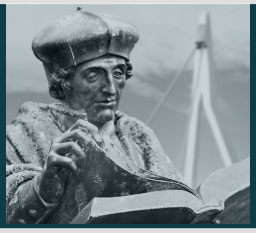

Do Different Product Strategies Require Different Innovative Capabilities?

An Exploratory Case Study

By Justin Zeilstra

ERASMUS UNIVERSITEIT ROTTERDAM

"To develop working ideas efficiently, I try to fail as fast as I can."

Richard Feynman, Nobel prize winner in Physics

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An Exploratory Case Study

Erasmus University Rotterdam
School of Economics
Economics & Business
Master Entrepreneurship, Strategy and Organization Economics

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Preface

This thesis is the final assignment for my master 'Entrepreneurship, Strategy, and Organization' at the Erasmus University in Rotterdam. After more than a year it is finally done. It has been a long and difficult process yet educational and fulfilling.

The topic of innovation was chosen because of its importance to society. Michael Porter once said that *"innovation is the central issue in economic prosperity"*. Although the topic was chosen well before the current economic crisis, it is even more important today than it was when the topic was chosen. Companies should invest in their innovation capabilities. But what does this mean? This is what is discussed in this thesis.

I would like to use this opportunity to thank a few people who helped and supported me during the writing of this thesis. First of all, I would like to thank my parents for their support. During the writing of this thesis we went through some difficult times but I am grateful that my mom is still with us today to witness this moment. I would like to thank my dad and my sister for reviewing my work. Secondly, I want to thank everyone who participated in the interviews for this research and last but not least, I would like to thank Dr. Gosselink for the time and support he gave in order to guide me to the final product that is in front of you. I hope you enjoy reading it.

Justin Zeilstra
Numansdorp, May 2009

Executive summary

This research examines whether product strategies require different innovative capabilities during the first phase of the new product development process. This was formulated in the following research question: *Do different product innovation strategies require different innovation capabilities during the search phase of the product development process?* To answer this research question the available literature was reviewed and empirically cases were examined.

The literature review starts with a review of the various product development models. There are a variety of models but almost all recognize the importance of the idea generation phase as a front-end homework activity before starting up actual product development. During this idea generation phase there are various sources of information for ideas that can come from both in or outside of the organization. Literature also provides techniques to stimulate idea generation such as brainstorming, attribute list, morphological analysis, and scenario analysis. To be able to generate ideas successfully certain innovative capabilities are required. A model developed by de Jong and Brouwer (1999) was selected and seven general dimensions (People, Culture, Structure, Strategy, Networks, Available means, and Company characteristics) are discussed in detail, since each dimension contains a range of capabilities required to be successful in increasing the idea generation power of a company. More importantly, these seven dimensions can also influence each other when factors within these dimensions change. Product strategies are also reviewed. There are numerous product strategies applicable in the marketplace. However, for the relevance of this research (the focus on idea generation) it can be concluded that most product development strategies tend to have either a market or a technology driven orientation. Accordingly, it is possible to categorize the variety of applied product strategies within these two strategic directions. Literature shows that different core capabilities are needed during the idea generation phase when following a market or technology driven strategy. When following a market-driven strategy (the Listener) the focal point of ideas are customers which means that the focus lies on marketing capabilities to be able to gather information from and about customers. On the contrary, following a R&D driven strategy (technology driver) the focus is on developing new technologies and capitalize on their own technical capabilities for new ideas. At the same time it is evident that there is no standard list of 'magic' capabilities appropriate for every organization.
To add to the literature review, two case studies were performed. The most important findings were that in a business-to-business environment the product development is strongly customer driven, the innovations were mostly incremental and that a company's position in the value chain within an industry is an important factor for the strategic direction.

From a theoretical perspective a positive answer can be given to the main research question by showing that a market-driven Listener strategy requires different capabilities during the idea generation phase than an R&D driven technology driver strategy. Based on this conclusion together with the other findings from the literature and the case studies, it was possible to develop a new diagnostic tool for SMEs.

