed.

Step 6: Create interview templates for each expertise area

Interview templates for semi-structured interview were created for each expertise area.

Step 7: Conduct interviews

The interviews were conducted during two weeks in a private conference room at Tetra Pak. After each interview, the authors transcribed the recordings.

Step 8: Summarise answers and send to respondents for confirmation

From the transcriptions, answers were summarised in excel sheets and sent to the respondents for confirmations or additional comments.

Step 9: Adjust transcriptions according to respondents' comments

The received adjustments were added to the existing answers and in some cases replaced some answers.

Step 10: Compile the empirical data

The answers from the different interviewees were sorted in an excel sheet after which area the information covers.

Step 11: Create the theoretical framework

The theoretical framework was first put together after the literature study. It was revised during the empirical study as well and ended up containing research regarding FEI and theories that can explain the environment around the subject. Due to complexity of the study involving iterative processes and uncertainty, the theoretical framework was continuously altered during the empirical research, in an iterative way. After the iterations and empirical study was completed all data was

analysed. To get an understanding of how different areas were used and analysed, see Figure 2.

Step 12: Comparative analysis

A comparative analysis between the empirical findings and the theoretical framework was carried out in order to classify the empirical findings depending on if the data indicated that the front end theory was confirmed, if theories regarding the subjective were confirmed or if the information covered something else. Appendix IV shows the mapping and coding of the comparative analysis.

Step 13: Analyse conflicting, non-conflicting and other findings

The classified findings were analysed in order to understand and explain why some findings contradicted and some did not. Findings that could not be connected to the theoretical framework were also analysed.

Step 14: Create a summary of findings

Based on the analysis, a summary of the findings was created. It describes how the subjective should work, in concordance with front end theory, in concordance with theories describing the environment around the subjective, as well as how the subjective should work, caused by being a newly established department.

Step 15: Analysis to find an appropriate prioritisation support method

The prioritisation models described in the literature study but not included in the theoretical framework were analysed based on the summary of findings, in order for one model to be selected.

Step 16: Combine the results

The chosen prioritisation model was combined with the summary of findings in order to create a framework that describes how a prioritisation method should be used by the subjective.

2.3 Selection of theories

A main literature study was conducted in order to create a theoretical framework and identifying prioritisation models. The theoretical framework was used for a comparison to the empirical findings during the analysis. The two focus areas of this part of the literature study were: the front end and theories that could explain the influence of the large product company with mature technology on the subjective. The latter area will from now on be called *The company environment,* as seen in Figure 2 above. The literature study covered the wider area of FEI, not limited to a specific type of company, since the empirical studies of FEI within large companies are scarce. The theories and research regarding the company environment were focused around the innovation behaviour of large product companies with mature technology. In this study a mature company was assumed to be old, however the authors are aware that there are companies that are young and mature.

The study focused on mature technology. It was assumed that maturity has similarities to the definition of technical manufacturing using the s-curve. This means that the performance of a product or a process and how performance will be handle by engineering change as the technology matures (Christensen, 1992). There are

three stages of technology maturity: the emerging technology stage, the development technology stage and the mature technology stage (Brown, 2002). Thus, a company of high maturity is found at the upper part of the curve, see Figure 1 (Brown, 2002). Another reason why the s-curve was a good way to explain the circumstances in this study was because the study investigates a product company. A product company sells products instead of services, and the revenues are affected by R&D performance.

Apart from creating a theoretical framework the second part of the main literature study was conducted in order to identify prioritisation models. For the selection of prioritisation models, only multi-criteria decision-making methods were researched since it was clear after the pre-study that prioritisation within FEI was complex and require multiple criteria. There exist a wide range of multi-criteria analysis methods. MCDM can be divided into multi-attribute decision-making (MADM) and multi-objective decision-making (MODM). (Sun et al. 2014)

In MADM the alternatives' attributes will be used to set criteria for a prioritisation, and this will enable the decision makers to see which the best alternative is. MODM on the other hand optimises the decision maker's objectives, and from that alternatives will be created. For simplicity, attributes were referred to as criteria in the rest of this study. Since this study examines the prioritisation of already existing ventures or ideas within the front end, similar to what MADM the selected prioritisation theories were limited to MADM methods. MADM can be divided into four categories: Momentary, elementary, multi attribute utility theory (MAUT) and outranking methods. During the pre-study enough knowledge was gather to rule out momentary, elementary and outranking methods, thus this study will only focus on MAUT methods.

The front end often require fuzzy values to be included, values are not numbers in this case. Based on the findings from previous research, it has shown that MADM methods had been of focus in research regarding fuzzy adaptations of methods for the front end, fuzzy NPD and innovation. Therefore MADM methods were selected for this study as well. Within the area of MAUT methods, three models were selected. These are Analytic hierarchy process (AHP), Analytic network process (ANP), The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS).

The literature study was conducted in order to (1) create a theoretical framework of what might influence the way the subjective works and (2) identify which prioritisation model that can be suitable to use for the subjective. To get a further understanding of when the theories are used, see Figure 2 and 3 in Sub-chapter 2.2.

2.4 Selection of empirical data

The empirical study was carried out in order to understand how a newly established FEI department at a large product company with mature technology works and what

their need of a prioritisation model looks like. The empirical study was conducted using semi-structured interviews, passive observations and informal interviews; these are further evaluated in sub-section *Data collection*.

2.4.1 The case

The subjective of this study is a newly established FEI department at a large product company with mature technology. A large company is said to be 2500 employees. This is based on an American study in The Business Journals (2012) and seems reasonable partly because one person has the ability to remember 125 different people in one group. This implies that multiple managers are needed, and as the amount of employees increase more structure is needed. A mature technology can be explained using the s-curve.

Tetra Pak was chosen as the case company because of the relevance to the issue studied. It is a large product company, with about 3500 employees in the site in Lund. The site in Lund is a structured organisation, which is something a large company needs, and it therefore indicates that the site in Lund acts like a large company. According to Henriksson (2015), Tetra Pak is at the end of the s-curve, working towards starting a new s-curve, which indicates that Tetra Pak is a highly mature company.

The FEI department at Tetra Pak is a new department; it was formally founded in 2013. As described in the introduction, other similar companies can benefit from starting their own FEI departments. This makes it relevant to do an in-depth analysis of a newly established FEI department in this context (Farguhar, 2012).

2.4.2 Data collection

This sub-chapter will present the data collection of the pre-study and the main study.

The pre-study

The empirical pre-study consists of eight interviews, see Appendix III, with people associated with FEI at Tetra Pak. The interviews helped to identify important people for the main empirical study and what kind of questions should be asked. The interviews also increased the understanding of the FEI department at Tetra Pak and the interactions and collaborations with R&D organisations within Tetra Pak, but outside of FEI.

Two of the respondents work on a strategic level within Tetra Pak and are directly a part of the overall strategic decisions concerning innovation within Tetra Pak. The rest of the respondents are employed within FEI, but on different positions. The interviews were semi-structured, following the same interview guide. The length of the interviews varied from 25 minutes to one hour. The questions were kept general and fact focused to get an overall understanding of the employees, the tasks and the department objective. The interviews were recorded and one of the authors was in

charge of interviewing while the other one took notes to complement the recording. The reason behind the recording was to create an opportunity to go back and listen to the answers again when preparing the empirical study. Doing this helped to identify both what the individuals said and the way they said it (Bryman & Bell, 2011).

The main-study

Based on the literature regarding front end, relevant expertise areas were identified. The areas are market, technology, venture leaders, strategy and leadership. Market and technical experts are believed to have relevant knowledge on how market and technology uncertainty is reduced. Strategy experts, venture leaders and the director contributed with different knowledge perspectives on characteristics of strategic value and how leadership is different from the environment where FEI exists.

In agreement with the authors' supervisor at Tetra Pak nine individuals were identified to be able to contribute with empirical data in all expertise areas. The empirical findings contributed with both information regarding the way work is carried out at FEI, but also regarding different individuals perceptions regarding the work they are doing. Understanding the individual perception of FEI is interesting because dependent of their experience and current position they may interpret the working conditions at FEI department differently. This could give some indication of what the working environment looks like at FEI.

In this study the employees interviewed will be named Venture leader 1, Venture leader 2, et cetera. Name identification is neither necessary nor possible because of privacy reasons. To be able to differentiate between individuals and to add context for the reader, the employees will be referenced to as Venture leader 1, Venture leader 2, and so on, or as named venture leaders if both venture leaders agree on the same thing. The employees can be affected by work interactions; this type of references will therefore enable a deeper analysis to be carried out.

Nine semi-structured interviews were conducted in the main empirical study, see Appendix III. Semi-structured interviews were used because there was a need for the same outline of questions, based on main categories and subcategories, but the interviewer also had to sense in which way the interview would proceed (Bryman & Bell, 2010). This was important for the study of two reasons. One reason was that the results needed to be comparable between individuals. The other reason was that because the environment within FEI was observed as unclear and the employees were uncertain of their way of working there was a need to ask a second question based on some of the answers from the first question.

All respondents work within FEI, and some but not all were interviewed during the pre-study. All except one interview were conducted in a semi-structured way, the remaining interview was conducted in an unstructured fashion. See Appendix III for

a list of interviews. The questions in the interviews were based on the findings in the pre-study along with the areas identified in the literature study. The questions were mapped based on parameters found during the literature study in order to ease the comparison between the result from the empirical study and the theoretical framework.

All interviews were conducted in a small meeting room to avoid disturbance both from people passing by as well as creating a safer environment in which it was possible to speak freely. The interviews were recorded while one interviewer held the interview and the other one was taking notes. This enabled for notes to be taken regarding reactions of the respondent and other thoughts and questions that appeared during the interview. Notes were also taken of the answers given in the interviews. The reason why the interviews were recorded was to enable transcription. The authors decided that it was necessary to use transcription for this study in order to catch small details that might otherwise have been lost because of the amount of information that was given (Bryman & Bell, 2010). By transcribing the interviews, the answers given could afterwards be confirmed by the respondents. This reduced the risk that the authors have misinterpreted some part of the interview (Bryman & Bell, 2010).

Theoretical sampling was used when choosing respondents for complementing interviews (Glaser & Strauss, 1967). As the data from the primary interviews where coded and analysed, the authors decided on which respondents needed to be interviewed again and which new respondents needed to be interviewed. Informal interviews were held when interviewing some of the respondents a second time or when following -up on the first interviews.

The authors also conducted observations of meetings at the FEI department of the organisation. This was conducted using open observations since it is quite difficult to attend a meeting not stating what the purpose of one's appearance is. Since most of the attendants in the meetings already have had interviews with the authors, they already had an understanding about what was observed. Observations have been carried out in multiple meetings; both venture follow-ups as well as knowledge spreading meetings. The authors kept a passive observatory role during the meetings. (Bryman & Bell, 2010)

2.5 Description of analysis method

This study's analysis has two parts. The first part of the analysis aims to describe the subjective's characteristics, which will explain how they work and their need of a prioritisation tool.

To fully understand this, a comparative analysis between the empirical findings and the theoretical framework needed to be performed. The first step was to map the empirical findings into the five areas identified in the theoretical framework. This

was done in order to make the rest of the analysis easier to understand and to create order in the empirical data. See Appendix IV for a summary of the mapping and coding. After this, the mapped empirical findings were compared to the theoretical framework and coded into three categories; front end theory, theories explaining the environment around FEI and not clear. The coding meant classifying if the findings agreed with front end theory and research or if the findings agreed with theories and research describing the environment around FEI. If findings corresponded with neither research area within the theoretical framework, it was classified as not clear. The findings that were classified as not clear where clarified using additional theory and then categorised into either front end theory, or theories explaining the environment around FEI. After all findings were categorised into either front end theory, or theories explaining the environment around FEI the result was analysed in seen in Chapter 6. This mapping was only done in tables because it was the best way to enable a clear overview of the findings for the reader and to analyse it, see Appendix IV (Backman, 2008).

When the coding was performed, the findings were compared to each other in order to see which findings indicate the same thing and which findings contradict each other. These areas were then further analysed and found in Chapter 6. This way of working is called enfolding the literature (Eisenhardt, 1989). In this case, the empirical findings are also enfolded against each other at the same time. In the last part of the analysis, leading to the adapted generalised framework, theory and empirical findings were not separated from each other. The summary of findings describes the way the subjective works within the areas identified in front end literature review. The result of the first analysis was a summary of findings describing the way the subjective works within the five areas in the theoretical framework identified earlier.

The second part of the analysis is based on the summary of findings and the literature review of prioritisation models.

In order to select an appropriate prioritisation model from the ones identified during the literature study, the pros and cons of each model were compared to the summary of findings. This created a prioritisation method suitable for the subjective, based on the summary of findings.

2.6 Limitations

This study has a qualitative research design and was carried out based on eight main interviews at one case company. Previous empirical research carried out for the front end in large and mature companies is scarce but what can be found is also based on qualitative research, even if the empirical data collection has been larger. This indicates that an appropriate research design has been used. The reason for choosing to conduct a single case study was to enable an in-depth analysis. Even though only eight employees were interviewed for the main study, which can sound

like a small number, eight employees is one third of all people employed at the FEI department. These eight employees include all people involved in prioritisation at the FEI department. Because of this, it is assumed that an in-depth analysis of the prioritisation can be made. All interviews except one were conducted using semi-structured interviews the last one was unstructured. It is believed that this has had no or little affect on the result of the study because the purpose of the answers from the unstructured interview was of a more general and informative nature.

From all areas, except one, in which interviews were conducted at least two individuals were interviewed. This was done in order to identify different perspectives of employees working within the same area. Unfortunately, only one market expert was interviewed. This can have resulted in limited understanding of the difficulties in working with market uncertainty. Since, the study has an individualistic perspective the market expert can still contribute with information on how they work with market uncertainty.

After conducting one interview with a venture leader, a misunderstanding was revealed. The respondent was not actually a venture leader. Because of this, the questions asked turned out to be inappropriate for this person and therefore the interview was not included in this study.

One problem with the observations was that it was not possible to record and therefore it has been difficult to remember everything that was said (Bryman & Bell, 2011). Notes were taken during the meetings in order to collect as much data as possible.

Writing a public paper and not being part of the organisation, the authors have experienced some difficulties in being allowed observe to meetings. This has led to limitations for the study, such as not being able to observe innovation strategy meetings outside of FEI.

3 Literature review

In this literature review, research and theories explaining the front end and the environment around the subjective will be presented. In the end of this chapter, a theoretical framework summarising the chapter will be presented. The theoretical framework will later be used in the analysis. For further understanding, please see Figure 2.

3.1 The environment around the subjective

This sub-chapter is a literature review describing characterising features of large product companies with mature technology as well as theories regarding change management. It aims to explain how the environment around the subjective might influence the subjective.

3.1.1 The product company

A product company develops tangible deliverables for a customer or consumer. The process of developing a new product differs from a service company, developing a new service. The service development has a closer development process with customer and is based on more development steps than product development. Product development focuses on testing the product, while service development includes both testing and educating personnel (Handfield, Ragatz, Peterson & Monczka, 1999). A product company's most critical factor to succeed is advanced technology, while a service company most critical factor is employee performance (Sasser & Arbeit, 1976).

3.1.2 The large company

As companies grow, the need for organisation and structure increase. Due to more relationships with suppliers and customers, there are increased external responsibilities, and increased internal control in order to achieve successful development. Multiple studies show that it is hard for large companies to introduce radical innovations because there are internal cultures and pressures often pushing towards lower risk, directly rewarding businesses and incremental innovations (McDermott & O'Connor, 2002).

3.1.3 The mature company

Usually when companies grow they mature, the core business develops and the innovation processes that exist slow down. Innovation processes slow down because, as companies grow, the employees' responsibility shifts from being creative to always focus on the problems that need the most attention (Freeman & Engel, 2007). A company with mature technology has a long history of stable operations (Dougherty & Hardy, 1996). The stable operations means to have incremental innovation practices, which results in companies struggle to become radically innovative. The major problems for these companies are technology changes and global competition. For these companies innovation occasionally occur,

not because of the organisational structure, but by coincidence (Dougherty & Hardy, 1996).

3.1.4 Uncertainty and decisions

Mature companies that focus on incremental innovation, exist in an environment where market know-how is clearly defined. From a market perspective, this means that the market is heading towards being saturated, with diminishing returns, many competitors and commodity-like products (Garcia & Calantone, 2002). When it comes to market scope a common problem is that companies that have focused on current customers may encounter problems foreseeing new markets, which can easily cause the company to look at familiar markets causing cannibalism or difficulties in finding the new paths (McDermott & O'Connor, 2002). Focusing on incremental innovation makes technology and market uncertainty lower than radical innovation does. (Garcia & Calantone, 2002). This means that decision-making for incremental innovations could be handle with relatively little difficulty (Bessant, von Stamm, Moeslein & Neyer, 2010). Having low uncertainty also makes it easier to handle decision-making using quantitative data through formal and precise processes (Kim & Wilemon, 2002).

3.1.5 Leadership and teams

A common problem within competence creation is that companies believe that experts within manufacturing and market are necessary in the beginning of and along the project. According to McDermott and O'Connor (2002) this is not true for development of radical innovation. However, when it comes to management it is common that projects are handled the same way for both incremental and radical innovation. One reason for this could be that radical innovation at large firms are usually rare and the companies lack the internal experience and expertise to know how to handle these projects. Managers working in a large company have to be good at understanding resource allocation and driving processes forward. The company also needs good specialists, belonging to specialist departments but working in appropriate projects that are functional specific. The project can then be passes on from function to function (Christensen & Overdorf, 2000).

3.1.6 Change Management

When working with change, there are several steps to take in order to move forward with the change. The first step is taken when an organisation has identified a need for change. The need could be caused by a new competitive market, a loss of patent or trends indicating future margin loss. Usually an action plan is created, that has to be communicated out in the organisation. Failing to communicate the reason for change, employees will not be motivated to change because they do not understand why they have to change. This is called to create a sense of urgency. If an organisation fails to create a sense of urgency employees will not invest time to work with or support the change. Thus, nothing will happen. (Kotter, 1995)

Even if change has been initiated and implemented in the right place, there is still a risk that people will go back to their old way of doing things. The reason for this is that within companies there exist change restrictors who aim to stop the change. If the leaders of change let go of the change too early, not making sure the change has become a part of the organisational culture, there is a risk that people who are far away from the change leaders will go back to their old social norms and shared values. Being too far away from change leaders, means that when the leaders are not actively working for change it is hard to remember how the new way of working should be carried out. (Kotter, 1995)

3.2 The Front End

The front end, the fuzzy front end or the front end of innovation, are different names for the first stage within the innovation process (Backman, Börjesson & Setterberg, 2007; Belliveau, Griffin & Somermeyer, 2004). The term fuzzy front end was discovered in the literature in 1991. At that point onwards multiple sources has considered the front end process as the product development process covering idea generation until the idea is approved for bigger investments, development or termination (Boeddrich, 2004; Verworn, 2009).

The front end is followed by new product development (NPD) and commercialisation (Backman, Börjesson & Setterberg, 2007; Belliveau, Griffin & Somermeyer, 2004), see Figure 4. The reason for separating the front end process from the NPD process is the assumption that they face different levels of uncertainty (Jetter & Sperry, 2009; Belliveau, Griffin & Somermeyer, 2004).