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1 Introduction

1.1 Innovation in perspective

The ability to produce new innovations is very important. It is often referred to as “the lifeblood” of small start-ups (Acs and Audretsch, 1990) and is a key factor for companies to survive and grow in the long run (Tidd et al, 2005). By bringing a new or greatly improved product to the market, for an undetermined period of time, that company will have something unique on the market and can give them a competitive advantage (Dosi, 1988). However, due to rapidly changing technological developments, the legal protection mechanisms are not enough for some products to prevent competitors from copying it and launching a similar product. This emerging threat has drastically increased the speed of new product development. Products that used to have life cycles of a year or more, now have product life cycles of only a few months (Assink, 2006). In order for companies to keep up with this changing business environment, they need to be able to create a permanent and stable stream of new products or services. This is why companies need to innovate. Without it, they fail to exist (Freeman and Soete, 1997).

Product innovation is not something that just happens. It is a process that consists of various stages. There are different variations to this process but in general it consists of a search phase, a development phase and an implementation phase. A fundamental problem is that small businesses do not seem to have enough knowledge about this process. While multinationals have the means to invest in special R&D departments and are creating there own sets of relations with the academic world to obtain the necessary knowledge, small and medium sized enterprises (SMEs) still lack this knowledge because they are simply to busy running their daily businesses. As a consequence, they completely overlook the changes in their environment and fail to innovate (Buijs, 1987).

An example of a company that did not keep up with their changing environment was Van Berkel’s patent. In 1898, Wilhelm van Berkel, son of a butcher with a passion for technics, founded Van Berkel’s patent. This was a Dutch company well known for manufacturing weighing and meat cutting machines. These machines were a great success and the company grew and ventured into new overseas markets. When the first digital weighing machines showed up in Japan, Van Berkel’s patent was not worried because it assumed its product was superior. However, when these digital weighing machines were further developed and became more accurate, cheaper and a success, Van Berkel’s patent did not have an answer to this digital product. It did not have the skills to manufacture a digital weighing device which eventually led to the company being taken over.

This example shows that product development needs to be a constant process. Too many organizations ‘go to sleep’ after one or two hits. A key factor is that companies need to secure their continuity in changing environments by making profits but not just by milking the cash cow until it is a dog. The business needs to have a process in place that results into a continuous and repeatable business practice. This process must do more than just create new concepts. It must also ensure the

successful introduction of new products. The competitive advantage is not the new or improved product itself but the innovative ability of the company. Here innovative ability can be described as the ability to turn new ideas into products or services.

From research it is known that there are different dimensions of innovative ability: people, strategy, culture, structure, availability of means, networks and company characteristics (de Jong and Brouwer, 1999). For each of these dimensions, there are certain factors that can lead to success. These critical success factors form the innovative capability of the organization.

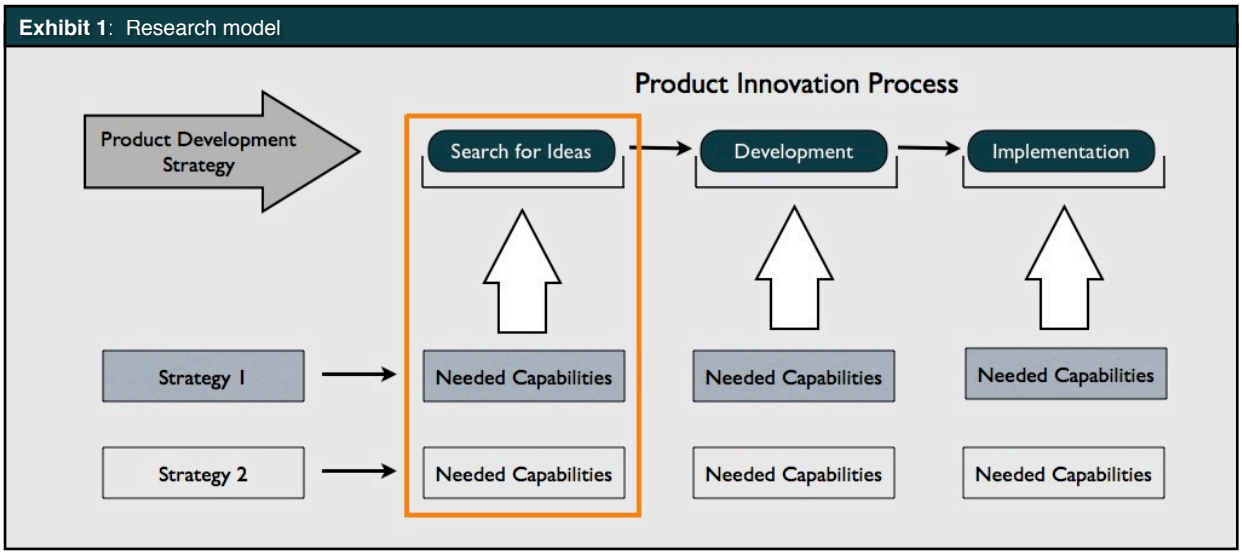
Although most companies acknowledge innovation as being important, fact of the matter is that only few companies actually have a dedicated innovation strategy as part of their overall strategy. A balanced innovation strategy shows commitment to the innovation activities (Gosselink, 1996) and the innovation ambition of the organization. It offers the possibility for employees to actively participate in the innovation process. With a clear innovation strategy, companies are able to guard the coherence between different innovation initiatives, which lead them to optimally use their innovation capabilities.

1.2 Research problem

As was mentioned in the previous paragraph, it is believed that companies must constantly develop new products to be able to compete in changing environments. They must develop a permanent and stable stream of new products. Developing new products is a process that consists of various stages and each stage requires its own set of capabilities.

It is thought that when a company chooses a certain product innovation strategy, that this will require a different set of innovative capabilities compared to another kind of product innovation strategy. The objective of this study is to link certain innovation capabilities to different product innovation strategies. This concept is illustrated in exhibit 1.

Exhibit 1: Research model



Source: the author

This thesis will limit its focus to the search phase of the product innovation process, as reflected in the following problem statement: *different product innovation strategies require different innovation capabilities during the search phase of the product innovation process*. The Search phase is also known as the idea generation phase.

1.3 Research goal and questions

The model that was presented in the preceding section leads to the following goal: to create a diagnostic tool which can identify which innovative capabilities are needed during the search phase of the product development process when choosing a certain product innovation strategy. This tool will be especially valuable for management of SMEs who want to know which innovation capabilities are available in their companies and how they should be used to get the most out of them in an optimal way.

In order to achieve this goal, research is conducted by the use of the following research question:

> *Do different product innovation strategies require different innovation capabilities during the search phase of the product development process?*

Theoretical sub questions are formulated that form a guide to answering the research question.

- *What are the stages of the product development process?*
- *Where do ideas come from and how can they be generated ?*
- *Which innovative capabilities are needed during the idea generation phase?*
- *What are the main new product development strategies?*
- *Which innovative capabilities are needed during the idea generation phase of the product development process when using a certain product innovation strategy?*

Empirically it will be explored by analyzing two SMEs by using case studies.

1.4 Research structure

This thesis is dividend into two parts. The first part consists of a literature review. The second part of empirical research. The literature review provides an overview of previous studies dealing with the topics. The sub-questions that were formulated in the previous section will form the basis for this literature review. The empirical research is aimed at finding information that can provide further insight into the use on innovative capabilities per product strategy. The research is of qualitative nature, consisting of open structured interviews. Companies from the machine/ equipment building industry were used. The respondents were the general manager, director of R&D, and the director of marketing/ sales.

1.5 Key definitions

Innovation

There are various definitions for the term 'innovation'. It is a widely used term but can mean different things to different people. In this thesis innovation is defined as *'the successful exploitation of new ideas'* (innovation unit ,UK Department of Trade and Industry 2009).

According to Kumar and Phrommathed (2005) innovation consists of more than just basic and applied research. An idea must pass through product development, manufacturing, marketing, distribution, servicing, and later product adaptation and upgrading to be considered an innovation. If an idea does not become a product, it is not an innovation but remains an invention.

Innovation can roughly be divided into two categories: technological and non-technological innovation. Traditionally, innovation has been seen from a technological point of view in the form of product innovation (what product is a company making?) and process innovation (how is it being made?). Non-technological innovations are focused on organizational innovation and marketing innovation.