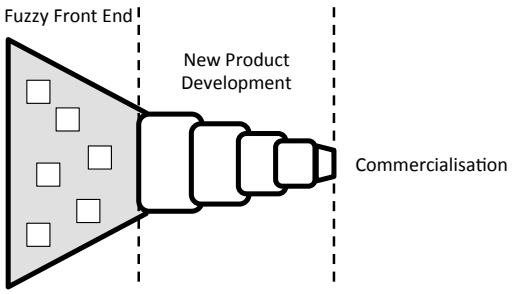

Figure 4: The innovation development can be divided into three parts, the front end, new product development (NPD) and commercialisation. (Belliveau, Griffin & Somermeyer, 2004; Koen et al, 2001)

3.2.1 Level of innovation

Literature has used different topology over the years to explain different innovation levels. Garcia and Calantone (2002) tried to merge different ways of explaining innovation levels to one common language. The level of innovation can be explained looking at two different s-curves: a technology s-curve and a market s-curve on macro as well as micro level. A macro level change means that an industry or a customer is affected, while a micro level change is company related. The highest

level of innovation is called radical innovation, and leads to macro level discontinuities on both s-curves. The second highest level of innovation is called really new innovations. These are commonly and easily confused with radical innovations. The difference is that really new innovations only have macro level discontinuities in one of the two s-curves. Both radical and really new innovations are called discontinuous innovations. Incremental innovations are a lower level of innovation and are often referred to as development of product features or improvements of existing technology on existing markets. Incremental innovations only lead to micro level discontinuities. Incremental innovations are useful for technology improvements in mature markets. (Garcia & Calantone, 2002)

To better understand where a type of innovation is handled in the organisation, Nagji and Tuff (2012) uses the terms core, adjacent and transformational. The core business is explained as optimising products for the customer, and here Garcia and Calantone (2002) explain that incremental innovation can take place. Adjacent innovation is something that is new to the company but not new to the industry, thus it could either be incremental or really new innovations. Transformational innovations are innovations that do not yet exist on any market. Transformational innovations can either be really new innovations or radical innovations (Nagji & Tuff, 2012; Garcia & Calantone, 2002).

3.2.2 Process

Both opportunities for radical innovation and problems within the development of radical innovations are often emergent and hard to foresee (Gomes, 2003). The objectives of an organisation working with radical innovation should be focusing on organising the employees. Rothwell (1992) describes this focus as being people-oriented. While employees working with adjacent innovation benefit from being organised with close ties to the core business, as long as the people are given the right tools, employees working with transformational innovations should be completely separated from the core business. This includes being separated financially, organisationally and in some cases physically, from the core business (Nagji & Tuff, 2012).

The organisation or department working with radical innovation is one of disorder, where ideas and ventures are uncertain. The work is dynamic, focusing on discovering new phenomena and the analysis of problems is based on organisational, market and technology interactions (Gomes, 2003). The work can also be explained as experimental and often chaotic, people devoted to this type of work often argue that it is possible to schedule work but not the process of generating ideas. To handle this type of chaotic work, iterations and loop-backs are often used. In a later stage of the development process, NDP, this type of work would cause delays and add costs. However, due to the explorative nature, costs are low and iterations increase understanding of the uncertainty, hence delays are not a problem. Instead, a well completed front end process increase development success (Koen et al, 2001).

While incremental projects works well with standardised and formal processes, the front end is described as an evolutionary product development process that has less explicit product and market specifications. The reason for less explicit market specification is that in early stages, such as the front end and when the level of innovation is high, is that customer specifications are not yet defined. When customer specifications are not defined, it can be hard to make calculations for return on investment and net present value, needed for more explicit market specifications. To avoid this problem, managers should use both economic and non-economic metrics to measure progress (Nagji & Tuff, 2012). Boeddrich (2004) argues that besides using non-economic metrics, in some cases a less chaotic environment in the beginning could be an advantage for the front end because it makes it easier for senior management to become engaged in a venture or idea. It can also increase the ability to estimate the anticipated investments in manufacturing and distribution. By doing so, it could be possible to evaluate the likely effect of developing completely new components on overall development time.

When working and moving forward in the front end, progress can be measured by strengthened concepts, which means that when a concept grows stronger, progress is achieved and the venture move forward (Koen et al, 2001). Verworn (2009) prove that the intensity of initial planning prior to development affects the success of the innovation. However, this effect is indirect. The reason is that initial planning increase communication and helps to establish common ground for the venture. By doing so uncertainties are reduced. Focusing on planning in FEI departments also helps to integrate employees from different departments (Verworn et al, 2008). Initial planning focuses on specification of tasks, milestones and resources. Boeddrich (2004) also talks about early structure and states that to be successful in moving forward in the front end process three parts are important. This includes that ideas should be linked to a strategic value as early in the process as possible, there should be a clear customer value and the idea concept definition phase has to be structured. The front end process aims to explore options, by doing this the process moves forward. This is also one of the reasons why the learning process, along with initial planning, becomes an important part of the front end process.

3.2.3 Learning process

Hurley and Hult (1998) show that a higher level of innovation is in need of increased market research and increased organisational learning. Stevens (2014) also emphasis the importance of learning and how learning strategies increase the success rate of creating NPD projects. Hurley and Hult (1998) concludes that learning has to occur on a culture level, which means that it has to be a natural course of action for all employees. The level of innovation is increased by the possibility to learn but also since employees feel that they are part of the decision-making (Hurley & Hult, 1998). Boeddrich (2004) describes that the front end process has to be, at some level, structurally managed without affecting the employees' creativity or ability to take own initiatives. This could be done by combining initial structure with a less

structured working method, where the focus is on increasing learning and reducing uncertainty (O'Connor, 1998; Boeddrich, 2004).

In a newly published research by Stevens (2014) there are three important areas in which to increase learning:

- Areas of uncertainty, market and technology
- Resources
- Organisation

Learning is defined as development of knowledge and insight and it can be illustrated in multiple processes: intuiting, interpreting, integrating and institutionalising on three levels, individual, group and organisational (Crossan, Lane & White, 1999). Intuition is necessary on an individual level to create ideas from the outside. Interpreting this with others helps to take an idea from pre-verbal to verbal objectives. Integrating the idea, by sharing it in a group and deciding for course of action. Institutionalising occurs when an idea is incorporated into the organisation, making learning, processes and rules spread throughout the organisation. According to Crossan, Lane and White (1999) intuition is an important part on an individual level and there are two types of intuition; expertise and entrepreneurial intuition. Expertise intuition, uses past experience and knowledge on a high level of recognising patterns, while entrepreneurial intuition, focuses on drawing novel connections and identifying possibilities that has not been seen before.

3.2.4 Uncertainty

In the study by Verworn (2009) it is evident that reducing market and technology uncertainty has positive effects on the success of concepts within the front end. Market uncertainty includes market and customer needs, and technology uncertainty includes knowledge about the technology, its components and usage (Verworn et al. 2008; Verworn 2009). Furthermore, reducing the technical uncertainty during the front end will directly improve the efficiency of the rest of the development process (Verworn, 2009). Reducing market uncertainty improve communication and reduce deviations during project execution, but is not proven to improve the efficiency of the development process as much as the reduction of technical uncertainty does. The market and technical uncertainty are higher for radical innovations than for incremental innovations (Nagji & Tuff, 2012). In order to lower the market uncertainty, for radical innovation, more resources and clearer final targets are required. The uncertainty associated with the front end makes it necessary to use iterations and loop-backs (Jetter & Sperry, 2009; Belliveau, Griffin & Somermeyer, 2004).

One reason why market uncertainty is higher for the front end than for NPD, is that the front end deals with long lead times, which makes it harder to identify customer needs. This means that the venture team has to figure out customer needs years in advance (Verworn et al. 2008). The difficulty in understanding customer needs in advance is one of the reasons why it is difficult to predict the commercialisation date

for a new product or business (Koen et al, 2001). To successfully identify market needs, Khurana et al. (1998) argues that companies have to understand the reason behind market leadership and understand who your customers are. When identifying market leadership, focus is on price sensitivity and market attractiveness. When identifying customers, focus is on what existing and potential customers need and want (Verworn et al. 2008).

In comparison to market uncertainty, technical uncertainty is fairly well reduced by the end of the front end process. In order to lower the technical uncertainty, technical requirements need to be defined. Technical requirements can for example be new technical knowledge, new components for the innovation or improved processes (Verworn, 2009). Even though technical uncertainty is fairly well reduced product specifications are still hard to specify. A reason that products specifications are not clear could be lack of communication between market and the front end. Another way to make product specifications clearer, thus reduce large risks and uncertainty, is for the front end to perform pre-development activities (Verworn et al. 2008).

The high uncertainty also makes it hard to decide for venture funding. Incremental projects are often given a certain budget for each project. Ventures within the front end, on the other hand, are often neglected by management or funded because the sunk costs are already high and the management do not want to lose their "investment". Furthermore, revenue expectations are often uncertain because of the unpredictable commercialisation date in the far future (Koen et al, 2001).

3.2.5 Decision-making

Decision-making is important in order to proceed with the ideas and concepts that are most probable to create the best opportunities for the organisation (Koen et al. 2001). Bessant, von Stamm, Moeslein and Neyer (2010) states that the risk of failure increases when companies do not invest time in developing an appropriate selection process. If the selection process is not managed, companies are only gambling (Bessant, von Stamm, Moeslein & Neyer, 2010). It is difficult to deal with decision-making within the front end because information is limited and uncertainty is high. To ease decision-making there should be some formality and it should be supported by management as well as having a process facilitator. Koen et al (2001) also states that decision-makers should have a positive attitude towards concepts rather than using decision-making as a way to filter bad ideas.

Information as well as decision-making, within radical innovation processes, has a bottom-up flow (Reid & De Brentani, 2004). This means that individuals identify patterns of the environment, for example a new technology that is emerging or a market shift, and communicate this upwards to corporate decision-making (Reid & De Brentani, 2004; Boeddrich, 2004). Brentani and Reid (2012) identify three interface levels where decision-making within the front end should be held: boundary, gatekeeping and project. The boundary interface exists where individuals

take part of what is changing within the environment. Whatever is selected to be brought back to the organisation is decided on individual basis. Next interface is gatekeeping; this is where information flows from an individual, often the one from the boundary interface, to the organisation. The last stop is project interface, which involves a flow of information from the organisation to a specific project (venture). Decision-making at this interface usually rests with senior management and concerns company investments (Boeddrich, 2004; Brentani & Reid, 2012).

A study based on multiple firms show that the senior management group that makes decisions is more successful when the group is based on expertise from many different areas (Bessant, von Stamm, Meoslein & Neyer, 2010). Verworn (2009) confirms this in a study that shows that interdisciplinary idea selection increases success rate. Kim and Wilemon (2002) state that different criteria could be important at different times. Market potential and company fit are more important in earlier stages, while competitiveness, resources, feasibility or profitability could be of higher interest in decision-making towards the end of the front end process.

3.2.6 Leadership

It is necessary to involve senior management in the front end process (Kim & Wilemon, 2002), because senior management can help to make funding decision, which may affect an already established yearly company budget (Nagji & Tuff, 2012). Furthermore, senior management's involvement is an important motivator for venture leaders working in the front end. If venture teams lack support from senior management, or from any management level it is more difficult to move the venture forward (Kim & Wilemon, 2002). Higher management can also be sponsors, these people aims to promote the work at of front end ventures and ease the tension it may cause (Bessant, von Stamm, Meoslein & Neyer, 2010).

Management is important because it can influence most of the factors that have an impact on development success. Knowing this, management should shift focus towards the front end instead of product launch (Verworn, 2009). Boeddrich (2004) argues that leadership within the front end should be sensitive and transparent. Literature shows that management continuously and with clarity has to communicate innovation ideas, goals and strategy to enable better work and help decision-making (Koen et al, 2001; Nagji & Tuff, 2012). Culture is mentioned in the process section, and is important for the learning process to be successful. A certain culture that is needed includes curiosity, transparency and trial and error. Hurley and Hult (1998) state that it is the responsibility of management to create a culture within the company and FEI departments in particular, that is favourable for the learning process within the front end.

3.2.7 Teams

The activities within the front end are normally carried out by individuals or teams, aiming to conduct research while minimising risk and optimise potential (Koen et al, 2001). Individuals working with early concepts have to have an entrepreneurial

spirit, which enables the exploratory phase (Crossan, Lane & White, 2004; Bessant, von Stamm, Meoslein & Neyer, 2010). These are people who seize opportunities; inside companies these people are called intrapreneurs. Driving these opportunities inside an organisation usually creates tension between creativity and control (Bessant, von Stamm, Meoslein & Neyer, 2010). Besides entrepreneurial skills, it is also important to have a combination of engineering and business sense (Kim & Wilemon, 2002).

According to Verworn (2009) idea generation based on interdisciplinary teams is important for concept success. Furthermore, if teams that select ideas are interdisciplinary the success rate increase even further because idea generation and selection are interrelated.

In order to handle radical innovations, companies have to invest in new internal or external problem solving approaches to develop new technical or commercial skills (Du Plessis, 2007; Zhou & Li. 2012). Working with radical innovation, inventors who can visualise the technical aspects, and people who can understand the market, are both needed (McDermott & O'Connor, 2002). In the beginning of idea generation, the need for technical skills is often stronger, but as the activities within front end proceed, the need for market knowledge grows stronger. Individuals usually bring ideas to the organisation, through a bottom-up information flow, without senior management directing activities to find certain solutions. These individuals can also be referred to as information creators (Reid & De Brentani, 2004).

Defining the concept for a radical innovation requires more competence and skills than when defining concepts for incremental innovation. The competence and skill of these employees also differ from that of other employees. This means that employees working with radical innovation increase their technical knowledge, thus radical innovation helps to widen the organisational knowledge.

3.3 A summarising theoretical framework

The theoretical framework below in Table 1 is a summary of the theory and previous research presented above. The summary has been divided into five subject areas, identified as common areas for the front end and the environment around the subjective. The subject areas are the following: process, uncertainty, decisions, leadership and teams. This is done in order to ease the analysis later on. The uncertainty area contains both market uncertainty and technical uncertainty.

Table 1: Theoretical Framework

Theory	Process	Uncertainty
The front end	Chaotic process with loop-backs and iterations. Initial planning	High uncertainty ventures. Reduce technical uncertainty by creating learning/knowledge. Venture progress is seen as increased technical knowledge. Understand market leadership and customer needs to reduce market uncertainty.
The environment around the subjective	Static and linear process. Stable operations. Standardized and formal using quantitative measurements.	Risk aversion: Push towards lowering market and technical risks for the entire company. Market uncertainty is lower than in FEI.

Theory	Decisions	Leadership	Teams
The front end	Bottom-up decision-making and information flow. Interdiciplinary decision making.	Leadership that support innovative ideas. Senior management help with funding.	Interdisiplinary idea generation. Investing in internal and external skills.
The environment around the subjective	Top-down decision-making and information flow.	Leadership that manage resource allocation and follow up processes.	Appropriate specialist are needed in the beginning and along the project

The theoretical framework is one part of the theoretical contribution of this paper and will be used in the Chapter 6. The other part of the theoretical contribution will be presented in the next chapter covering prioritisation models for the front end.

4 Prioritisation models for the front end

The models that will be presented in this chapter are three MAUT-models; Analytic hierarchy process (AHP), analytic network process (ANP), The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The chapter will start by shortly explaining what a MAUT-model is, after which the three MAUT-models ANP, AHP and TOPSIS will be presented. Lastly, the term "fuzzy", when applied to MAUT-models, will be explained together with new variations of AHP, ANP and TOPSIS. The models presented in this chapter will be analysed in the Chapter 7.

4.1 MAUT-models

MAUT stands for multi attribute utility theory. The basis of MAUT-models is a utility function, which can transform individual performance values of the alternatives to dimensionless scores. The scores will be weighed differently depending on the criterion and a utility value will enable comparison.

In MAUT either direct weighing or pairwise comparison can be used. In pairwise comparison prioritisation models, prioritisation is created by comparing one alternative to another and then continuing doing so until you have gained the preferences of the decision maker. Relative priority is used in pairwise comparison prioritisation models. While, absolute priority is created in direct weighing since every criterion is given a weight, which in turn will enable for an absolute score to be given to each alternative.

4.1.1 TOPSIS

Hwang and Yoon developed TOPSIS in 1981. TOPSIS model is commonly used in the MCDM area. The model is helpful when dealing with highly complex decision-making because it is effective in solving MCDM as well as it is easily computerised. Some criticism is found towards the original TOPSIS model because of its inability to deal adequately with ambiguity and imprecision that will occur if multiple decision makers are involved. (Wang & Chan, 2013)

TOPSIS include the following steps:

1. Calculate normalised ratings.
2. Calculate weighted normalised ratings.
3. Identify positive and negative ideal solutions.
4. Calculate separation measures.
5. Calculate similarities to positive ideal solution.
6. Rank preference order.

(Yoon & Hwang, 1995)

The model is used to define a solution from a finite set of data (Feng et al., 2014). It is a model that aims to choose an alternative that has the shortest way to the best or positive ideal solution and the longest way to the worst solution or negative ideal

solution. The model introduce two reference points, the positive ideal and negative ideal solution, but it does not consider the relative importance of the distances from these points, which can make it hard to rank the alternatives (Wang & Chan, 2013; Feng et al., 2014; Wang & Wenlu, 2015). Furthermore, based on empirical data the model has shown to provide the most stable results when data is oscillating (Podviezko & Podvezko, 2014). The model is based on criteria and these can generally be classified as either a benefit or a cost, but other criteria can also be included, for example maturity of the alternative. For the benefit criterion a higher value is better and for the cost criterion the opposite is favourable (Feng et al., 2014).

Explaining the model, firstly a decision matrix is created (Feng et al., 2014). The matrix is based on either statistical data or experts' estimates and must be weighed and normalised. Feng et al. (2014) normalise the matrix first (1), by calculating a normalised value; b_{ij}.

$$b_{ij} = \frac{a_{ij}}{\sqrt{\sum_{j=1}^{n} a_{ij}^2}} \; i = 1, 2, \dots m, j = 1, 2, \dots, n \qquad (1)$$

(Feng et al. 2014, p2265)

In the equation, *i* is the criterion and *j* is the alternative. So for each criterion, normalised values between 0 and 1 will be calculated for each alternative (Feng et al., 2014). Normalising the matrix is important because the source of information differs. Normalisation turns the matrix dimensionless (Wang & Chan, 2013). Then the values within the matrix are weighted. The weight normalised decision matrix (2) is calculated using c_{ij} (Feng et al., 2014), given by

$$c_{ij} = \omega_j \times b_{ij} \; i = 1, 2, \dots, m, j = 1, 2, \dots n \qquad (2)$$

where ω_j is weighted of the j^{th} criterion G_j and $\sum_{j=1}^{n} \omega_j = 1$
(Feng et al. 2014, p2265)

From these calculations the best and worst alternative can be created, called or C^+ (3) and C^- (4). (Feng et al., 2014)

$$C^+ = \{c_1^+, \dots, c_n^+\} = \left\{\left(\max_i c_{ij} \,\middle|\, j \in I\right), \left(\min_i c_{ij} \,\middle|\, j \in J\right)\right\} \qquad (3)$$

$$C^- = \{c_1^-, \dots, c_n^-\} = \left\{\left(\min_i c_{ij} \,\middle|\, j \in I\right), \left(\max_i c_{ij} \,\middle|\, j \in J\right)\right\} \qquad (4)$$

(Feng et al. 2014, p2266)

Here *I* is associated with benefit criteria and *J* is associated with cost criteria. The distance from the every considered alternative to the ideal solution is calculated using Equation (5) as well as the distance from the worst alternative given by (6).
The distance to the positive ideal solution is

$$d_i^+ = \sqrt{\sum_{j=1}^{n}\left(c_{ij} - c_j^+\right)^2},\ i = 1, \dots, m \quad (5)$$

(Feng et al. 2014, p2266)

The distance from the negative solution is

$$d_i^- = \sqrt{\sum_{j=1}^{n}\left(c_{ij} - c_j^-\right)^2},\ i = 1, \dots, m \quad (6)$$

(Feng et al. 2014, p2266)

Then the cumulative criterion, R_i, is calculated using the distance given by (7) (Podviezko & Podvezko, 2014). Also called the relative closeness to the idea solution, R_i, is defined as

$$R_i = \frac{d_i^-}{(d_i^- + d_i^+)}, i = 1, \dots, m \quad (7)$$

(Feng et al. 2014, p2266)

Criterion R_i is cumulative in the TOPSIS model and the values range from $0 < R_i < 1$. The cumulative criterion takes the value 1 for the best alternative and 0 for the worst alternative. Then, by taking the average value of all best and worst alternative the criterion correspond to a cumulative criterion of $R_i = 0.5$ (Feng et al., 2014; Podviezko & Podvezko, 2014).