Another distinction can be made based on the degree of the innovation. Some innovations are so dramatic in their scope that they bring fundamental change to the market. Others offer only a minor improvement and are hardly seen as change. We speak of radical innovation when it concerns something totally new to the world. If a product, service or process is only improved we speak of a incremental innovation (Kumar and Phrommathed, 2005). Koen and Kleinschmidt (2009) divide incremental into: (1) Cost reductions and repositioning, (2) Improvements/ revisions to existing products, (3) Additions to exiting product lines. They divide radical into: (4) New product lines for existing markets and technology known to the organization, (5) New product lines for new markets and new technology to the organization, and (6) New to the world.

In this study, the focus will be on product innovation which can be radical or incremental. The following definition will be used:

Product innovation: a successful market introduction of a new or greatly improved product or service.

Innovative ability

3M's vice president once said: "A creative thought is not worth anything unless you can translate that into something useful for the company". Creativity is seen as a company's ability to create new ideas no matter if the ideas are turned into successful products (Kumar and Phrommathed, 2005). De Jong and Brouwer (1999) provide the following definition of innovative ability *"Innovative ability is a necessary condition for an organization to have a permanent flow of innovations. It is the ability of the entrepreneur and his employees to generate ideas and develop and successfully implement these ideas into new or improved products, services, technologies, work processes or*

market conditions" (de Jong and Brouwer, 1999). A company can be creative but not innovative if it does not turn the ideas into commercial products.

1.6 Relevance of the research

The relevance of this research can be seen as both scientific and practical. From a scientific point of view it is relevant because this research attempts to link product innovation strategies to innovation capabilities per stage of the new product development process. By themselves these three subjects have been researched extensively. Literature exists on the determinants of innovative ability (de Jong and Brouwers, 1999) and about developing the innovation capabilities within SMEs (Lawson and Samson, 2001). A great deal has also been written about the process of new product development (Booz, Allen and Hamilton, 1982; Wheelwright and Clark, 1992; Cooper, 2006). Some have looked at the complete process, while others choose a specific part (McCarthy et al., 2006; Tidd et al., 2005). By combining these subjects, the research attempts to make a modest contribution towards the product innovation literature.

The practical relevance of this study is, that for organizations it is important to keep ahead of their competitors and, as stated earlier, innovation is a key factor to business success. It is therefore thought that management is highly interested in learning about those capabilities per product innovation strategy which might impact the success of new product development. In particular the results can be used by management of SMEs who want to start exploring the potential of the innovation capabilities in their companies. As a result they can then improve their new product development activities by using the right set of capabilities per chosen product innovation strategy in an effective and efficient way.

1.7 Structure of the thesis

The structure of the paper is as follows. This first chapter was an introduction. It briefly described the need for innovation in todays business practice and the research goal and questions were formulated. In chapter two the first theoretical sub question *what are the stages of the product development process?* will be discussed. In the following chapter a thorough description will be given of the idea generation phase and the second sub question *Where do ideas come from and how can they be generated ?* will be answered. This chapter will be followed by providing an answer to the sub question *Which innovative capabilities are needed during the idea generation phase?* in chapter four. Chapter five will provide different product innovation strategies which answers the sub question *What are the main new product development strategies?* All of previous sub questions will come together in chapter six when the sub question *Which innovative capabilities are needed during the idea generation phase of the product development process when using a product innovation strategy?* will be discussed. Chapter seven presents the methodological framework for the case studies. This chapter contains the research design and data collection method. In chapter eight, the findings of two case studies will be discussed. This will be followed by the conclusion.

2 Product innovation process

2.1 Introduction

When looking back over the last 20 to 30 years, one can think of many well known successful innovations. One of the most successful innovations was Sony's Walkman. The Walkman started out as an idea which was: portable music entertainment. This idea could have been transformed into a product in various ways such as a backpack style player with headphones or a larger headset with a tape mechanism inside. These products would have covered the idea but these products would probably not have had the same kind of success as the launched Walkman. Fact of the matter is that a good idea is not automatically a good product. The idea needs to be turned into a physical product that has the intended features and functionalities and customers find worthwhile and are willing to buy. This challenge requires that the idea be further developed which will ensure that it is possible to make and that it is affordable, reliable and attractive for customers (Hart, 2002). These activities of developing a new product can essentially be seen as the product innovation process or the new product development process (NPD). In this chapter various process models will be discussed which will lead to an answer for the subquestion: *What are the stages of the product development process?*

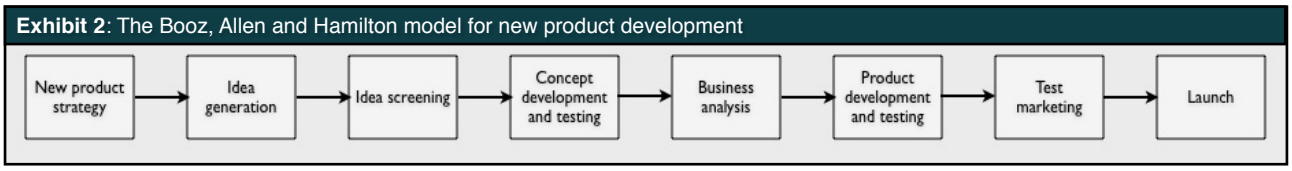
2.2 New product development process

The literature on innovation is vast and wide-ranging and is constantly growing (McCarthy et al., 2006). One aspect of this research has been new product development. This activity is usually described as the complete process of bringing a new product to the market. In 2000, using a sample of UK firms, Tzokas (2000) found that 98 per cent of the companies had some kind of process in place for developing new products. Several authors have developed models to define this process of which a simplified description will be given.

Booz, Allen and Hamilton

Booz, Allen and Hamilton (1982) developed a NPD model that is widely recognized and is still connected to successful innovations (Griffin, 1997; Tzokas, 2000). This model starts with the generation of new ideas which is followed by making a rough selection of the ideas with which the company wants to proceed. During the next phase, the idea needs to be further analyzed and turned into a concept. It must be checked if the concept is viable in terms of marketing and costs. If the commercial evaluation is positive, the idea moves to the next phase which is the technical development phase. This is where the idea turns into a product by building a prototype and subsequently the prototype is tested by a select group of people. Using feedback from the testing phase the prototype is made into a final version. And finally the product is introduced to the market. This model is illustrated below in exhibit 2.

Exhibit 2: The Booz, Allen and Hamilton model for new product development

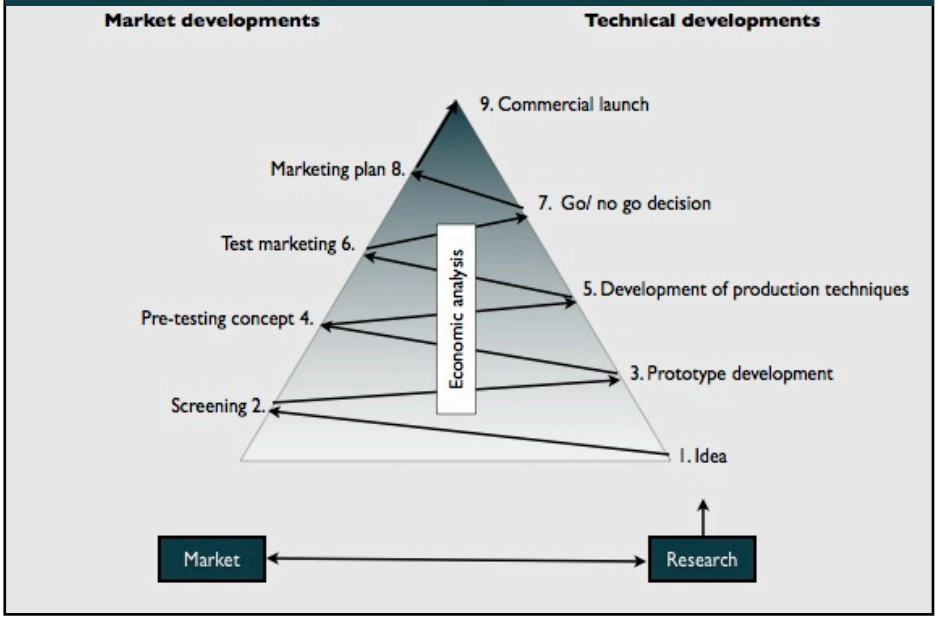


Source: Booz, Allen and Hamilton (1982)

Rewoldt, Scott and Warshaw

Rewoldt, Scott and Warshaw present a somewhat different visualization of the product development process (exhibit 3). Again, different stages have been identified: idea creation, screening, prototype development, concept pre-testing using prototype, developing production techniques, test marketing, go/no go decision, and if positive followed by the commercial launch. The core theme of their model is that there is a need to align market developments and technological developments under the constant oversight of economic analysis (Boekema et al., 1995).