4.1.2 Analytic Hierarchy Process (AHP)

AHP was developed by Saaty and published in 1980. It includes both rating of alternatives as well as comparison of alternatives. AHP builds on the assumption that a decision is a process that needs to involve the following steps.

1. Structure a problem to show key elements and their relationships.
2. Extract judgements that reflect knowledge, feelings, or emotions.
3. Give those judgements meaningful numbers.
4. Use these numbers to prioritise the elements of the hierarchy.
5. Synthesise the results to determine an overall outcome.
6. Analyse sensitivity of changes in judgement

The AHP model structures the overall goal of the prioritisation in a hierarchy, with sub goals, criteria, sub criteria and finally on the lowest level decision options. It is also recommended that the actors involved, the actors' goals and the actors' policies are identified. For yes-no decisions, the most preferred outcome should be identified and then compared to the option of not doing anything. When doing the benefit/cost analysis, marginal values should be used since AHP is based on a dominance hierarchy, where a clear order of ventures can be identified. (Saaty, 1994)

The comparison in AHP is done pairwise, in other words, how important criterion A is compared to criterion B. This comparison, which uses the scale of 1 o 9, then sets the weights for the model. A pairwise comparison is also used in order to create relative scores for the criteria and alternatives. Having identified the weights and scores of the criteria and the alternatives, the evaluation of the alternatives can then be done using different MAUT-models, for example, the additive AHP uses weighted algebraic means (Fürlöp, 2005).

Criticism towards AHP includes the problem with rank reversal, which will occur if an alternative is deleted or added during the decision process. Rank reversal means that the ranking of the alternatives might change if a new alternative is added to the decision. (Maleki & Sahir, 2013)

4.1.3 Analytic Network Process (ANP)

ANP is a generalisation of AHP, highlighting that the decision structure is more like a network, working with feedback and paths to function (Saaty, 1994). Priorities are obtained using the same pairwise comparison and judgement as AHP does. Because feedback is involved in networks, deriving priorities in a network is more demanding than in a hierarchy. This makes the model challenging to use when multiple users are involved in the prioritisation process. However, feedback is used to help define today's value of an idea in the future, which helps to attain the desired future. Since it uses feedback and the networking structure cycles connecting different elements, this makes the hierarchy levels disappear and loops are created making internal connections.

Figueira (2005) also argue that besides feedback, ANP also creates paths that uses sources and sinks. A source is a node from where a path of importance origins and not the destination of a nodes path, while a sink is a node where the path of importance arrives. Knowing this, a network can be created in many different ways, containing sources, intermediates and/or sinks. Here intermediates can be a part of any part of a path. These paths illustrate the decision problem described by a network. The challenge is to prioritise between the elements in the network. Using a zero-one matrix, dependencies between criteria can be mapped. This mapping is then used in order to answer the question for every criterion: Which of two criteria depend more on the third criterion?

An example is that a AHP has a hierarchy of elements going top-down, while ANP has a cluster of elements being either inner dependent, elements connected within the same cluster or outer dependent, elements being connected to elements in another cluster, see Figure 5.

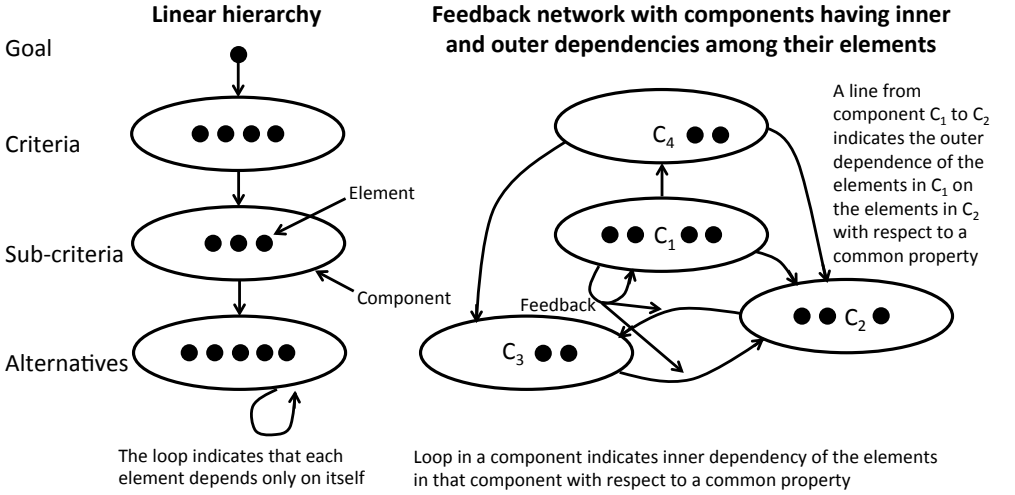

Figure 5: AHP model to the left and ANP model to the right (Saaty, 1994)

4.2 New variations including the fuzzy dimension

Apart from the MAUT models presented above the literature review also explains how the MAUT models change when they are combined with fuzziness. Multiple authors have investigated how the fuzziness of different MAUT-models affects complex decision-making. (Chen 1997; Kahraman, Büyüközkan & Ates, 2006; Ayağ & Özdemir, 2009; Yuen, 2014; Yan & Maa, 2014)

4.2.1 Fuzzy TOPSIS

Wang and Wenlu (2015) state that TOPSIS is appropriate for complex MCDM for individual decision makers. However, multiple articles discuss the use of a fuzzy TOPSIS model for group decision-making. These solutions uses both TOPSIS techniques (Yuen, 2014) as well as a tool to defuzziness the results (Yan & Maa, 2014) to make it more appropriate.

Chen (1997) adapted TOPSIS for a fuzzy environment. Instead of using precise numbers, the criteria are first described in linguistic terms, which can then be expressed in triangular fuzzy numbers, see Table 2. After that the fuzzy decision matrix (also seen in Table 2) will be used to calculate the distance to ideal positive solution and ideal negative solution. Chen (1997) suggests that a team of decision makers should weigh and rate the criteria according to linguistic terms, since humans have a hard time estimating judgements, which includes preferences. According to Kahraman, Büyüközkan and Ates, (2006) the linguistic terms makes it easier for the decision-maker to pass judgement. According to Bao et al. (2012) the uncertainty of human learning and vague judgment has led to linguistic terms often being used instead of numerical values by decision makers or experts.

Table 2: t.l shows weighing of the criteria and t.r. shows rating of the criteria

Very low (VL)	(0,0,0.1)	Very poor (VP)	(0,0,1)
Low (L)	(0,0.1,0.3)	Poor (P)	(0,1,3)
Medium low (ML)	(0.1,0.3,0.5)	Medium poor (MP)	(1,3,5)
Medium (M)	(0.3,0.5,0,7)	Fair (F)	(3,5,7)
Medium high (MH)	(0.5,0.7,0.9)	Medium good (MG)	(5,7,9)
High (H)	(0.7,0.9,1.0)	Good (G)	(7,9,10)
Very high (VH)	(0.9,1.0,1.0)	Very good (VG)	(9,10,10)

4.2.2 Fuzzy AHP and ANP

A fuzzy ANP approach was proposed by Ayağ and Özdemir (2009) for evaluating alternatives in a NPS environment. The fuzzy element was introduced in order to handle the vagueness and uncertainty of the decision-maker. As for the original AHP and ANP, fuzzy AHP is easier to apply than fuzzy ANP, but it has a holistic view and covers more interdependencies than the fuzzy AHP. For this reason, Ayağ and Özdemir chose to use the ANP model for their fuzzy approach. In the conclusion, ANP is considered to be a cumbersome model using multiple matrices compared to AHP. In some cases the difficulty of handling the matrices can be greater than reaching a holistic view (Ayağ & Özdemir, 2009).

4.2.3 Hierarchical fuzzy TOPSIS

Kahraman, Büyüközkan and Ates, (2006) proposed an approach for identification and selection of new product ideas based on fuzzy heuristic multi-attribute utility model and hierarchical fuzzy TOPSIS model. The approach has two phases. The first one being eliminating alternatives clearly dominated by others, for which the heuristic multi-attribute utility model is used and the second phase involving a more detailed analysis to select the best alternative, for which the hierarchical fuzzy TOPSIS is used. The hierarchical fuzzy TOPSIS is a combination of AHP and TOPSIS. It takes into account more levels of attributes than TOPSIS, but is easier to implement, has less number of questions to consider and is faster to calculate than AHP. To put it simply, it uses sub criteria and main criteria as in AHP and then fuzzy TOPSIS model described above. Combing AHP and TOPSIS could help to rank the alternatives that the basic TOPSIS model struggles to do. (Kahraman, Büyüközkan & Ates, 2006)

4.2.4 Summary of prioritisation models

The models explained above are presented in Table 3. All models including fuzzy elements are described as one.

Table 3: Summary of prioritisation models

	Prioritisation models			
	TOPSIS	**AHP**	**ANP**	**Fuzzy models**
MCDM subgroup	MAUT	MAUT	MAUT	N/A
Characterising features	Comparison to positive and negative ideal	Structure the goal in sub-goals, criteria and sub-criteria and alternatives	Less simple than AHP	Linguistic terms
	Easily computerised	Pairwise comparison	Handle complexity	Suitable for group decision-making

5 The FEI department at Tetra Pak

This chapter will present the empirical findings of the study. The information mainly comes from eight interviews, with eight employees from five different expertise areas within FEI. The interviewees within the areas are referred to as technical experts, market experts, venture leaders, strategy experts or the director. Some of the information comes from complementing questions asked after the interviews were conducted, some come from information collected in the pre-study and some come from observations. Since FEI at Tetra Pak is a new department, it can sometimes be unclear if the employees describe how the work is carried out today or if they describe the goal for how they think the department should work. This together with the fact that the employees do not always agree on things, will lead to that the information presented will at times be contradicting. The contradictions will be analysed further in the Chapter 6. How this following chapter will be structured is seen in Table 4.

Table 4: The structure of the empirical chapter

Sub-chapter	**Contains**
Tetra Pak and FEI - A background	Description of Tetra Pak, the organisation, what FEI does and where it is in the organisation.
A need to prioritise	Why and how prioritisation should be done within FEI, according to the director and strategy experts.
The role of innovation forum	What role the external governance, Innovation Forum has, according to the director.
An explanation of a venture	What ventures look like when they start and what their goals are, according to venture leaders and strategy experts.
The venture process	How the work within a venture is carried out according to strategy experts and venture leaders.
Uncertainty	How market and technical uncertainty is measured and lowered according to market and technical experts.
Governance and information flows	How the ventures are supported and supervised, internally within FEI and externally from Innovation forum, according to venture leaders and strategy experts.
Interactions with other parts of Tetra Pak	The interaction and difficulties with the interaction between FEI and the rest of Tetra Pak according to the director, strategy experts, venture leaders and technical experts.
Qualities needed in the team	What is needed when working with FEI activities, according to market experts, technical experts, strategy experts and venture leaders.

5.1 Tetra Pak and FEI - A background

Tetra Pak is a large Swedish packaging company with a revenue of €11 billion and about 23 000 employees, whereof 3500 are working at the site in Lund (Tetra Pak, 2013). Within Packaging Technology (PT), a department at Tetra Pak, a FEI department was established about two years ago, focusing on some level of radical innovation within, or adjacent to, the core business. PT is apart of the organisation Development and Service Operations (DSO), which is one of four operational departments located below the president and CEO in the hierarchy. Working with FEI there are different levels of governance. The highest level is Innovation Forum, a management team outside of FEI that involves people from higher and senior management. Other governance exists within FEI and has been designed in different ways, but aims to help ventures when more complex questions appear than what the venture usually deals with. For a complete overview of the organisation, see Appendix II.

FEI at Tetra Pak has different phases of development; the discovery phase, the incubation phase and the acceleration phase. Initial idea generation takes place in activities within what is called focus areas. At the moment there is one active focus area, for which one employee at FEI is responsible. More people can be involved in the work of the focus area, without formally belonging to it. Although, people who put the majority of their time into ventures are not involved in the work within the focus areas. The focus areas are established by Innovation Forum. When the employee responsible for the focus area believes that an idea is mature enough, meaning that some kind of concept can be defined, and the management of FEI agrees, FEI can choose to start a venture. The venture will be assigned a team and a venture leader and start in the discovery phase. After testing, learning about and defining a concept for the venture in the discovery phase, the venture moves on to the incubation phase, where the concept will be tested on the market. Because the FEI department is newly established, no ventures have yet reached the incubation phase. At the moment three ventures are active in the discovery phase, where one of them is approved for and about to enter incubation as this study is carried out, shown in Table 5. After the incubation phase, the acceleration phase will take place, where the venture will be commercialised. (Emanuelsson, 2015)

Table 5: Activity of ventures and focus areas

	Pre-venture	Discovery	Incubation	Acceleration
Other focus areas	Non-active			
Focus area A	Active			
Business model venture		Active		
Product venture		Active		
Product venture		Approved for incubation		

FEI is the only department at Tetra Pak using the term venture. Development projects outside of FEI can be technology development projects (TDs), product development projects (PDs) or project life cycle projects (PLCs). These projects are incremental and a part of the core business strategy of Tetra Pak. FEI has 25 employees but regularly bring in people from outside of FEI in their ventures.

5.2 A need to prioritise

In order for an idea to be interesting to pursue within FEI, the director wants there to be a market that is large enough for it. Even if the profitability is satisfactory, an idea will not be pursued if the potential market size is not also satisfactory. For an idea to be interesting it also needs to have a connection to Tetra Pak's vision, strategy and capabilities. The idea should not have a natural relation to an existing part of Tetra Pak, if it is to be pursued by FEI. (The director)

FEI needs to prioritise between different ventures and concepts because they have a limited budget (Strategy experts). Prioritisation also helps to keep focus on the right ventures. In case not enough value is created it is necessary to reprioritise. This reprioritisation is done continuously (Strategy expert 1). Different criteria for prioritising have been mentioned by the strategy experts. For example, Strategy expert 2 highlights the investment it would require to achieve real value as a criterion, while the other two Strategy experts 1 and 3 do not. The combination of criteria varies, depending on if it is for a prioritisation decision, a go/kill decision or if it concerns the need for a prioritisation tool (Strategy experts).

All strategy experts are in agreement that two criteria are identified for prioritisation: Attractiveness and feasibility. Clarifying these two criteria helps to understand what the need to be successful is and to understand how to obtain this need. It is also important to understand how much it cost to attain a certain business value and the time to market cost (Strategy experts).

It is both hard and important to prioritise between ventures or activities within a focus area. One might have low potential but has been worked on for a long time,

and the other one might be young but with high potential. Between the two, the problem is that not enough knowledge is created to compare them (Strategy expert 2). According to Strategy expert 1, FEI can also use the following prioritisation criteria to make a decision regarding priority:

1. How big business potential has the business case?
2. What is the probability to succeed?
3. What are the risks?

Knowing when to kill a venture is still a problem for Tetra Pak. The focus has always been to develop interesting technologies and not to create value for the company. The goal is to be able kill a venture when an idea with better potential and attractiveness is found. When there is no money to support the venture or when they do not believe in the venture anymore, FEI governance and/or Innovation Forum, in collaboration with the ventures, give recommendations on go/kill/modify decisions (Strategy experts 2, 3). A go/kill decision should be based on the same parameters that are investigated at the start of a venture: Attractiveness and feasibility (Strategy expert 3). Each venture has the responsibility to give a recommendation on risk, problem and opportunity, but to also understand cost, business value as well as market and technical opportunity. The venture team also has to understand what the competitive advantage looks like (Strategy experts).

5.3 The role of Innovation Forum

Innovation Forum has a strategic role and does not have a formal decision-making role. Innovation Forum's role is to look into which innovation areas, or focus areas, that are interesting and not worked on anywhere else. The director of FEI is a part of Innovation Forum. It is the director's task to spread knowledge about FEI's ventures, outside of FEI. He works to make sure that decisions are taken regarding ventures and that the ventures get the support they need from outside of FEI. (The director)

"Innovation Forum works to coach concepts and ideas that would be fragile elsewhere in the organisation." (Director DSO Strategic Planning).

It is Innovation Forum's responsibility to make sure activities are started and stopped. By creating a governance team for a venture, Innovation Forum can pass on the responsibility to this group. Representatives from FEI activities or ventures are not always present during innovation forum meetings, even though the activity or venture is discussed there. The questions that are asked regarding focus areas or ventures, differ from activity to activity, since they are all different. (The director)

If a new idea is discovered in a focus area, the director wants the idea to be presented in innovation forum meetings. That is, if the idea cannot be included into an existing business area. Either the director can present the idea to Innovation Forum, or the employee responsible for the idea can come to the meeting to present

it. When these activities are identified, Innovation Forum's goal is to support these activities in its overall portfolio. The management experience within Innovation Forum can contribute with experience, technical skills, deep company knowledge and contacts. Collaboration is important within Innovation Forum, ventures and FEI. (The director)

5.4 An explanation of a venture

The time it takes for a concept within a focus area to become a venture can vary, from a month if the concept is clear, or up to six months if the concept is hard to clarify. Due to budget limitations, it may sometimes take longer than it should.

A venture does not start with one specific target. In the beginning of a venture a target is designed based on a hypothetical problem and solution (Strategy expert 3). It can be more or less mature, depending on its previous development. The more mature a venture is, the more defined different aspects of its concept are. The concept can for example be a wish to meet a customer need through diversification or an old prototype that is very early in the development process. Product specifications vary in the beginning of a venture depending on the concept, sometimes the technology might be developed and sometimes market knowledge might exist (Venture leaders; Strategy experts). For example, in order for a product venture or a business model venture to start, the concepts need to have different product specification criteria (Strategy experts). The venture leaders agree that the overall goal for a venture is clear from the start, it is to take the venture to incubation in order to test it in reality and get a real answer. Having the goal of incubation is important to the venture teams, both as motivation and in order to lower the uncertainty of the venture.