Exhibit 3: Product development process according to Rewoldt, Scott and Warshaw



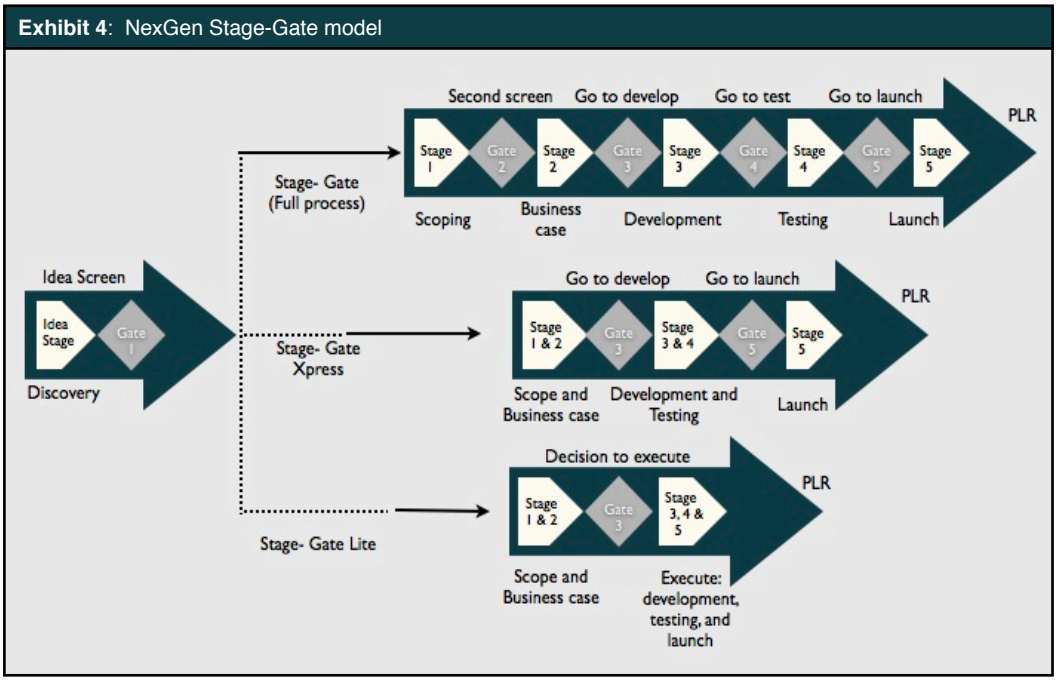
Source: Boekema et al. (1995)

Stage-Gate model

Another model was developed by Cooper (1988) which he named the Stage-Gate model. This model divides the innovation process into five stages. In each stage a certain set of actions are performed by a project team to guide the project effectively and efficiently to the next stage. The stages are 1. Scoping; 2. Business case; 3. Development; 4. Testing; 5. Launch. These stages are preceded by an idea generation phase also known as the discovery stage. Before each stage there is a gate. These gates are for management decision points to continue with or to terminate the project. Each gate has criteria which have to be met in order to be able to continue with the project. These gates also form the point where the project team secures its new resources for the next stage. Throughout the years, Cooper (2006) has further developed this model into the NexGen Stage gate model and made it scalable. This model has now changed into three process dimensions namely: Stage-gate xpres, Stage-gate Lite and Stage-gate TD. Stage-gate xpres is used for projects dealing

with improvements, modifications and extensions. Stage-gate Lite is used for small projects, such as simple requests from customers and the Stage-gate TD model is used for projects dealing with technological development. Stage-gate TD is the full process described earlier (exhibit 4).

Exhibit 4: NexGen Stage-Gate model



Source: Cooper (2006)

However, using these processes is not enough. Cooper (2006) also said that in order to maximize productivity in product innovation, companies need to follow seven principles. These principles are being customer focussed, heavy front end homework before actual development begins, loops with users throughout development, cross functional teams, accountability, portfolio management and scalable and adaptable processes. Some of these principles will be further discussed in chapter four.