The purpose of having a target is to be able to create business opportunities within a focus area. To achieve the purpose, the venture team works to find evidence for if an opportunity is feasible, has a strategic value and has market potential. The venture moves forward by focusing on the next step of the learning process. Focus areas are defined by FEI and confirmed by Innovation Forum. It is up to each venture how to proceed and develop their specific targets. If senior management was more involved in the focus areas within FEI, strategy experts believe it may be easier to stay in line with the overall strategy. (Strategy experts)

"We do not have enough strategic guidance from the senior management to be able to answer the strategic alignment of a concept easily. It is somewhat opportunistic from time to time."
(Strategy expert)

According to the venture leaders, the ventures at FEI are all measured on their progress. The measurement is done in different ways depending on the venture; it is up to the venture leader how to measure the progress. The ventures do not have

any fixed tollgates but create their own deadlines, by which the progress can be measured. During the first four to five weeks of a venture, it is mostly the venture leader's deliverables that are possible to check. For some of the ventures, post-its and boards are used to visualise tasks that are under progress and tasks that have been completed. When a venture has a part of the venture outsourced to a TD outside of FEI, the TD is measured much more and the venture sometimes will get evaluated depending on the result in the TD.

Today FEI starts a venture based on an issue with significant business potential (Strategy expert 2). When initiating a venture it is important that the intention with the concept stays the same until incubation product specifications can be defined. (Strategy expert 1)

5.5 The venture process

Venture leaders describe the process of a venture as agile and dynamic. The work includes using iterations and loops and the venture leaders see a value in the learning achieved in this way of working (Venture leaders). Iterations enable opportunities to make small changes back and forward to increase learning and improve the venture (Strategy experts). Getting results that indicate that the opportunity or solution is in some way not viable does not mean failure for the ventures. The work is carried out by taking one step at a time and not simplifying the work to get results straight away. The goal is to try and understand the opportunity, in terms of business value and technical feasibility (Venture leaders).

One of the differences between pre-venture activities and ventures is the difference in scope. Before a venture is created, the scope is wider and nothing is eliminated. As a venture the scope is narrower, which means that the remaining areas can be investigated more thoroughly. It is during a venture that the technical part can be handled by a TD. (Venture leaders)

There is no scheduled time for idea generation within the ventures, but the team gets the opportunity to work with new ideas connected to the venture concept. Through different activities, for example meetings within FEI, the venture teams get the chance to exchange ideas regarding each other's ventures and focus areas. (Venture leaders)

There is a trade off between daring to take risks in ventures and continuing develop concepts, and identifying when risks have become too big and the ventures no longer are attractive. FEI needs to take chances on ventures but also close them down. (Venture leaders)

"We have to be prepared to kill our baby."
(Venture leader 1)

To go back from one phase to another, called pivoting, has never occurred. Pivoting is hard to do because it requires large changes in structure and organisation. Strategy experts believe a pivot is not done on purpose. The reason it has never been done is partly because no venture has reached incubation yet, but also because a venture is not meant to go back to an earlier phase (Strategy expert 1). FEI opposes to seeing the phases as a linear process, preferring to view it as different periods with different focus. This means that activities from the discovery phase could potentially continue on parallel with the incubation. Incubation gives the opportunity to extend the practical knowledge of a business case, if the team realise afterwards that the business case is missing certain areas they may have to go back to the desktop or kill the case (Strategy expert 3).

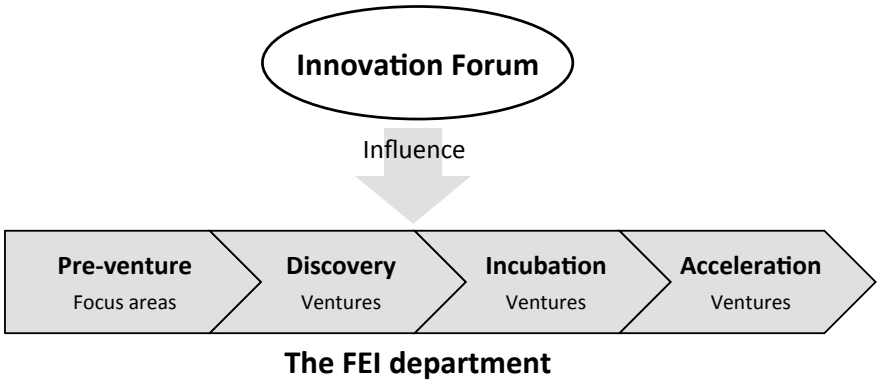

Figure 6: Illustrates the venture process

There are two reasons why the different phases are used, see Figure 6. The name and the linearity description of the process are necessary when communicating with the rest of the company. For FEI the different phases help the venture to stay focused on increasing learning and identify new business areas for Tetra Pak.
Iterations within the first phase, the discovery phase, are often used. (Strategy experts)

5.6 Uncertainty

The uncertainty of a venture is reduced and measured by working towards increasing the understanding of the uncertainty. This can be done by mapping uncertainties against each other and testing different scenarios. According to Venture leader 1, both business value scenarios as well as technical scenarios need to be researched. The understanding can also be achieved by conducting workshops for Tetra Pak marketing clusters in different parts of the world. There is not a specified risk list used when working with uncertainty (Venture leaders). The director says that it is important for FEI to not view everything as risks that needs to be reduced, but to work on maximising the learning in as many uncertain areas as possible. To understand what the venture will contribute with to consumer, customer, or retailer is a way to reduce uncertainty and create value. If the ventures

had the possibility to reach the market at an early stage, it is thought to ease the work within the ventures (Venture leader 1).

5.6.1 Market uncertainty

Understanding the market uncertainty is important in order to make sure there is logic behind the venture and that there is a real market for it. The measurement is not done in a certain way. Different questions to measure uncertainty are asked in different ventures since they are all different. By building a story around the venture and backing it up with facts, the knowledge about the venture will increase. There is no clear documentation or control of the progress of ventures. FEI works to identify the fastest route to failure in order to understand what would make the venture lose its viability. If it is an unattractive venture for Tetra Pak, it does not matter if it would be attractive for the customer. FEI values learning and will in some cases see a point in spending more money on a venture if it will generate a lot of learning, even though it might not directly lead to a successful venture. These cases are often defined by that the additional money spent is relatively limited while the learning gained is relatively large. (Market expert)

Market uncertainty is lowered by testing hypothesis on other things than the actual venture. The team tries to identify other occasions where the mechanism has been used and worked. Hence, if anything similar been done before, the market uncertainty is lower. FEI works with market uncertainty by asking “What needs to be true for the hypothesis to be true?”. This will define the barriers for the venture. There are two main questions that need to be answered in order to lower market uncertainty.

1. How large is the market?
2. Which barriers need to be overcome in order for the venture to work?

Today FEI do too little research regarding these barriers, possibly because not everyone is aware of them. During incubation, FEI gets the opportunity to test the venture on a real situation, which lower the uncertainty considerably. (Market expert)

5.6.2 Technical uncertainty

Technical uncertainty focuses on all risks concerning technology that might stand in the way of reaching a certain goal. In the beginning of a venture it is hard to estimate what the technical uncertainty includes. Many of the obstacles are harder to manage than first anticipated. To handle this, FEI tries to increase technical knowledge in relevant areas for the venture through a learning process. At FEI, technical uncertainty is evaluated differently by different people, however this is not seen as a problem as long as the evaluation creates a dynamic discussion around uncertainty. There are two kinds of uncertainties: Unknown risks, which can be identified, and unknown-unknown risks that are not possible to identify or foresee. (Technical experts)

Uncertainties in ventures look different and are handled differently, but in general unknown-unknowns are more common in the beginning. In some ventures, it can be important in the beginning to drive the technology research though a linear process. This helps to reduce the risk of getting stuck in only making loops and iterations. When reaching a point of refining the technology, iterations are more common. (Technical experts)

Technical uncertainty is reduced through learning and increased knowledge around the concept. It is not always the technology that is hard to produce or define. It can also be the complexity build up by the dependency of many different components. Knowledge creation can be done with development partners and collaboration with suppliers along with constant risk evaluation. Technical expert 1 highlights that risk evaluation can be handled using FMEA. FMEA is a toolbox used to reduce risk by answering questions and sub-questions. The goal to drive a venture to incubation is another way to increase knowledge, which gives the technical team a common goal to get the technology done. (Technical experts)

The last thing that the technical experts mention as important when creating knowledge is technical requirements. Technical requirements are used to identify the goal and the test specifications in a venture. By using technical requirements FEI can compare venture results to a target. In one venture, working on a distribution solution, the technical requirements are derived from the demands on today's distribution solution and the venture aims to at least satisfy these demands in the new concept. The venture process is more dynamic and there are no tollgates or set technical requirements like in TDs. One reason could be that in the beginning of a venture it is hard to set requirements for something that does not yet exists, but as the venture progresses requirements become clearer. (Technical experts)

The technical experts find the way of working with technical uncertainties within FEI, good to some extent, but some things can be improved. Some feel that the risks within FEI need to be taken more seriously and that the process of identifying unknown-unknowns needs to be iterated better (Technical expert 1).

Two difficulties when dealing with technical uncertainty is that it is not possible to use Project Management Institute (PMI) (Technical expert 1) and it is hard visualise the uncertainty (Technical expert 2). PMI is a toolbox that Tetra Pak currently uses to certificate project leaders working outside of FEI. If it had been possible to use PMI more project leaders would know how to work in the FEI process. Visualisation of technical uncertainty is made difficult due to the complexity of many components, which can vary from venture to venture (Technical expert 2).

A systems perspective can also be used when setting technical requirements, so called system demands. Technical expert 1 have this in mind but would like to see it used by more people within FEI.

"I want to see a systems perspective on how we work with risk management in early development, focusing on the ten largest risk areas and the corresponding risk response plans "
(Technical expert 1)

In the beginning FEI focuses on increasing their learning, especially within the business and commercial side. Technical learning, on the other hand, is not monitored by FEI as much as the business and commercial side is. In the active focus area, the technical expert work with technical learning by identifying ten sub-areas, in which knowledge has to be increased. The learning is thereafter focused in three to four sub-areas, which are followed up monthly or quarterly for evaluation. For example, in the focus area Digital printing, Ink is one of the sub-areas. (Technical experts)

In the end FEI focuses shift more towards specific technical requirements. At the end, when dealing with go/kill decisions management should take part in the decision-making. During the process a governance team monitors the ventures, but due to the learning process the venture team needs to be autonomous and make their own decisions. The reason for this is that they alone have all knowledge and therefore are best suited to make decisions in the daily work. (Technical expert 1)

5.7 Governance and information flows

Governance and information flows are presented depending on if they are within FEI or if they are between FEI and other parts of Tetra Pak.

5.7.1 Within FEI

Strategy experts within FEI consider the process of monitoring and follow up ventures to be vague. Strategy experts say the reason is that it is hard to define properties of the result in the beginning and also because the focus is to understand business potential and not reaching a specific goal. Today a venture is monitored two ways: during meetings, hosted every second week and by a venture sponsor (Strategy experts; Venture leaders). There are two types of meetings: one focusing on the ventures getting the chance to update each other and the rest of FEI regarding the status of the venture (Venture leaders) and the other focusing on sharing experiences and endorse engagement (Strategy experts). The venture leader will have regular contact with the FEI director who is a venture sponsor. A sponsor is according to venture leader 2, a senior management role that allocates resources, helps with decisions and supports the venture in the rest of the organisation. Continuous contact is also kept with one from FEI management, who is responsible for the financials; they will contact each other for check ups regarding costs and budget (Venture leader 2). The venture leaders do not have exactly the same view of the main purpose of the supervision as the strategy experts. Alignment, support and guidance are perceived as important parts of the supervision by venture leader 2. These parts would not require active supervision but access to people who can

provide the venture leaders with this. Today a lot of guidance comes from directions given by the FEI management (Venture leaders). According to the strategy experts, the governance teams have more of a guiding character, than a controlling one.

A cross-functional management team should be designed for a particular venture. A cross-functional team is explained as a team that includes different competences and works at different departments. Venture leader 2 also raises the importance of keeping management teams, for specific ventures, small. The cross-functional management team could benefit from taking in competences from outside of FEI. The ventures look for more external competences covering customers, business value and technical feasibility (Venture leaders). There is a desire from the venture leaders to get guidance and competence from people that are not a part of the venture team's daily work. In some cases, they feel this guidance and competence exchange need to increase.

"I believe we need to look beyond the department… There is a whole organisation with close connections with the commercial reality."
(Venture leader 1)

"We need to discuss and learn from each other (between venture teams). We do not need to make the same mistakes as someone has already made."
(Venture leader 1)

The strategy experts and technical expert 1 say that venture leaders have to take a bigger responsibility to follow up how the venture is doing, than regular projects leaders do. The venture leaders expressed the preference to get the mandate to internally, within the venture, measure the progress. The FEI management team helps them in this process and the reasons why ventures are monitored are considered to be:

1. To understand their direction and why this direction is chosen, and support it when needed.
2. To ensure learning and capability development
3. To increase cross-venture learning
4. To enable Go/Kill decisions

(Strategy experts)

According to strategy experts, looking at the learning process for each venture usually gives information on venture progress. Governance can create demands along the way to make sure certain things, such as a viable business case and costs are equivalent to the learning process are getting done. Strategy experts believe incubation is the best way to understand and measure a business case. Furthermore, they say the learning process can be measured through four dimensions: technology, market, organisation and resources. However, this is not done today. (Strategy experts)

5.7.2 From outside of FEI

Strategy experts consider it important that senior management watch over FEI's most prioritised ventures, unfortunately it is not done today. In order for FEI to be able to inform senior management about their prioritisation, strategy experts would like an easy way to continuously visualise prioritisation of ventures and the progress of ventures, to be developed. (Strategy experts)

The information flow from FEI up towards higher management, through Innovation Forum and governance teams, consists of limited information compared to the information available in the venture team. Only information that is considered relevant at the moment will be forwarded (Market expert). FEI communicates relevant information to Innovation Forum about progression within ventures and focus areas. The FEI department often handles discussions about the different ventures and focus areas first, and when a certain level of maturity is reached it is brought to a innovation forum meeting. However, the degree of maturity varies from time to time which creates an opportunistic working method (Strategy expert 3). The technical information presented to Innovation Forum varies from venture to venture. It includes cost calculations goals and how to reach them, current problems and why they are interesting and how knowledge can be created in the venture. What technical experts view as the focus for Innovation Forum varies from cost calculations to current problems. Some find that risk analysis is not the focus for Innovation Forum (Technical expert 2).

Venture leaders perceive that it is often traditional governance that might show some resistance against FEI's way of working. There is a perception that it can take time to get things approved from people outside of the venture, but it is not rare that ventures do things on their own mandate, and communicate it outside of the venture after it is done. At the same time, there are indications that additional confidence should be given to the ventures to do things on their own.

"...it would have led to too much thinking… which only leads to too many questions for a team already drowning in even more important questions…"
(Venture leader 1)

The ventures depend on different actors outside of FEI. For example, venture leaders wish financing decisions would be faster and that decision makers would sometimes trust their intuition more and allow themselves to take risks. (Venture leaders)

To some extent FEI need to market their ideas and concept to external actors. In the beginning of a venture or activity, it is often easier to iterate. The more resources that have been put into the venture, the harder it is to iterate (Market expert). Innovation Forum makes few decision without alignment with the venture or focus area leader. The concepts and ventures within FEI are at some level of radicalness,

the more radical an idea is the more persuasion is needed to convince management that it is a good idea (Strategy experts).

5.8 Interactions with other parts of Tetra Pak

When FEI was first established, the rest of the organisation found it difficult to understand how a learning process could be important for Tetra Pak's future. Today most of the organisation seems positively curious about FEI's working method (Strategy expert 2, 3). When activities are done in FEI's regime, there are not any difficulties in working with loops and focusing on learning. According to the director, difficulties appear when ventures are to be realised in technical and industrialised solutions, because other parts of Tetra Pak are used to focusing solely on cost optimisation. When introducing FEI ventures to these other parts of the company, the start takes a long time and includes many challenges (The director).

Technical experts find that external communication with other employees and departments in the organisation works fairly well but that problems often occur during the planning of a venture. The line organisations, a permanent and clearly defined organisation focusing on one area for example base material, want to focus on long-term planning while the venture team's planning is more ad hoc (Technical experts). The venture leaders do not perceive any resistance against FEI working in a different way than the rest of the organisation (Venture leaders).

"They think it's fun… they have really embraced the approach…"
(Venture leader 1)

Strategy experts find that people who have worked in traditional projects within Tetra Pak experience some difficulties in FEI's work. The biggest problem is the traditional governances, used for regular development projects, since it becomes hard to finance a learning process instead of a checklist. (Strategy experts)

In one of the ventures, the technology development has been outsourced to a TD. There are divided opinions regarding if the TD is an integrated part of or separated from the venture. When integrating people, that are used to working in TDs, in a venture, their way of working has eased the progress of the venture itself. When separating the technology development from the venture, there are fears of this separation leading to too much administrative work. (Technical experts)

5.9 Qualities needed in the team

To work with market uncertainty, employees need common sense, understanding of some theories, the ability to question assumptions and facts, and to understand the relationships between variables. To some extent a market expert can base a decision on intuition. This intuition needs to be based on relevant experience. Within FEI most people should not reject qualitative data based on their intuition. If your

intuition is pointing in a different direction, you should wait with questioning the data until you have something else to go on as well. (Market expert)

Within the technical area of a venture intuition is used to some extent, for example when dealing with the choice of supplier or when handling risks as well as a team leader (Technical expert 2). Intuition is best when used together with personal experience. The overall need within Tetra Pak is to make decisions based on quantitative data, however within the FEI department intuition is necessary because the environment is uncertain (Technical expert 1).

Strategy experts believe it is important to trust your intuition, especially in the beginning of a venture or in a focus area. In order to do this you have to understand the problem and be able to combine your intuition with strategic analysis. However, trying to push your intuition into quantifiable metrics can create false grounds for discussions. Intuition has to come from the right person with the right experience and the ability to use the experience in the right way (Strategy expert 3). It is also important to combine people with different experience (Strategy experts).

Compared to other projects the venture leaders have been on, outside of FEI, the venture leaders feel they need to have a wider focus when working at FEI. A wider focus means that the technical focus needs to be complemented by a market and business focus. Another difference is that ventures compared to traditional Tetra Pak projects are more visible within the company and therefore get attention from the higher management. (Venture leaders)

6 An analysis of the coded empirical findings

In this chapter, a comparative analysis of the empirical findings and the theoretical framework will be presented. See Figure 2 for further understanding. To enable the analysis below, the empirical findings above were mapped based on both which individual or individuals who indicated the finding and into one of the five areas identified in the theoretical framework; process, uncertainty, decisions, leadership and team. The mapped empirical findings were then coded, for each area, into three categories, depending on which theory they agreed with; front end theory, the environment around the subjective or not clear, this is in detail described in section 2.5 and seen in Appendix IV in which a further view of the mapping and coding is found.

The analysis presented below is structured after the five theoretical areas. Within each area, the analysis were conducted by identifying:

- Findings that indicate the same thing
- Findings that contradict each other

The sub-chapters will be divided into these two areas. After each sub-chapter, the key take aways will be summarised.

6.1 Process

In this section the mapped and coded empirical findings concerning the process will be analysed. The process includes working methods from planning until incubation. A summary of these is found in Table 6.

6.1.1 Findings that indicate the same thing

The market expert argues that there is little focus regarding barriers. This indicates that the department is evolving from acting like a large and mature company that has had a long history of stable operations, since barriers are not as big of an issue in that environment. Product development has focused on optimising existing products for existing customers, reducing the concern for market barriers. Another indication that FEI is still evolving from acting like a large and mature company, is that a technical expert talks about having a system perspective, a method the rest of the organisation uses frequently in projects. It seems to exist a desire to use known processes to handle the chaotic work of dealing with high uncertainty. This indicates that they are working in environment focusing on higher level of radicalness. However, in this environment they focus on using working methods that are more familiar, such as having a system perspective, instead of choosing the most suitable working method.

Indications that the process is similar to that of a FEI environment is that there is little or no clear documentation or control of the venture progress when it comes to

reducing market uncertainty. This goes in line with literature about bottom-up flow (Reid & De Brentani, 2004). In the interview with the director, it is said that decision-making should be driven by the venture or lower down in the hierarchy until enough and relevant information is found. The director also states that not only ventures has this focus, but ideas generated in the focus areas should be presented to Innovation Forum, when matured.

All interviewees talk about learning and how learning helps to measure process progress. The learning process is explained as being dynamic or agile with loops and iterations. According to Hurley and Hult (1998), if the level of learning is increased, the level of innovation will become higher. Both venture leaders argue that the process of different ventures has to be measured differently. There are no tollgates or specific checklists used to move forward, which is a behaviour that characterises the front end, according to Koen et al (2001). The strategy experts argues that iterations are often done in the discovery phase, which goes in line with the literature by Koen et al (2001) and Kim and Wilemon (2002). The strategy experts have discussed the learning process, and reached the conclusion that it can be measured on four dimensions: technology, market, organisation and resource learning. It seems that it is concurrent with literature, since these four dimensions are presented in a study by Stevens (2014). In the study by Verworn (2009) technical uncertainty and market uncertainty are two of four important dimension. The result of Verworn study also shows that interdisciplinary idea generation and selection, as well as initial planning are important factors in order to be successful in the front end. Knowing this, it seems as if what the strategy experts are aiming for is in line with front end theory. However, the strategy experts at Tetra Pak also state that this learning process is in development and not yet fully implemented. This indicates that the process is new and they have not yet achieved creating a learning process that works for them.

The venture leaders indicate that there is a trade-off between daring to take risk and realising when attractiveness is too low, thus closing a venture. This trade-off exists for mature companies as well. However, many of the success factors, such as low market and technology uncertainty, are easier to achieve for a mature company (Nagji & Tuff, 2012), since mature companies know their markets and technical capabilities, in areas where production is optimised. For a venture, the trade-off lies in taking risk and building a case by lowering the uncertainty. In order to be able to take larger risks it could be important to keep the FEI department close to senior management. The risks could include large investments, and therefore it is important that senior management, which can rise above the annual budget, works closely with FEI. The FEI department is located far down in the hierarchy, although, Innovation Forum includes the vice president of DSO. This indicates that the company is not really ready to fully commit to the FEI department.

FEI aims to work in three phases; discovery, Incubation and Acceleration (Strategy expert 1). This indicates that there are linear tendencies, similar to how the rest of

the company is working. When talking to the strategy experts, this turned out to be a way for FEI to handle communication with the rest of the company. As long as the language does not affect the process within FEI, this could be a good way to integrate highly innovative ventures with the large product company with mature technology.

Having autonomous ventures and a bottom-up information flow is important for FEI departments. The fact that problems, according to technical experts, with the line organisations often occur during the planning of the venture, indicates that planning in ventures differ from planning in regular Tetra Pak projects. This is strengthened by the fact that within the FEI department it is up to each venture how to proceed and move forward. This is in concordance with front end theory and venture leaders saying they need to take more responsibility to follow up on the ventures, than regular project leaders outside of Tetra Pak do. This can be a result of a bottom-up information flow and less monitoring from governance.

The ventures use small changes back and forward to increase learning in the venture and ventures move forward by focusing on the next step in the learning process. This can be a way for them to work without having an extensive long term planning. Front end theory describes the use of iterations and seeing the venture as a learning process.

Some issues have been lifted though. Visualisation is made difficult for the technical experts because of the complexity of the many components. At the same time, technical learning is not measured as much as business and commercial learning. The reason for this could be that the management at FEI and the governance teams feel more comfortable with the technical part of the venture since Tetra Pak has been a technology oriented company for a long time. Hence, they might feel a stronger need to control and monitor the unknown business and commercial part. A venture leader has from time to time felt that the venture has been evaluated depending on the standardised TDs, connected to the venture. The conclusion is that since many employees feel uncomfortable or insecure regarding the business and commercial side of a venture, more focus is put into planning and measuring this, while governance assume that the technical side of the venture will be resolved, since Tetra Pak has a lot of experience in this area.

When it comes to financial follow-ups, both the employee responsible for the financials and the venture leaders contact each other for check ups regarding cost and budget. In one way it indicates that the behaviour is both influenced by a bottom-up information flow, but also by a top-down information flow. It is not clear if this behaviour is a result of the department being immature and that they simply have not decided for a certain way of handling the financial planning, or if this behaviour is a result of typical chaotic front end behaviour (Koen et al, 2001). Turning an idea within a focus area into a venture can take varying amounts of time. Depending on how hard it is to clarify an idea and current budget limitations it can

take from one month to six months. Budget limitations are a typical problem for the front end faces.

From the venture leaders it was clear that the goal of a venture is incubation, but they were also aware of the fact that if they realise on the way that the venture is not a good idea, they should kill it. The first question that arises is why they have a goal that only focuses on the first phase. As analysed under uncertainty, it seems like the front end process described in literature, ends when the incubation at Tetra Pak's FEI department is started. At this point the FEI department at Tetra Pak continues on with the venture but with a new goal and a more linear process. Since clear goals are important for front end ventures, and since the ventures are characterised by uncertainty, setting a goal that is not in the end of the process but closer in time might be necessary.

6.1.2 Findings that contradict each other

The market expert talks about it being easier to iterate in the beginning of the venture, which is in line with Koen et al (2001). The market expert says that the more resources that is put into the venture, the harder it is to iterate. The venture leaders and the strategy experts talk about having an iterative process and being agile and dynamic, which they say often occur in the discovery phase.

It is important to keep in mind that all ventures at FEI are in the discovery phase and that they have not yet taken a venture to incubation. This means that even if all agree that iterations are done in the discovery phase, the market expert is the only one articulating that it is easier in the beginning. If the market expert bases this on experience, it means that it is easier to iterate in the beginning of the discovery phase. If it is based on intuition, it might mean that it is easier to iterate during the entire discovery phase, compared to incubation and acceleration. With this in mind, it seems as if there is some sort of iterative process established at FEI. However, one of the technical experts has a contradicting opinion. The technical expert expressed that a linear process in the beginning of technology development reduce the risk of getting stuck in loops and not moving forward, and was positive towards using a more linear process. This could mean that initial planning and structure, which Boeddrich (2004) says is important for an iterative process, both in terms of general and company specific requirements, are not clear when a venture is started. The result of this could be that the technical expert wants to use a different method to compensate for the vague direction, using linearity in the beginning. Even so, iterating more in the beginning is more in line with literature when working with high level of innovation. At the same time technical experts also states that iterations to solve unknown-unknown are more commonly used in the beginning of the venture. Perhaps, this only indicates that it is a difficult process in the beginning and if a clear structure is missing, like Boeddrich (2004) is suggesting, then employees will go back to working in processes they are familiar with. With this in mind, it seems as if FEI is working on creating a proper way to handle the process. When structure and a secure way to work with uncertainty is lacking, linearity seems

to be the most common way for employees to handle this at Tetra Pak. To conclude, FEI needs to focus more on the initial planning. Since FEI is evolving from the Tetra Pak environment, it could be favourable to keep some of the linearity because it makes it easier for senior management to become engaged in ventures and ideas (Boeddrich, 2004).

Besides contradicting views on the iteration process in a venture, the employees' view on the goal for a venture seems to vary as well. Boeddrich (2004), Koen et al (2001) and Verworn (2009) argue that the there should be a clear goal and that the initial planning is crucial for success. Looking at the findings from the empirical study, there are small disagreements between the strategy experts. While one strategy expert suggests that a concept should stay the same from the beginning of a venture until incubation, another strategy expert says that the focus lies in understanding the business potential and not reaching a specific goal. Depending on the meaning of goal and concept this could mean different things, however both seems to be in line with the literature about FEI. Both arguments indicate that there should be a process, but one person focuses more on the learning process while the other person identifies the need for more structure and initial planning. Both parts are important to be successful, so if they manage to communicate and focus on both, they will be more successful according to Boeddrich (2004). It could be that they are talking about similar things but express it differently. If the concept expressed by one person is to stay the same and is actually a preferred target, then this concept have the freedom to develop and change as the venture progresses. If so, the two statements would thereby not be contradicting. This would indicate that the FEI department is developing towards what front end theory describes, but that they have not yet been able to create are common language.

Table 6: A summary of findings for process

Theory	**Process**
The front end	Chaotic process with loop-backs and iterations. Initial planning
The environment around the subjective	Static and linear process. Stable operations. Standardized and formal using quantitative measurements.
Findings	• Little or no clear documentation or control of the venture process, indicating bottom-up. • Focus on a learning process. It is still in development and needs to be increased. • Dynamic, agile with loops and iterations. • Increase contact with management, maybe through innovation forum. • Use linearity terms for communication outside of FEI. • Iterations are done. • Need structure in the beginning in order to dare iterating. Without structure there is a risk that individuals move back to old way of working. • A common language is missing. • Learning process needs to be combined with structure and initial planning. • Chaotic financial planning, could be a result of working in a FEI manner or of a newly established department. • Many do not feel comfortable with the business and commercial aspects when planning. • Planning to take one step at the time, follow FEI theory. • The goal is not to reach commercialisation, instead incubation is near and can make the goal clearer. • It seems as if technical requirements are not necessarily hard to set, what is hard is to define what constitutes a technical requirement.

6.2 Uncertainty

In this section the mapped and coded empirical findings concerning uncertainty will be analysed. Uncertainty includes both market and technology uncertainty. A summary is found in Table 7.

6.2.1 Findings that indicate the same thing

A market expert at FEI sees incubation as an opportunity to test market uncertainty in reality. The strategy experts say that incubation is the best way to measure and understand a business case. Since they do not plan to do any pivoting when incubation is reached, it is questionable if the incubation phase should be considered to still be within the front end or if it is actually the first step of NPD (Belliveau, Griffin & Somermeyer, 2004; Koen et al, 2001). Due to the unwillingness to start incubation before they are quite sure that the concept will work, it seems like a more linear process will take place when the incubation has started. This can be compared to the more linear phase seen in the NPD execution in Figure 5. It is of importance for FEI to understand where they are in the innovation process, so that they will strive for a way of working that is suitable for that particular phase. For

example, striving for a work process that is suitable for the front end might not be suitable for the incubation phase, since it does not seem to be a front end activity.

A lot of emphasis is put on the incubation phase; the venture leaders all see incubation as the goal for the venture. One of the reasons is that the incubation most often means both large investments and large potential for reducing uncertainty. As mentioned above, the incubation done at Tetra Pak does not seem to be a part of what theories classify as the front end. It is normally separated because of the different levels of uncertainty that the phases have (Jetter & Sperry, 2009; Belliveau, Griffin & Somermeyer, 2004). One reason for prolonging the FEI process at Tetra Pak could be the large differences between the way work is carried out at FEI and outside of FEI. Not knowing if the venture will survive in the environment outside of FEI, can have affected the people at FEI to include large parts of the NPD process in FEI's process. To take it one step further, if senior management at Tetra Pak would be truly supportive of the work FEI does, then the rest of the company might find it easier to take over ventures when they are ready for incubation. That the FEI department is still young might be one of the reasons for why this support does not exist and why a larger part of the NPD process takes place within FEI.

Front end theory shows that small development activities helps to reduce uncertainty (Verworn et al. 2008), FEI could look into ways of including smaller incubation activities already during the discovery phase. The market expert say that they lower uncertainty by testing hypothesis on other things than the actual venture but it is not clear if this could be seen as a small incubation activity. If as said earlier, the discovery phase is what research describe as the front end, companies should identify market leadership and understand who the customer is during this phase (Khurana et al., 1998). Waiting to do any kind of incubation activities til after the discovery phase is done, will lead to the market uncertainty being higher than it would have been if the market would have been more probed.

At FEI, building a story for the venture and backing it up with facts will increase the knowledge about the venture and decrease market uncertainty. Development of knowledge and insight will according to Hurley and Hult (1998) enable a higher level of innovation. There needs to be logic behind the venture; the teams ask questions to understand how large the market is and which barriers need to be overcome in order for the venture to be successful. A different way of describing this is working to understand attractiveness and feasibility. According to Khurana et al. (1998), market leadership should be identified when working in FEI. Researching market leadership should be done by looking at price sensitivity and market attractiveness. Knowing this it seems as if FEI’s work is concurrent with theory but if they by saying attractiveness only mean potential market size, other factors such as strategic value might be lost. Boeddrich (2004) says that a success factor for an idea within FEI is that it is linked to the strategic goals. The strategy experts say that the teams work by looking at if a venture is feasible, has strategic value and has market potential. In

this case, a factor such as strategic value is not lost since it seems like attractiveness is considered to involve both market potential and strategic value. One can wonder if the inclusion of strategic value is something that strategy experts would want the ventures to look at but that the venture teams themselves do not prioritise. Because of the strategy experts' area of expertise, it is understandable if they place higher value in the strategic contribution of the ventures, than the venture teams do. The venture leaders describe their way of working as increasing the understanding of the uncertainty. More specifically they map the uncertainties against each other and test business and technical scenarios.

Technical experts at FEI say that technical uncertainty is harder to estimate in the beginning of a venture. They handle the uncertainty by increasing the technical knowledge, using FMEA, and viewing the their process as a learning process. This way of working is typical for the front end where especially the technical uncertainty can be decreased significantly by the end of the front end (Verworn, 2009). It is highlighted that a dynamic discussion about uncertainty is important.

Whether FEI at Tetra Pak acts like the rest of the company or if they have adapted to a front end way of working, they feel that there is a great complexity because of the different component dependencies. For example, when prioritising between ventures of different age and maturity, one strategy expert says that there is not enough knowledge to make sound decisions. This statement point to an awareness about the difficulties that FEI faces and indicate that the FEI department at Tetra Pak have the characteristics of the front end.

6.2.2 Findings that contradict each other

Some conflicting information has been identified from the empirical study. The market expert says that measurements are not carried out in a specific way and that different questions need to be asked for the different ventures. Venture leaders confirm this statement by saying that they do not work with a standardised risk list. The technical experts view this issue differently. They see a need to use a system perspective to work with risk and uncertainties. One technical expert works with a system perspective framework and thinks that everyone should do so.

The lack of risk focus is also brought up by the technical experts in regards to the input Innovation Forum has for the ventures. They considered current problems and cost calculations to be the main focus areas for Innovation Forum. The director on the other hand points out that FEI should not view everything as risks that need to be reduced, but instead focus on maximising learning in as many uncertain areas as possible. According to one of the technical experts, awareness of risks is important when working in the FEI department. The different views on how to work with risk, makes it clear that there is some kind of miscommunication. Looking closer on the director's view, the important words are "view everything" and "reduced". One can be aware of risks in the environment and thereby satisfying the technical experts need to understand what risks are out there but still not focus the work of the

ventures on lowering these risks. Having a specified risk list is not characteristic for the front end. The behaviour described above indicates a will to create some form of risk list. This can be seen as a result of being close to a large product company with mature technology, and the FEI department being so recently established.

The technical experts and the venture leaders agree that tollgates are not used in ventures. Technical experts say that it is hard to set requirements for something that does not exist, but they still say that technical requirements are used to specify the goal for the venture. The venture leaders on the other hand say that by creating their own deadlines, they can measure progress in the venture. It is not clear which requirements can be set and what the deadlines actually include. Technical requirements are often defined during a venture in order to decrease the uncertainty. It is not clear whether or not the ventures actually use technical requirements and if these technical requirements are a lot different from the ones used in tollgates.

Table 7: A summary of uncertainty findings

Theory	**Uncertainty**
The front end	High uncertainty projects. Reduce technical uncertainty by creating learning/knowledge. Project progress is seen as increased technical knowledge. Understand market leadership and customer needs to reduce market uncertainty.
The environement around the subjective	Risk aversion: Push towards lowering market and technical risks for the entire company. Market uncertainty is lower than in FEI.
Findings	• Incubation is normally a part of NPD and more linear than discovery, at Tetra Pak incubation is included in FEI. • Use small test activities to decrease market uncertainty earlier. • Decision criteria are attractiveness and feasibility. There is a risk of strategic value being forgotten by ventures. • Work with technical uncertainty through the learning process. • Dynamic discussion about uncertainty is important. •There is not enough knowledge when prioritising between ventures of different age and maturity. • Technical experts are keener to find a standardised way of working with uncertainty. • Communication of risk awareness should be done both bottom-up and top-down.

6.3 Decisions

In this section the mapped and coded empirical findings concerning decisions will be analysed. Decisions include both prioritisation decisions as well as other types of

decisions. To some extent, Innovation Forum's role in decisions is included. A summary is found in Table 8.

6.3.1 Findings that indicate the same thing

The strategy experts feel that it is difficult to know how to prioritise between ventures of different maturity. This shows that there is awareness among the employees of the complexity within the front end.

The market expert says that some decisions regarding market uncertainty have to be based on intuition. Intuition is the first part of a learning process (Crossan, Lane & White, 2004), and therefore necessary in the beginning of the venture or concept development. Crossan, Lane and White (2004) describe two types of intuition, expert intuition and entrepreneurial intuition. McDermott and O'Connor (2002) argues that market expertise is not necessary in the beginning of working with higher level of innovation, even though mature company seem to believe it is. If market expert intuition is not necessary, then market entrepreneurial intuition could be of higher importance when working in the beginning of higher levels of innovation.

Some technical decisions from a venture are handled in a TD. This could indicate that the ventures, where parts of the technical work are done in a TD, are ventures with lower level of innovation. Nagji and Tuff (2012) argue that adjacent innovations can be incorporated somewhat in the normal business. However, if the level of innovation is high, the reason to use a TD to handle the technical part of the venture could be that it helps them to handle uncertainty in a way they recognise. If they have a high level of innovation and work by outsourcing activities to a TD, it indicates that they are evolving from having the behaviour of a mature company and are trying to adapt to new tasks in a way they are familiar with.

Kim and Wilemon (2002) state that formal decision-making concerning go/kill decisions first occur at the end of the front end process, a formal decision is explained as quantitative and precise. Informal decision-making is important throughout the whole process, and is described as qualitative and approximate (Kim & Wilemon, 2002). Boeddrich (2004) says that prioritisation using portfolio management is used after the final decision concerning company investment is made and the concept no longer is a part of the front end. What one of the strategy experts explained as continuously reprioritisation, seems to be informal decision-making. As long as the continuously reprioritisation is based on informal rather than the formal decision-making, this process seem accurate to use for FEI.