Kuczmarski

Kuczmarski (1992) describes a ten step process. He states that this process offers a logical, systematic, and well tested approach to taking a set of needs and wants and generating ideas from them which will eventually evolve into new products. This process starts by exploring the needs and wants of each customer and identifying customer problems. This forms the basis for the idea generation phase. Next, the ideas that pass through the initial screening need to be turned into a concept and the concept needs to be analyzed from a business perspective. This is followed by the actual building of a prototype and the manufacturing setup is tested. After this follows a test marketing phase and the final introduction. Step ten consists of a post launch check up.

Robert

According to Robert (1995) change is the raw material of the product innovation process. This process has four stages: search, assessment, development, and pursuit. The search and assessment stages are about being able to spot opportunities and ranking these opportunities in terms of their potential. Development is about innovative companies being able to foresee critical factors that will lead to the success or failure of the opportunity. And finally, the pursuit stage is about being able to

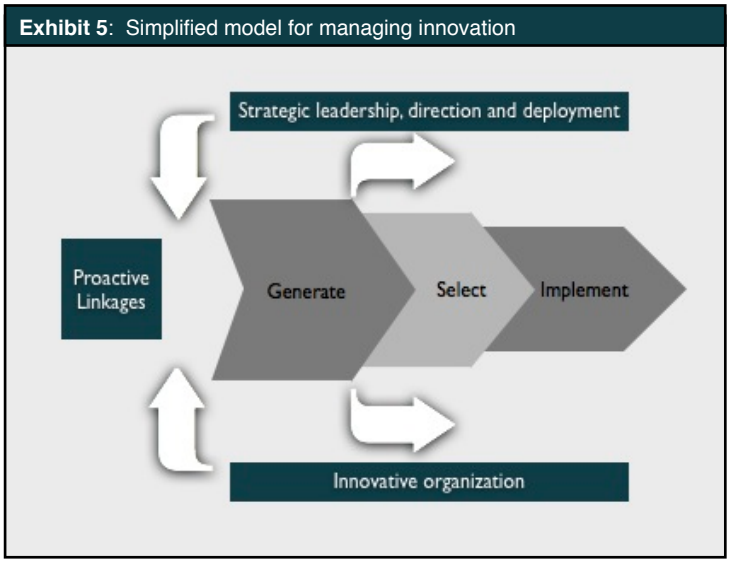
develop an implementation plan that leads to success and avoids failure. He states that this process can be used to move assets and resources to higher yields and higher productivity levels.

Other authors just describe an innovation process rather than focussing on NPD process.

Bessant and Tidd

Bessant and Tidd (2008) provide a model that views innovation as a core process that runs through the organization which is associated with renewal (exhibit 5).

Exhibit 5: Simplified model for managing innovation



Source: Bessant and Tidd (2008)

This process starts by scanning the internal and external environment to pick up on signals about potential innovations. This step is followed by strategically selecting from this set of potential innovations. The challenge lies in selecting the best option which will make the most use of the available resources. This is followed by implementing the innovation. This is done by growing it from an idea to a product using various stages of product development (outline concept, detailed design, testing, and launch).

Like Cooper's (2006) seven principles, Bessant and Tidd (2008) also say that this process needs to be supported by clear strategic leadership and direction but also by the commitment to provide the resources to make it happen. These resources can either be developed in house or can be acquired via a technology transfer of some kind. There also needs to be a structure and culture to support innovation. And finally they say that proactive links across boundaries need to be supported.

2.3 Usefulness of these models

The described models show that all of these models are basically the same. Some are more detailed than others but basically all describe a path from an idea through product development to the final market introduction of a new product. However, in practice this simplified linear process will be somewhat more complex (Buijs, 2008). Nonetheless, the usefulness of these process models lies in the way in which they provide an indication of the total number of activities that might be required

in order to develop and launch a new product (Hart, 2002). For a description of these activities see Buijs (2008). Bessant and Tidd (2008) acknowledge that their model is not as complex as reality but say that by simplifying the picture into clear stages it will be easier to manage the process successfully. Kuczmarski (1992) says that systematic process provides a thinking and action framework for transforming ideas into products and that using the same process uniformly produce the best results.