In the beginning, decision-making should focus on learning, in order to avoid killing or moving forward with the wrong venture (Bessant et al. 2010). The strategy experts discuss different criteria, on which decision-making could be based. This includes the combination of attractiveness and feasibility, and business potential, probability of success and risk. All these criteria seem accurate to use when working

a higher level of innovation environment, since they are the same as the parameters reducing venture uncertainty (Stevens, 2014; Verworn 2009). The strategy experts also mention that decision-making should be based on the same criteria in the beginning and end of the FEI process. The reason why there are different criteria mentioned could be because it is a new organisation working on getting a consistent language. As mentioned above, the decision-making along the front end processes is based on qualitative data while at the end of the front end it should be based on quantitative data. This implies that FEI should adjust its decision-making along the way.

The director believes that the people within Innovation Forum can contribute with experience, technical skills, deep company knowledge and contacts. These can all be important factors to endorse interdisciplinary idea selection. This type of decision team is seen in many different companies over the world; Bessant et al. (2010) believe it is a good way to handle innovation selection.

The market expert and the director argue that in order for an idea to be interesting, the market for it has to be large enough. Even if the profitability is satisfactory, an idea will not be pursued if the potential market size is not. According to literature, one success factor for the front end is identifying ideas that can create products that are beneficial for the customer (Boeddrich, 2004; Nagji & Tuff, 2012). This seems to be contradicting to how they think at FEI. The market expert argues that if there is an unattractive venture for Tetra Pak it does not matter if it would be attractive to the customer. This indicates that there is risk aversion within FEI hindering customer value to be pursued. The reason for this risk aversion is not clear. It could be that FEI has not tried focusing on the customer before and therefore does not feel comfortable doing so. It could also be because the level of innovation of the ventures are higher and therefore it is harder to obtain information regarding the customer need of something the customers do not yet know they need. It is therefore easier to focus on company value for FEI.

There is a mixture of maturity and level of innovation within and around the FEI department, causing opportunistic behaviour. The degree of maturity an idea or venture at FEI has varies, which makes it harder to promote ideas with less information. The market expert claims that sometimes they have to market their ideas to external actors. This implies that there could be prioritisation problems on a higher level, probably not setting aside as much money as needed, for the level that FEI at Tetra Pak is operating on today (McDermott & O'Connor, 2002). It could also be so, that the Tetra Pak environment has a tendency to favour certain ideas. One strategy expert believes that it is necessary to have senior management taking greater responsibility of the ideas that are of higher level of innovation, which is concurrent with what Kim and Wilemon (2002) say.

6.3.2 Findings that contradict each other

The technical experts express a need that the ventures should be more autonomous when it comes to decision-making and management should not step in unless for go/kill decisions. According to Reid and De Brentani (2004), this is a good way to work with decision-making within FEI. However, this statement indicates that this is how they want to work and not how they are doing it today. The venture leaders say that they want less senior management involvement, in terms of monitoring, but more senior management involvement, in terms of guidance. Today, the ventures are monitored to enable go/kill decisions, according the strategy experts, indicating that there is a top-down structure. Top-down structures characterise large and mature companies (Wessel, 2012), and they seem to be influencing how FEI works. On the other hand, this is contradicting to how the Innovation Forum is described by the director. According to the director, Innovation Forum makes few decisions without aligning with venture leader and has more of a strategic than a formal decision-making role.

It seems like most employees within FEI are striving for a bottom-up information flow and autonomous ventures, which is concurrent with front end theory (Reid & De Brentani, 2004). FEI has have some barriers to overcome before reaching a balanced decision process. One being that the employees are from, and surrounded by, an environment that focuses on strict governance structures, which could be hard to change. Employees within FEI understand the process differently. This indicates that they have not yet reached a common way to work, and that a common language is not established yet.

Table 8: A summary of decision findings

Theory	**Decisions**
The front end	Bottom-up decision-making and information flow. Interdisciplinary selection
The environment around the subjective	Top-down decision-making and information flow.
Findings	• Entrepreneurial intuition is important. • Important to use intuition for technical work as well. • Be careful when outsourcing parts of a venture to a TD, TD is a less innovative process. • If reprioritising occurs during the FEI process, use different criteria than for go/kill at an investment decision. • Hard for TP to focus on customer value even though it is necessary. • Senior management need to take responsibility when opportunistic behaviour appear. • Disagreement regarding how much Innovation forum is monitoring and guiding. • Striving for bottom-up information flow and autonomous ventures.

6.4 Leadership

In this section the mapped and coded empirical findings concerning leadership will be analysed. This chapter analyses FEI governance, Innovation Forum and individual leadership seen in the director and the venture leaders. A summary is found in Table 9.

6.4.1 Findings that indicate the same thing

One venture leader says that they would like to have a more cross-functional management watching over them. To some extent the FEI management accomplish this today, but some still think it should be improved. Verworn (2009) identified interdisciplinary idea selection as a factor affecting the innovation process. Increasing the cross-functionality of the governance teams should therefore be seen as something that can positively affect the rest of the process.

There are some indications from the venture leaders that FEI has implemented a behaviour typical for the front end. The venture leaders highlight the need for alignment, support and guidance in the ventures and say that they do not require active supervision, which are both indicators of a bottom-up information flow. Another indication is that the traditional governances within Tetra Pak sometimes show resistance against FEI's way of working, which is brought up both by venture leaders and by strategy experts. The strategy experts draw the conclusion that it is because of the difference in financing learning, which needs to be done in FEI, and financing a check-list, which is done in the rest of Tetra Pak. The resistance from traditional governance indicates that they are not used to the way FEI is working, thus it is not typical for the rest of Tetra Pak. The traditional governance need to understand the way FEI works better, in order to overcome this.

When talking about risk, venture leaders wish that financing decisions would be made faster, that decision makers would trust their intuition more and allow themselves to take more risks. This view is strengthened by technical experts saying that the more radical a concept is, the harder it is to convince management. The key take away from this is the decision-makers' risk aversion experienced by technical experts and venture leaders. Pushing towards low risk and incremental innovations can be a result of a large product company with mature technology influencing the FEI department (McDermott & O'Connor, 2002). Today senior management of Tetra Pak is not involved in watching over prioritised ventures, successful front end departments should have this help and FEI at Tetra Pak is aware that they would benefit greatly from getting this support. On the other hand, the director of FEI is involved in all ventures, not on a detail level but as a sponsor promoting the ventures outside of FEI. This could be a way of compensating for the senior management not being involved. This indicates FEI has not fully developed into a department characterised by front end theory, but it seems as if they understand that they need to have leadership that is supportive of innovative ideas, even if they do not always get the support they need from outside.

Venture leaders say they need to have a wider scope, when working on FEI ventures, compared to the scope project leaders at the rest of Tetra Pak have. The reasons for this can be many, but during observations at Tetra Pak it has become clear that a main difference between FEI and the rest of Tetra Pak is that FEI strive to focus more on business and commercial opportunities, while the rest of Tetra Pak focus more on the technical side. This can be the reason why venture leaders need to be able to keep both perspectives in mind.

6.4.2 Findings that contradict each other

Venture leaders say that a lot of guidance come from directions given by the FEI management. This indicates that there is behaviour in the FEI department that is more typical of a large mature company with a top-down information flow. The fact that one venture leader wants to have more cross-functional governance but does not have it, indicate that FEI is stuck in an old behaviour, typical for the rest of Tetra Pak. The strategy experts say that monitoring is done in order to create understanding and enable support. Focusing on giving support indicates that FEI management works in a way that is typical for FEI.

It is unclear if monitoring at FEI is of a controlling or supportive type. The market expert says that the governance teams have more of a guiding character and the strategy experts describe the monitoring as vague. At the same time, venture leaders say that they wish additional confidence would be given to venture teams to do things on their own. This indicates that the control from governance teams is stronger than described by the market expert and the strategy experts. The strategy experts also say that governance can create demands to make sure that things such as cost is equivalent to the learning process. Given that it is actually the venture leaders that will experience the monitoring and that the strategy experts describe behaviour more typical for controlling monitoring, it is assumed that the governance in some way still display behaviour more typical for a large mature companies than for the front end.

Table 9: A summary of leadership findings

Theory	**Leadership**
The front end	Leadership that support innovative ideas. Senior Management helps with funding
The environement around the subjective	Leadership that manage resource allocation and follow up processes.
Findings	• More cross-functional governance is needed. • Everyone has to understand that this is the reason for monitoring the ventures is to understand them. • Traditional governance needs to better understand the way FEI works. • Better support should be given to highly innovative concepts. • FEI has compensated the lack of closeness to top-management with the director leadership. • Venture leaders need to keep both market and technical perspectives in mind. • Governance still display behaviour typical for a large mature company. • Management is experienced as more monitoring and controlling by the people that are monitored.

6.5 Teams

In this section the mapped and coded empirical findings concerning teams will be analysed. The analysis covers how team composition affects the work. A summary is found in Table 10.

6.5.1 Findings that indicate the same thing

According to Verworn (2009) one success factor for the front end process is to use interdisciplinary teams for both idea generation and selection. The director states that collaboration is important within Innovation Forum, ventures and FEI. Based on this, there could be two possible conclusions: either it is important for any development at any company or the director is aware of the additional success this may lead to within the front end.

The venture teams collaborate with people from other departments within Tetra Pak, which indicates that the work is somewhat interdisciplinary. The employees at FEI have seen that employees from outside of FEI have some difficulties in working in ventures, but they also say that the external employees have expressed that they enjoy this way of working. This could mean that the employees at Tetra Pak are not opposed to the new way of working.

The technical experts say that ventures benefit from collaborating with other departments within Tetra Pak. The collaboration exists with dependent actors as well as development partners and suppliers. Nagji and Tuff (2012) states that adjacent innovation work can benefit from near collaboration with other

departments within the company, while transformational innovation should work as a separate department. This indicates that some of the work at FEI might be a lower level of innovation, than radical innovation. The observations done seem to confirm these indications.

The venture leaders have expressed a need to get more external guidance and competence covering customers, business value and technical feasibility. According to Verworn (2009) this is necessary for a front end environment. However, the fact that they express this need, indicates that the department is moving from the old way of working towards a front end way of working. There are things currently happening to improve this. For example, meetings encouraging knowledge sharing and updating each other on venture status, are something both the strategy experts and the venture leaders talk about.

Common sense, understanding of some theories, the ability to question assumptions and facts, understanding of the relationship between variables along with relevant experience creates relevant intuition according to the market expert. Furthermore, the market expert says that relevant intuition is needed in order to reduce market uncertainty. Based on the analysis of uncertainty it seems as if for market uncertainty, entrepreneurial intuition is needed (McDermott & O'Connor, 2002; Crossan, Lane & White, 2004). This indicate that an interdisciplinary team consisting of employees with common sense, understanding of some theories, the ability to question assumptions and facts, understanding of the relationship between variables, with relevant experience, as well as employees with entrepreneurial intuition will create the best team constellation.

The meetings held every second week are identified as a good way to better understand how much knowledge is created in a venture or focus area. It also gives employees the opportunity to take advantage of different people's intuition. It is also a way for FEI management to monitor that cross-venture learning takes place. Monitoring of learning is not described in front end theory, but it indicates that the department is not used to working with learning and the management feels the need to support their employees in this transformation. One could see the monitoring as a result of FEI not having developed a front end leadership style yet, but it could also be necessary when teaching the employees a new way of working, so that they do not fall back into old habits.

When working with a higher level of innovation than incremental innovation, some sort of idea pipeline is necessary (Boeddrich, 2004). Today there is no scheduled time for the employees within venture teams to engage in idea generation for other areas than their own, but within the ventures, the team get the opportunity to work with new ideas connected to the concept. It is beneficial for the venture that the team is working on ideas for their particular venture. However, it could also indicate that the new ideas for ventures are still being created and selected by higher

management, which is behaviour more typical for large companies with mature technology, rather than a bottom-up structure (Brentani & Reid, 2012).

6.5.2 Findings that contradict each other

There are different ways to put together teams. One technical expert is positive towards including experts that are used to work in TDs, motivating it by saying that including people used to working in TDs, can ease the progress of the venture. This implies that people working in today's ventures using iterations, sometimes seem to think they benefit from working in the way they used to do before FEI, using linear processes. This indicates that FEI is still trying to define its working methods, changing from a linear to a more dynamic way of working. However, Nagji and Tuff (2012) states that working with transformational innovation teams need to be separated from the regular operations, and TDs are a part of that.

Technical expert 1 sees TDs as an integrated part of a venture, while technical expert 2 and one venture leader see it as a separate process. The fact that different people in the same department talk about the same thing in different ways could indicate that the department is missing a unified way to speak about their work.

Table 10: A summary of team findings

Theory	**Teams**
The front end	Interdisciplinary idea generation and selection. Investing in internal and external skills.
The environement around the subjective	Appropriate specialist are needed in the beginning and along the project
Findings	• There exists some awareness of the importance of interdisciplinary teams. • Based on the venture teams, FEI work with both radical and adjacent innovations. • Some ventures benefit more than others from using external actors. • Increase the possibility to use external competence, but also make sure the internal knowledge is spread. • Include more entrepreneurial intuition. • In a newly established department, monitoring might be necessary in order for the new way of working to be followed. • There is a possibility that new ideas are still generated and selected by higher management. • They should use employees within FEI to generate ideas. • Some employees seem, to some extent, to prefer the old Tetra Pak way of doing things. • The FEI department is observed to have some communication difficulties.

6.6 Summary of findings

Based on the key take aways in the analysis above, a summary has been put together, presenting the characteristics of a newly established FEI department within a large product company with mature technology (the subjective), see Table 11. The summary is structured after the five areas that were identified for the front end in the literature review. For each area three types of characteristics will be presented:

1. factors for how the subjective should work, in concordance with front end theory
2. factors for how the subjective should work, in concordance with theory describing the environment around the subjective
3. factors describing how the subjective should work, caused by the subjective being a newly established department

The factors caused by the subjective being a newly established department can both be a result of the study showing problems seen within the subjective, as well as solutions to problems seen within the subjective.

Table 11: Summary of findings

Findings	Process
Charactaristics indicating a front end environment	• Little or no clear documentation or control of the venture process is needed .• Dynamic and agile work methods with loops and iterations. • Chaotic financial planning exists. • Planning to take one step at the time. • The goal is not to reach commercialisation; instead incubation is near and can make the goal clearer. • Technical requirements are not necessarily hard to set, but it is hard to define what constitutes a technical requirement.
Characteristics of the environment around the subjective	• Focus on the learning process exists, but it is not fully developed. • Few feel comfortable with the business and commercial aspects. • Governance focus less on technical parts. • Venture leaders have more responsibility in planning than project leaders do.
Characteristics of the subjective being a newly established department	• Increase development of the learning process. • The learning process needs to be combined with structure and initial planning. • Increase contact with senior management; either through a forum or organisational contact. • Use linearity terms for communication outside of FEI, without affecting FEI process. • Structure is necessary in the beginning in order to dare to iterate, otherwise there is a risk that individuals move back to old ways of working. • Focus on having an internal common language.

Findings	Uncertainty	Decisions
Charactaristics indicating a front end environment	• Measure a venture or idea using attractiveness and feasibility. • Work with technical uncertainty through the learning process. • Dynamic discussion about uncertainty is important. • There is often not enough knowledge when prioritising between ventures of different age and maturity. • Technical requirements are not necessarily hard to set, but it is hard to define what constitutes a technical requirement.	• Not all ventures should outsource technical parts to TD, only the less innovative ones. • Striving for a bottom-up information flow.
Characteristics of the environment around the subjective	• Technical experts are keener on finding a standardised way of working with uncertainty.	• Disagreements regarding how much Innovation Forum should monitor and guide.
Characteristics of the subjective being a newly established department	• Include phases after the front end in the FEI departement. • Use small test activities to decrease market uncertainty. earlier. • Add strategic value as a measurement to already existing attractiveness and feasibility. • Communication of risk awareness should be done both bottom-up and top-down.	• Increase entrepreneurial intuition. • It is important to use both entrepreneurial and expertise intuition for technical work. • The criteria used for reprioritising during the FEI process, should be different from go/kill criteria at an investment decision. • It is necessary to focus on customer value even though it is hard. • Senior management need to take responsibility when opportunistic behaviour appears. • Ventures should be autonomous.

Findings	Leadership	Teams
Charactaristics indicating a front end environment	• When FEI department lacks closeness to top-management, director leadership should compensate for it.	• Awareness of the importance of interdisciplinary teams is necessary. • The FEI department is observed to have some communication difficulties.
Characteristics of the environment around the subjective	• Governance can display behaviour typical for a large mature company. • The management is percieved as more monitoring and controlling by the people that are monitored.	• The FEI department works with both radical and adjacent innovations. • Some employees seem, to some extent, to prefer the old way of doing things.
Characteristics of the subjective being a newly established department	• Increase cross-functional governance. • Clarify the importance of monitoring as a means to understand ventures. • Traditional governance need to better understand the way a FEI departement works. • Better support should be given to highly innovative concepts. • Venture leaders need to keep both market and technical perspectives in mind.	• Increase the possibility to use external competence, but also make sure the internal knowledge is spread. • Include more entrepreneurial intuition in teamwork. • Monitoring might be necessary in order follow up the new way of working. • Reduce the risk that new ideas are only generated and selected by higher management. • Use employees within the FEI department to generate ideas. • Some employees seem, to some extent, to prefer the old way of doing things.

The summary is the first part of the result of the study. In the next chapter, the summary will be used in order to present how a prioritisation support method can be designed.

7 Finding an appropriate prioritisation method

In this chapter, characteristics affecting how a prioritisation method should be designed will be analysed. These characteristics have been identified as the following: high uncertainty, communication problems, opportunistic behaviour, the front end ends before incubation, the progress is measured by the learning process, the learning process needs to be combined with structure and planning, strategic value, attractiveness and feasibility should be the main criteria of prioritisation and preferring the old way of doing things.

During the analysis of how these characteristics affect the prioritisation method, the hierarchical fuzzy TOPSIS model will turn out to be appropriate for the subjective. The Hierarchical fuzzy TOPSIS model is a part of the prioritisation method and the reasons behind it being recommended will be summarised in Sub-chapter 7.9. Lastly the framework for the recommended prioritisation method is presented.

7.1 High uncertainty

In an uncertain environment, literature points to using a fuzzy model to be favourable. The summary of findings indicates that there is high uncertainty in the subjective, both in regards to the ventures but also when it comes to leadership, the process and decision-making. Those areas all have fuzzy or uncertain characteristics. A fuzzy model is based on the idea that linguistic parameters are necessary to use when dealing with a fuzzy environment. However, it can be questioned if it is harder to measure learning, using numbers than linguistics.

7.2 Communication problems

The summary of findings points out communication problems within the front end, caused by that the language lacking consistency, which in turn can be a result of the department being newly established. Using a model based on linguistic parameter instead of numbers help the decision-makers to evaluate the alternatives (Kahraman, Büyüközkan & Ates, 2006). For example, when evaluating a concept the numerical perception may vary, level 1 could mean low for one person while low is level 3 for another. However, evaluation based on Low, or Low to medium levels are easier to discuss and it is easier to explain what Low means for a particular concept. Using a model based on solely numerical input is therefore believed to increase the communication problem within the department. Since literature indicate that a fuzzy model should be used during high uncertainty, and the analysis regarding communication problems indicates the same thing. The conclusion from this can be that a fuzzy model is appropriate to use for the subjective.

There are some characteristics indirectly affected by the communication problems and language inconsistency; communication between the subjective and the rest of Tetra Pak and cross-functional governance. If the communication within the

subjective is improved, using a fuzzy model, one can assume cross-functional governance will become easier. When FEI and employees outside of FEI understand each other, it becomes easier to make decisions. This could increase the interest and participation in cross-functional governance, which is desired by employees within the subjective.

7.3 Opportunistic behaviour

Having a common, consistent language could also decrease opportunistic behaviour. If everyone uses the same terms and language when prioritising and making decisions, it becomes easier to discuss the reason behind decisions. The opportunistic behaviour can further be reduced by making the criteria that the prioritisation is based on clear. In the AHP model, criteria are divided into sub-criteria in a hierarchical system, which will make the meaning of the main criteria clear to the employees.

7.4 The front end ends before incubation

The subjective is a FEI department that includes more parts of the NPD process than literature indicates that the front end normally consists of. The conclusion is that the focus areas and the discovery phase are the parts of the subjective making up the front end. Since the prioritisation method described and recommended in this study is for the front end, it will be applicable for the focus areas and for the discovery phase. This is before a decision regarding the investment in an incubation is to be done; how to prioritise when taking a venture to incubation needs to be researched separately in order for a recommendation to be given for it.

If a model that includes main- and sub-criteria is used, using the model for the earliest stages will become easier. Even if only a few things are certain, having other sub-criteria to compare too will make the estimations that need to be done easier to do.

7.5 A learning process

The subjective measure progress by seeing their work as a learning process. This is concurrent with how literature views the progress of a front end venture. Using the prioritisation method recommended in this study is not a substitute for this type of measurement, it is a way to measure the venture itself and prioritise between different ventures.

7.6 Combine a learning process with structure and planning

Both the study and previous research indicate a need to combine a learning process with structure and planning. Implementing the use of a formal prioritisation method,

that includes a prioritisation model, can be a way to achieve structure and ease planning.

The employees working within the FEI department are aware of that a more dynamic and chaotic environment is needed for front end activities, and aim to provide the employees with this environment by giving autonomy to the venture teams. Problems seem to occur because the employees within the FEI department are not used to this way of working and therefore turn to behaviours similar to that of the surrounding environment.

By implementing a formal prioritisation method, the structure and support needed for the employees to feel secure in exploring a more dynamic and chaotic way of working, can be achieved.

7.7 Strategic value, attractiveness and feasibility as the main criteria for prioritisation

Based on the summary of findings, the main criteria should be strategic value, attractiveness and feasibility. Strategic value focuses on the company vision, future and competitive advantage. Attractiveness focuses on opportunity of the technology; market, including customer value, and business. Last, feasibility focuses on the risk within the technology features, reaching market and the holistic and sustainable perspective. By using these main criteria, the subjective can make sure that all employees involved in prioritising within the front end are aware of what should be evaluated and feel that they are part of the decision-making. This will increase the level of innovation within the department (Hurley & Hult, 1998).

Using the model can help to increase risk awareness. For some employees risk awareness is part of all their work, while others needs to be reminded of it. Including risk in the model as a mandatory input or criterion would help to create risk awareness. More than risk, the company as well as the FEI department struggles to make sure that everyone is aware and actively work to increase strategic value. The strategic awareness will be increased using the model, in similar ways as for risk awareness. This helps to spread awareness to all employees working in ventures. Customer value has sometimes been overlooked within the FEI department, by including it, maybe as a sub-criteria, will increase the awareness of it.

7.8 Preferring the old way of doing thing

Boeddrich (2004) states that systems used within organisations need to be simple to manage. The summary of findings indicates that the employees at FEI tend to fall back into old habits when the work is too complex. This means that in order for the FEI department to use a prioritisation method regularly, the prioritisation model used in it needs to be simple. Of the prioritisation models presented in Chapter 4, TOPSIS is considered the simplest one, partly because it is computerised.

7.9 Recommending the Hierarchical fuzzy TOPSIS model

Combining TOPSIS with AHP and making it fuzzy, results in the Hierarchical fuzzy TOPSIS (Wang & Chan, 2013). It is a model with both depth and simplicity in the prioritisation. The Hierarchical fuzzy TOPSIS model gets depth from the AHP model with its hierarchical structure of main and sub-criteria, and simplicity from the computerised TOPSIS model. The hierarchical structure makes it more advanced, however it is necessary because it can handle more information, suitable for group decision-making (Wang & Chan, 2013). If strategy experts at FEI define these sub-criteria in advance it could help to increase awareness and ease the communication in different areas, such as risk and strategy. By clearly defining different sub-criteria, the venture teams will all be aware of the same types of areas to look into. The fuzziness of the model will make the model more suitable for an environment where communication problems are common.

7.10 A prioritisation method framework

The analysis in this chapter indicates that the Hierarchical fuzzy TOPSIS model should be used in the prioritisation method. In this chapter a prioritisation method framework will be presented and explained. Below, in Table 12, the characteristics of the subjective are presented together with the influence they have on how a prioritisation method can be designed.

Table 12: The characteristics of the subjective

Characteristics of subjective	**Influence on prioritisation support method**
High uncertainty	Fuzzy model
Communication problems	Fuzzy model
Opportunistic behaviour	Criteria and sub-criteria (AHP) to enable discussion
The front end ends before incubation	Used for focus areas and discovery phase
A learning process	The model will evaluate the ventures, not the progress
Combine a learning process with structure and planning	Create structure around the venture so it can be chaotic inside them
Strategic value, attractiveness and feasibility as the main criteria for prioritisation	Criteria and sub-criteria (AHP) to increase awareness
Preferring the old way	Keep the model simple (TOPSIS)

7.10.1 The framework

Based on the analysis in Sub-chapters 7.1-7.9, a framework for a prioritisation method was designed, see Figure 7 below.

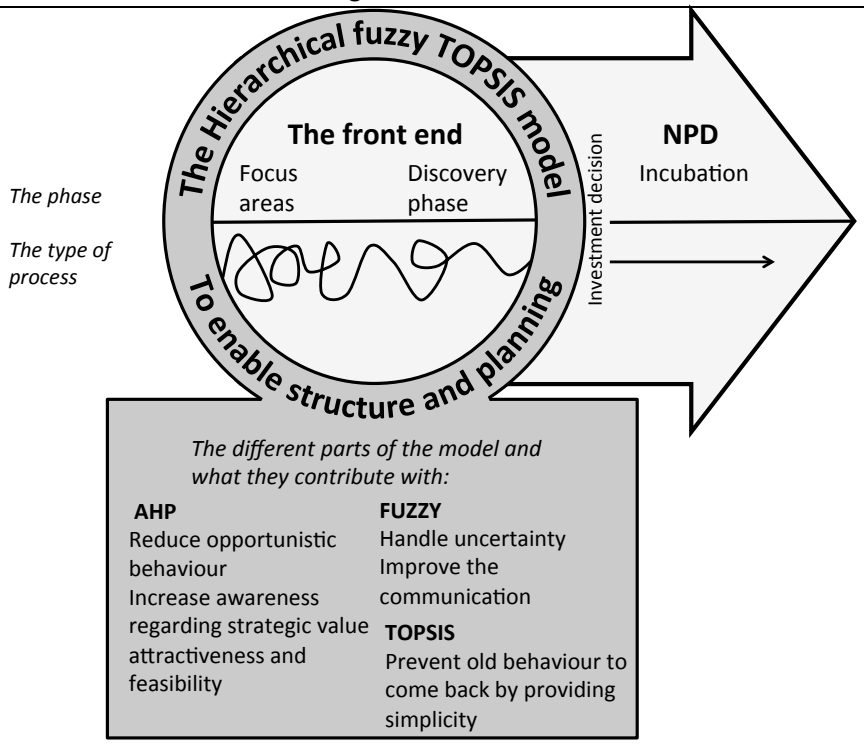

Figure 7: Framework to describe the prioritisation method

The prioritisation method includes the Hierarchical fuzzy TOPSIS model and illustrates when the model should be used and what the method can contribute with. The main purpose of the prioritisation model is to provide structure and planning to newly established FEI departments at large product companies with mature technology. This is illustrated by circle around the front end part of the process in Figure 7.

Excluding the incubation from the circle illustrates that the Hierarchical fuzzy TOPSIS model should only be used before incubation takes place, since the uncertainty is lower for incubation and a large investment decision has been made at that point. In the earlier phases the process is dynamic and iterative and by using the Hierarchical fuzzy TOPSIS model, structure and planning is created within the department. This enables each venture to focus on creating an iterative and dynamic process within the uncertain environment instead of falling back in to the old structure seen in the rest of the company.

The prioritisation model is a combination of TOPSIS, AHP and a fuzzy adaptation and aims to help a newly established FEI department at a large product company with mature technology to handle the difficulties the department faces at an early phase of radical product development. The contributions of the different parts of the Hierarchical fuzzy TOPSIS is summarised under the circle in Figure 7. By combining the TOPSIS and AHP model a hierarchical structure of criteria is created, which

includes both main-criteria and sub-criteria. This is necessary because it helps to increase awareness around strategic value, attractiveness and feasibility, which should be the three main criteria. By defining common sub-criteria for the main-criteria it will become easier for the ventures and the department to communicate and understand what the different ventures are doing, whether it concerns what they are currently working on or what they are having difficulties with. This understanding will also help to reduce opportunistic behaviour because everyone understands the criteria.

7.10.2 Before using the Hierarchical fuzzy TOPSIS

Before the Hierarchical fuzzy TOPSIS model can be used, the department needs to clarify the sub-criteria to strategic value, attractiveness and feasibility. This should be done by everyone within the department in order for everyone to agree on the criteria. This study shows that customer value should be included as a sub-criterion to attractiveness and risk as a sub-criterion to feasibility. The rest of the sub-criteria need to be established by the employees who will use the model. After identifying these criteria the department will know what to look for when they are working and can more easily communicate their work to the rest of the organisation avoiding opportunistic behaviour.

7.10.3 Using the Hierarchical fuzzy TOPSIS

It can be hard to numerically evaluate the criteria in the front end; the fuzzy adaptation is therefore essential when using the Hierarchical fuzzy TOPSIS model. Therefore, the linguistic terms, such as the ones seen in Table 2, should be used. Furthermore in Table 2, the fuzziness of the model turns the linguistic terms into numbers. These numbers can later on be used in in the third step, which is the TOPSIS model, explained in Equation 1-7 in Chapter 4. The result from the last step using the TOPSIS is a distance between an evaluated venture and the positive ideal solution and the negative ideal solution. The distance that is the shortest is also seen as the best. The TOPSIS model is easily computerised and because of that, it is believed that it could be easier for the employees in a newly established FEI department at a large product company with mature technology to adjust and use the new method.

For a FEI department using the model, it is important that they are aware of what the model can contribute with so that they can take advantage of these opportunities. This includes reducing opportunistic behaviour, improving communication, handling uncertainty; all findings can be seen in Table 11. The result of using this model makes the work and resource allocation for ventures within a newly established FEI department better. By combining this with focus on the learning process could enable better work with radical innovation for a large product company with mature technology.

8 Conclusion

The purpose of the study was to create a framework describing a prioritisation method for newly established FEI departments within large product companies with mature technology. The purpose was reached by answering the following two research questions.

1. What characterises a newly established FEI department within a large product company with mature technology?
2. What can a prioritisation model look like that satisfies these characterising features of newly established FEI departments within large product companies with mature technology?

When answering the first question a categorisation of front end theory using Process, Uncertainty, Decision, Leadership and Teams was created and this was the first contribution and result of this study. Through a comparative analysis, characteristics, within these categories, of newly established FEI departments at large product companies with mature technology were identified, see Table 11 for all characteristics. These characteristics are second result of this study and are called Summary of findings.

The second research question was answered based on the identified characteristics and the literature review of prioritisation models. The Hierarchical fuzzy TOPSIS was identified as a suitable prioritisation model for newly established FEI departments within large product companies with mature technology. This is the third result of this study.

The final contribution of this study is the framework describing a prioritisation method. The method uses the Hierarchical fuzzy TOPSIS model and the characteristics found by answering research question one. The method will give the FEI department the initial structure and planning needed in order for the employees to feel comfortable with a more chaotic work process. It includes fuzzy linguistic that will help them handle uncertainty and improve their communication. Through better communication opportunistic behaviour will be reduced. Defining criteria and sub-criteria in the prioritisation model will increase awareness and the understanding of strategic value, feasibility and attractiveness. The method is designed to be simple to use in order to prevent old behaviour to come back. The method is to be used as a support for when working with a prioritisation model; it will create an awareness of what the model can contribute with and what the department should focus on when using it.

Creating a systematic prioritisation method for a newly established FEI department within a large product company with mature technology is important, not only to be

able to prioritise but also in order for the venture teams to feel secure enough to work in a dynamic, chaotic and iterative way.

The study shows that the environment around a FEI department affects the way they work and therefore also the way the prioritisation method can be used. Defining criteria and sub-criteria will increase the understanding within the department of what is valued in ventures and ideas. When the people within a FEI department have a consistent and clear communication, it will also be easier to enable a bottom up information flow from the department to top management. If the bottom-up information flow is consistent and clear it will also be easier for a FEI department to make the rest of the company understand the urgency of the work they are carrying out.

9 Discussion and further research

In this chapter the study's contribution to the literature will be discussed. After that, the weaknesses will be discussed and along with them suggestion to further research is given.

9.1 Academic contribution

The categorisation of front end literature that was created in this study is one the authors have not found in earlier research. This indicates that there are still much to learn regarding the front end and the research that have been done do not yet cover all that can be found.

The result in this study also shows that more phases than just the front end can be included in the FEI department. In this case, the incubation phase was included, meaning it should be excluded from the prioritisation. What can be generalised from this conclusion is that a newly established FEI department within a large product company with mature technology can include more than just front end activities, and this should be researched before implementing a prioritisation method, since all phases might not be appropriate to prioritise together.

Looking at the opportunity to categorise the literature in a new way and the results presented in Chapter 7 show that both the front end process and the prioritisation method should and can be adapted to the environment around the department. This confirms Nobelius and Trygg's (2002) statement that all front end processes are different and that one generalised process can not be developed.

The prioritisation method developed for newly established FEI departments at large product companies with mature technology can be useful for companies similar to the one used for a case in this study. The sub-criteria need to be adapted to the company using the prioritisation method and the process within the department need to be studied in order to understand if other parts than the front end are included in the department. Using this prioritisation method, large product companies with mature technology that have identified a new need to focus on radical innovation can manage to stay competitive in today's competitive environment.

Companies with different characteristics than the case company can, based on the theoretical framework, create its own prioritisation method because the theoretical framework is of a more generalised kind than the prioritisation method. By doing so this study can contribute and raise awareness how to work in the front end for all companies that tries to improve their innovation strategy to stay competitive.

9.2 Weaknesses

When conducting this study, all empirical research was done within the FEI department at Tetra Pak, except for one interview with the director for DSO Strategic planning at Tetra Pak. A risk with limiting the study to the FEI department is that the whole picture and the complexity of the problematisation might not be covered. If the people within FEI have a very different picture of their work compared to the rest of Tetra Pak, some parts of the result, concerning the interaction between FEI and the rest of Tetra Pak, might be faulty. The reason for limiting the empirical research to the FEI department, was because the authors experienced the same problems as FEI does, in getting contact and support from higher management. Because of this limitation, it is not clear if the recommended prioritisation method will satisfy external governance, for example Innovation Forum.

A possible issue regarding internal validity was connected to identifying if the employees were explaining how they worked or how they wanted to and planned to work. Since this possible issue was identified during the pre-study, the interviews for the main study were conducted in a way to minimise the risk faulty internal validity. In the main study the information from the interviews were complemented with passive observations and informal follow-up interviews. By using different sources of information, triangulation can be done to strengthen the internal validity (Farguhar, 2012).

The result of this study was not tested and evaluated. If it were to be tested and evaluated, it would have to be done over a longer period of time. Since the prioritisation method will need time to be properly implemented, Kotter (1996) recommends an eight-step process for implementing change. It can therefore not be confirmed that the prioritisation method is suitable to use in practise.

The empirical research done in this study had an individualistic perspective, meaning the focus was the perspective of individuals within the FEI department at Tetra Pak and not the perspective of stakeholders, such as venture leaders as a group. If the study had a stakeholder perspective, the result might have been different.

The choice to limit the selection of analysed prioritisation models to MCDM methods that have been used in earlier adaptations for the front end, fuzzy NPD and innovation was done in order to take advantage of previous research. This can have led to other methods that could have been of interest to be overlooked. The contribution of this study is mainly the summary of findings from Chapter 6, while the selection of prioritisation model is a smaller part. In order to do this study, it was necessary to start with creating the summary of findings, which was therefore the focus of study.

9.3 Suggestions of further research

A suggestion for a future extension to this study is to conduct a larger comparison between different prioritisation models, based on the summary of findings. The main part of this study was identifying characteristics of the subjective. By conducting a larger comparison between prioritisation models, the result in this study can be verified or adapted.

This study has had an individualistic approach, meaning the focus has been different employees' perspectives. A suggestion for a different method to use studying prioritisation within the front end, is having a stakeholder perspective, conducting a multiple case study and trying to understand different stakeholders' needs on a prioritisation method. In order to achieve this, several FEI departments might need to be interview, in order to get the actual stakeholder perspective and not just individuals' perspectives.

In addition to this study, a study of how the employees around a newly established FEI department at a large product company with mature technology view the department is suggested. It can create a deeper understanding of the characteristics of a FEI department and of the entire company's requirements on a FEI prioritisation model.

Because it takes time to implement this kind of prioritisation method, the prioritisation has not been evaluated yet. A suggestion for an evaluation is to compare FEI departments having implemented the method with FEI departments not having implemented the method. The fist step of doing this would be implementing the method in one or two FEI departments and identifying one or two FEI departments that have not implemented the method. After some time, the success rate and the rate of radicalness of the different departments could be compared to each other.

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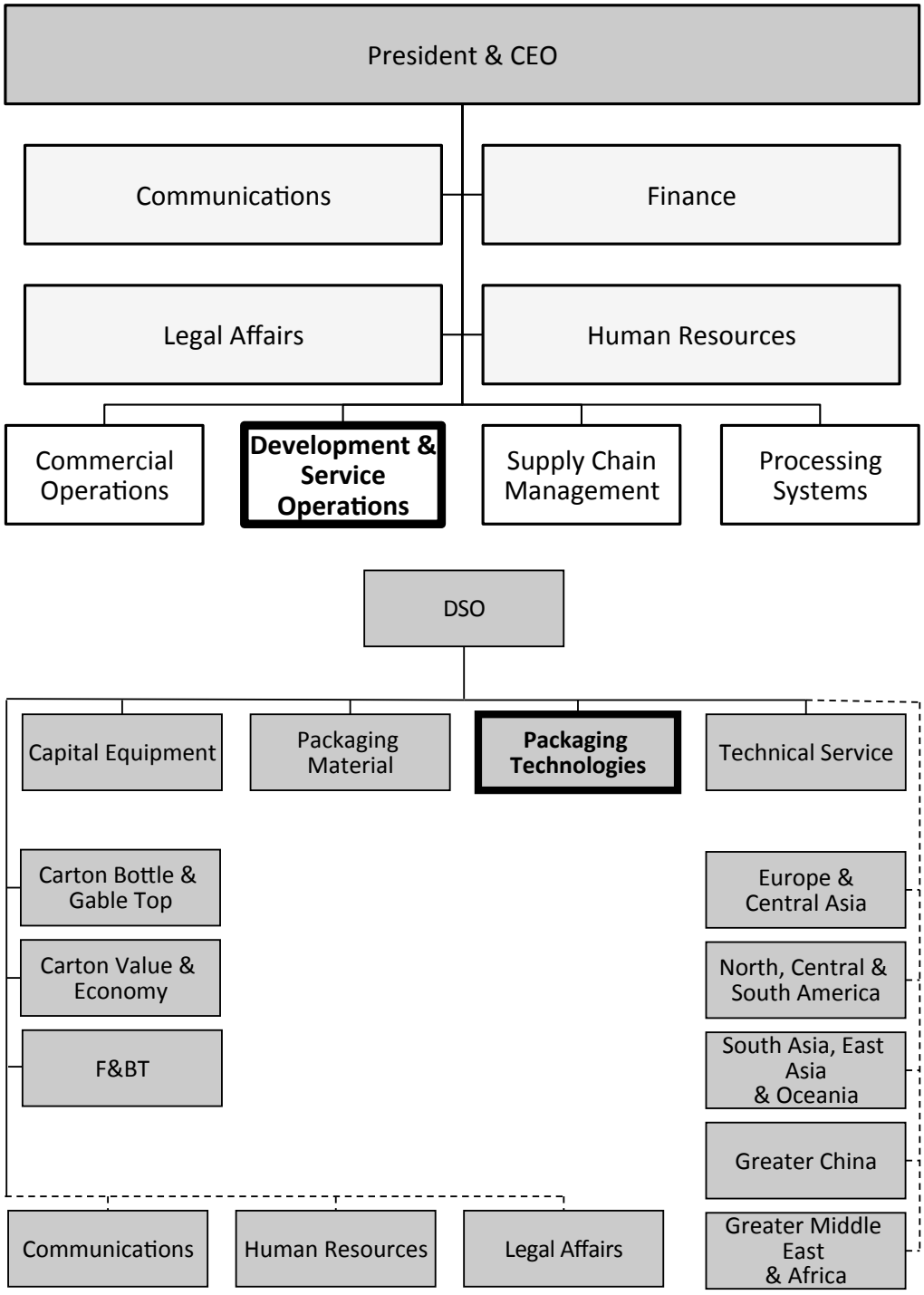
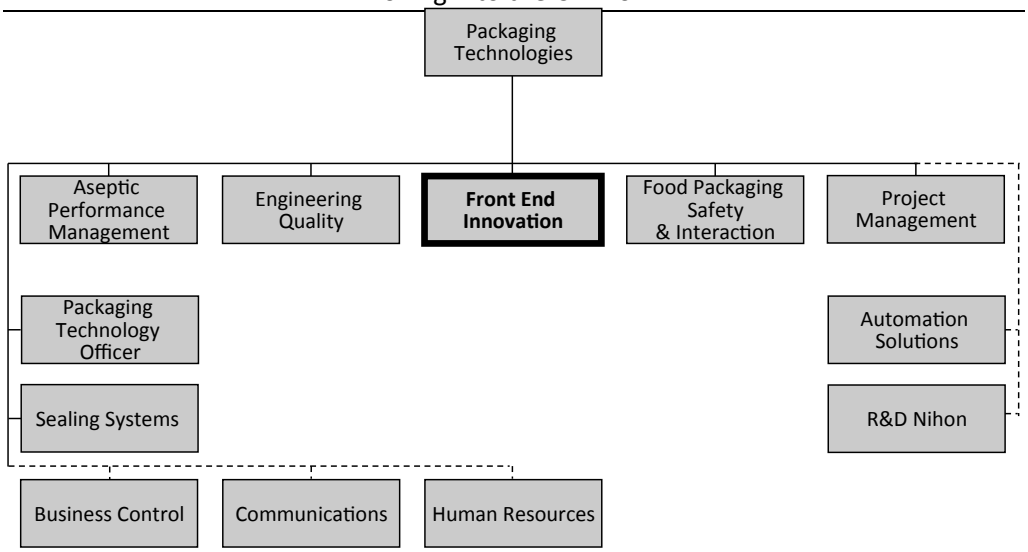
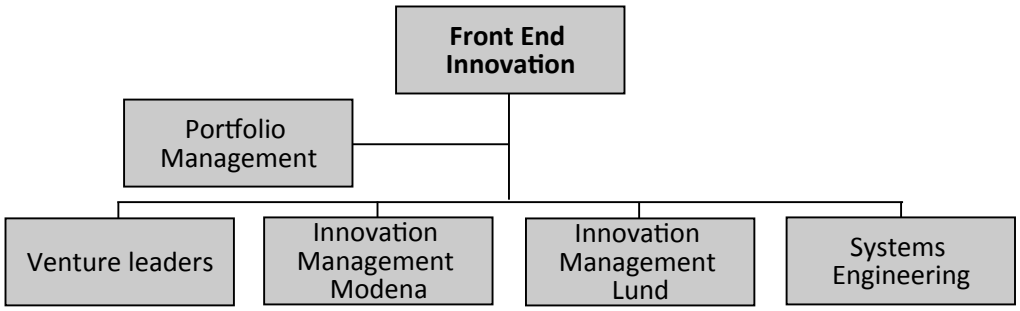
Appendix I: List of definitions

The front end	The term for the initial stages of radical innovation development.
A FEI department	Any front end department.
FEI	The specific front end department at Tetra Pak.
The subjective	A newly established FEI department at a large product company with mature technology.
The environment around the subjective	Refers to the environment of a large product company with mature technology.
Concept	An idea that is somewhat defined and is found to have some kind of potential, whether it being business or technical potential.
Activity	Anything done within the FEI department, it can be both short and long term; for example a venture, something that is part of a venture, something that is done to develop an idea or concept further.
Project	A set of activities that aims to reach a certain goal. The term is used for projects outside of FEI departments.
Pre-venture	A set of smaller activities carried out before a venture is established
Venture	A project that focuses on developing a concept that exists within a FEI department.
Focus area	A term used by the FEI department at Tetra Pak, in which idea and concepts are generated.
Prioritisation model	A model found in literature that explains the technical part of the prioritisation.
Prioritisation method	A prioritisation method does not necessarily include a prioritisation model, but covers the softer values of prioritisation.
Innovation Forum	Governance outside of FEI watching over the focus areas, ventures and radical innovation activities within Tetra Pak.
TD	Technology Development Project

Appendix II: The Tetra Pak organisation




Packaging Technologies
Aseptic Performance Management
Engineering Quality
Front End Innovation
Food Packaging Safety & Interaction
Project Management
Packaging Technology Officer
Automation Solutions
Sealing Systems
R&D Nihon
Business Control
Communications
Human Resources


Front End Innovation
Portfolio Management
Venture leaders
Innovation Management Modena
Innovation Management Lund
Systems Engineering

Appendix III: Lists of interviews

Pre-study

Date	Interviewee
4 February 2015	Leader Innovation Capabilities, FEI
5 February 2015	Manager, Technology Strategic Planning, PT
5 February 2015	Project leader, FEI
5 February 2015	Portfolio Management, FEI
6 February 2015	The Director, FEI
6 February 2015	Manager, Advanced Concepts, FEI
6 February 2015	Manager, Systems Engineering, FEI
6 February 2015	Director, DSO Strategic Planning

Main-study

Date	Interviewee	Expertise area
16 March 2015	Portfolio Management, FEI	Strategy expert
16 March 2015	Manager, Advanced Concepts, FEI	Strategy expert
16 March 2015	Leader Innovation Capabilities, FEI	Strategy expert
18 March 2015	Venture leader, FEI	Venture leader
18 March 2015	Innovation business developer	Market expert
~~19 March 2015~~	~~Project leader~~	~~Venture leader~~
20 March 2015	Manager, Systems Engineering, FEI	Technical expert
23 March 2015	Director, FEI	The Director
24 March 2015	Development Engineer	Technical expert
24 March 2015	Venture leader, FEI	Venture leader

Appendix IV: Mapping and coding

The mapping and coding was the first two steps of the analysis process, see Figure 2. The mapping and coding aim to help the authors understand how the empirical data is related to the theoretical framework in Table 1. Going through the empirical data, key points were mapped depending on which one of the five areas in the theoretical framework it belonged to. Based on the first division of the mapped data, the data was coded based which individual said what, as well as the different levels in the theoretical framework. The different levels in the theoretical framework are if the finding indicated *front end theory* or if it indicated *the environment surrounding the subjective*. While doing the coding the authors found that not everything identified from the interviews were described in the literature chapter. Therefore, some of the findings were at first declared as *Not clear*. After complementing the literature chapter it became possible to code all findings that had been unclear. All the findings were then analysed in Chapter 6 based on if the findings indicate the same thing and/or in-line with theory or if they were contradicting.

What the coding of data looks like is illustrated in this appendix. By looking at the different tables the reader can understand what findings that matched a certain area of the theoretical framework, belonged to a certain individual and if the finding indicated front end theory, the environment surrounding the subjective or were at the first check not clear to the authors. The order of the tables is Market experts, Venture leaders, Strategy experts, Technical experts and the Director. Some of the tables were too big to fit on one page and were therefore divided into the three areas of findings, front end theory, the environment surrounding the subjective and not clear.

Market expert mapping: Showing all the findings from each category; front end theory, the environment surrounding the subjective and findings that were unclear to the authors.

Findings	The process	Uncertainty	Decisions	Leadership	Teams
Indicate front end theory	No clear documentation or controll of venture progress when talking about market uncertainty.	By building a story around the venture and backing it up with facts, knowledge about the venture will increase. There has to be a logic behind the venture and confim market uncertainty.	The information flows from FEI up towards higher management, through innovation forum and governance teams. The flow consists of limited but relevant information compared to the information available in the venture team.	The governance teams have more of a guiding character, than a controlling one	
		1. How large is the market? 2. Which barriers need to be overcome in order for the venture to work?			
Indicate the environment surrounding the subjective	Not enough research regarding market barriers	Reaching incubation creates real opportunity to test market uncertainty.			
Not clear	They value learning and will in some cases see a point in spending more money on a venture if it will generate a lot of learning.	Measurement is not done in a certain way, different questions are asked between projects to understand what is needed for a certain idea.	If it is an unattractive venture for Tetra Pak, it does not matter if it would be attractive for the customer.		To work with market uncertainty, employees need common sense, understanding of some theories, the ability to question assumptions and facts, and to understand the relationships between things.
	In the beginning of a venture or activity, it is often easier to iterate. The more resources that have been put into the venture, the harder it is to iterate.	Market uncertainty is lowered by testing hypothesis on other things than the actual venture.	To some extent a market expert can base decision on an intuition		
		If you have done anything similar before, the market uncertainty is lower.	To some extent FEI need to market their ideas to external actors.		Intuition needs to be based on relevant experience.

Venture leaders mapping: Showing the findings indicating front end theory, and findings that indicate the environment surrounding the subjective.

Venture leaders

Findings	The process	Uncertainty	Decisions	Leadership	Teams
Indicating front end theory	Agile and Dynamic process. The work includes using iterations and loops and the venture leaders see a value in the learning achieved through this way of working.	The uncertainty of a venture is reduced and measured by working towards increasing the understanding of the uncertainty.	It is not rare that ventures do things on their own mandate, and communicate it outside of the venture after it is done	Alignment, support and guidance are perceived as important parts of the supervision. Not require active supervision.	Venture leaders to get more guidance and competence from people that are not a part of the venture team's daily
	The measurement is done in different ways depending on the venture.	Not using a specified risk list		The venture leader will also have regular contact with the sponsor of the venture or the management of FEI.	The ventures depend on different actors outside of FEI.
	The ventures do not have any fixed toll-gates but create their own deadlines, by which the progress can be measured.			More often traditional governance might show some resistance against FEI's way of working.	Every second week the ventures at FEI have a meeting, during which the ventures get the chance to update each other and the rest of FEI regarding the status of the venture.
	The goal is to try and understand the opportunity, in terms of business value and technical feasibility.			*FEI awareness:* The venture would like to have more of a cross-functional management that is watching over them.	
	What is specified for the product in the beginning of a venture varies, sometimes the technology might be developed and sometimes market knowledge might exist.				
	The goal for a venture is clear from the start, it is to take the venture to incubation in order to test it in reality and get a real answer.				
	The process	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Indicating the environment surrounding the subjective				Today a lot of guidance comes from directions given by the FEI management.	There is no scheduled time for idea generation but within the ventures the team get the
				are indications that additional confidence should be given to the ventures to do things on	opportunity to work with new ideas connected to the concept.

Venture leaders mapping continues: Showing findings that were unclear to the authors.

Venture leaders					
	The process	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Not clear	The ventures at FEI are all measured on their progress.	Mapping uncertainties against each other and testing different scenarios.		*Stuck in the old enviroment:* venture leaders wish financing decisions would be faster and that decision makers would sometimes trust their intuition more and allow themselves to take	People from outside of FEI working in ventures seem to enjoy the different way of working.
	Trade-off between daring to take risks in ventures and continue developing concepts, and identifying when risks have become too big or when the venture is no longer attractive				
	Maybe Indicate control: venture leader and Ulf Palmblad, who is responsible for the financials, will contact each other for check ups regarding costs and budget.	Both business value scenarios as well as technical scenarios need to be tested.		*Maybe front end indications*: venture leaders need to have a wider focus when working at FEI.	
	Venture sometimes will get evaluated depending on the result in the TD.				
	The preference to get the mandate to internally, within the venture, measure the progress, was expressed.				
	One way to describe the difference between pre-venture activities and ventures is as a difference in scope. Before a venture is created, the scope is wider and nothing is eliminated.				

Strategy experts mapping: Showing findings that indicate front end theory.

Strategy experts

Findings	The process	Uncertainty	Decisions	Leadership	Teams
Indicating front end theory	Focus lies is to understand business potential and not reaching a specific goal.	Not enough knowledge has been created to handle prioritising between ventures of different age/maturity.	*Check theory:* Reprioritisation continously. Look at attractivness and feasibility.	Vague monitoring.	Meetings every 2 weeks to endorse engagement and cross-venture learning.
	Progress is seen in the learning process.			Director is engaged in	People who has worked in regular projects experience som difficulties at FEI.
	Iterations is often done in the exploratory phase.	Teams work to find evidence for if an opportunity is feasible, hast strategic value and has market potential.	It is hard to prioritise between ventures of different age/maturity.	Monitoring is done to create understanding and enable support	
	Venture leaders need to take a bigger responsibility to follow up on how the venture is doing, than regular project leaders do.		Each venture has to give recommendation on risk, problems and opportunity but also understand business value, market and tech opportunity.	Involving traditional governances in FEI work is hard, they have to finance learning instead of a checklist.	
	Small changes back and forward to increase learning.				
	venture moves forward by focusing on the next step in learning process.		IF makes few decisions without aligning with venture leader.		
	Up to ech venture how to proceed.				

Strategy Experts mapping continues: Showing findings that indicate the environment surrounding the subjective

Strategy experts					
Findings	**The process**	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Indicating the environment surrounding the subjective			Ventures are monitored to enable go/kill decisions.	Governance can create demands to make sure that things such as cost is equivalent to the learning process.	
				It is important that top management whatch over prioritised ventures, which is not done today.	
				The more radical a concept is, the harder it is to convince management.	

Strategy experts mapping continues: Showing findings that are unclear to the authors.

Strategy experts					
Findings	**The process**	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Not clear	Pivoting is not done. Do not see the process as linear, uses phases for communication with the rest of the company. Discovery can be done parallel with incubation.	Incubation is the best way to measure and understand a business case.	When prioritising Use 1. Business potential. 2. Probability to succ. 3. Risks.		Also monitoring so cross-venture learning takes place.
	The concept should stay the same from the beginning of a venture until incubation.	Trying to push intuition into quantifyable metrics can create false grounds for discussions.	The degree of maturity an idea has varies, which enables to opportunistic behaviour.		
	The learning process can be measured on four dimensions (tech, mark, org, resources) but it is not.				
	The time it takes for a concept to become a venture varies (1 month to 6 month) depending on if it is hard to clarify and budget limitations.				
	In the beginning target based on hypothetical problem and solution.				

Technical experts mapping: Showing findings that indicate front end theory.

Technical experts

Findings	The process	Uncertainty	Decisions	Leadership	Teams
Indicating front end theory	The venture process is more dynamic.	Uncertainty is harder to estimate in the beginning.	Venture team needs to be more autonomous in their daily work and make their own decisions. When it comes to higher decisions (go/kill) management should step in, not before that because the team has all the knowledge.		Knowledge creation can be done with development partners and supplier
	Learning process	Handle by increasing technical knowledge through a learning process.			
	Focus on the learning process in the beginning and technical requriements later on				
	No tollgates, it is hard to set requirements for something that do not exist.	Dynamic discussion about uncertainty is important.			
	Both: Technical requirements used to specify the goal.				
	Problems with the line organisation often occur during the planning of the venture (long term for line, ad hoc for FEI)				

Technical experts mapping continues: Showing the findings that indicate the environment surrounding the subjective and the findings that were unclear to the authors.

Technical experts					
Findings	**The process**	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Findings that indicate the environment surrounding the subjective	They think a linear process can be beneficial for the start in technology development. Want to reduce the risk of getting stuck in loops and iterations in the beginning.		Outsorcing technical development to TD.	Feel the need to use some kind of PMI but understand that it does not work for FEI.	Including people that are used to working in TDs, can ease the progress of the venture.
	Use a systems perspective to work with risk and uncertainties.				
Findings	**The process**	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Not clear	Iterate unknown unknowns (common in the beginning) more.	Complexity by different component dependencies.	Intuition is used for external decisions (supplier etc)	A governance team monitor the venture.	Divided opinions regarding if TD is an integraded part.
	The goal is incubation.	Use a systems perspective to work with risk and uncertainties.		Innovation forum looks at cost calculations and current problems. Some fnd that risk is not the focus.	
	Visualistion is made diffecult because of the complexity of many components. Could be done by having system perspective of risk.				
	Risk needs to be taken more seriously.				
	Technical learning is not monitored as much as business and commercial learning.				

The directors mapping: Showing all the findings from each category, front end theory, the environment surrounding the subjective and unclear findings.

The Director

Findings	The process	Uncertainty	Decisions	Leadership	Teams
Indicating front end theory	If a new idea is discovered in a focus area, it should be presented during innovation forum meetings.		Innovation Forum has a strategic role and does not have a formal decision making role.	It is the director's task to spread knowledge about FEI's ventures outside of FEI. He works to make sure that decisions are taken regarding ventures and that the ventures get the support they need from outside of FEI.	The management experience within innovation forum can contribute with experience, technical skills, deep company knowledge and contacts.
			It is Innovation forum's responsibility to make sure activities are started and stopped. (Go/kill belsut)		
Findings	**The process**	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Indicating the environment surrounding the subjective					
Findings	**The process**	**Uncertainty**	**Decisions**	**Leadership**	**Teams**
Not clear		Mikaelsson says that it is important for FEI to not view everything as risks that needs to be reduced, but to work on maximising the learning in as many uncertain areas as possible.	In order for an idea to be interesting, there needs to be a large enough market for it. Even if the profitability is satisfactory, an idea will not be pursued if the potential market size is not satisfactory.		Collaboration is important within innovation forum, ventures and FEI.