Various studies have looked at the use of these models within companies. Tzokas (2000) found that the better performing companies, on average followed more steps of the process. This was backed up by Riek (2001) who said that skipping development steps to be faster to the market is stepping on to the road to disaster. Cooper, Edgett and Kleinschmidt (2004) also found that the chances of success were greater if all the steps were followed. However, each step does add development time and can lead to a later market introduction. As a result, a trade-off might be necessary between following all the development steps and the time it takes to complete these steps.

2.4 Conclusion

This chapter set out to answer the sub question *What are the stages of the product development process?* It was shown that some authors describe an innovation process while others describe a product development process. The innovation process consists of an *idea generating phase, a selecting phase* and *an implementation phase*. It should be noted that during the implementation phase ideas will be transferred into products via a product development process. The new product development processes describe the stages for developing a new product. Booz, Allen and Hamilton (1982) divided this process into *idea generation, screening, concept development, business analysis, product development, test marketing,* and *finally launch*. Cooper (2006) used this model to create his NexGen stage gate model. A discovery stage in which ideas are generated is needed after which the ideas are entered into the Stage gate model. This model consists of scoping, business case, development, testing, and launch. Cooper built check/decision points into his model which he called gates, which were located before each stage.

It can be concluded that there is a variety of models dealing with the development of new products. Although, there is no single process suited for every company, there are common elements that can be used to support a company with setting up a specific new product development process. One common element is that all models recognize the importance of the idea generation/ discovery phase. It is also a given fact that innovations are fueled by ideas. It is clear that having a better understanding of the activities within this phase and managing these activities effectively could lead to a competitive advantage. Cooper, Edgett and Kleinschmidt (2004) found that the better performing product innovators pay more attention to this early stage. This is why the decision has been made not to choose a specific model but to focus on this phase of generating ideas which will be further discussed in the next chapter.

3 Idea generating phase

3.1 Introduction

In the previous chapter the process for new product development was discussed. In this chapter a more in depth analysis will be given of the idea generation phase. This first phase of the NPD process is all about creating a constant and stable stream of new ideas. Once a pool of ideas has been formed a selection process can begin to select those ideas that are most promising for further development (Baker and Hart, 2007). There is an article with the title '3000 raw ideas = 1 commercial success' (Stevens and Burley, 1997). The meaning of this title is self-explanatory. This article shows that a lot of ideas are needed in order to have the possibility of success. This chapter will deal with the subquestion *Where do ideas come from and how can they be generated?* I will look at the different sources of ideas, where the opportunities lie, and how the generation of ideas can be stimulated.

3.2 Sources of ideas

There are various sources of information for new ideas which can come from both in- and outside of the organization. The task for the organization searching for ideas is to identify these sources and organize them in such a way that the flow of new ideas reaches the people faced with the task of developing them into new products.

3.2.1 Internal sources

Employees are in potential a very important source of ideas within an organization, most often in technical, marketing, or service positions. It is important to incorporate their knowledge and suggestions into the search phase.

Technical positions

In house R&D is a source of ideas for many companies. Researchers are hired to develop, improve or integrate technologies for new products. However, large scale R&D is usually something only large organization can afford. It often requires large investments and still the chances of success are slim. These researchers can also be part of an engineering or design unit or work within a more general department. The main function of those individuals is to start the ball rolling and develop new products (Baker and Hart, 2007).

Marketing and sales positions

One of the tasks of a marketing department is constantly monitoring market developments. Identifying new trends within the market can potentially lead to new product ideas. Another task is dealing with the customers, who are a very important source of ideas especially when it comes to product improvements (Baker and Hart, 2007).

Customer and technical services

When a customer has a problem with the product, they often need help from customer services or a technical help desk. The employees that work in these departments have a lot of user experience with the actual product. This makes them a potential source of ideas because they can identify possible problems or opportunities which might be solved or exploited by new or modified products (Baker and Hart, 2007).

3.2.2 External sources

Ideas can come from inside the organization but they can also come from outside the organization. Research has shown that companies with an external orientation are more likely to innovate (Cooper and Kleinschmidt, 1995). By bringing other stakeholders into the process, it can provide new insights which were not available before.

Customers, suppliers and distributors

Customers are an enormous source of ideas when it comes to product improvement but also for future product development. Customers can inform the company about problems but also about features they might like (Heydebreck, 1997). This information can be used to fill in the product gaps (Baker and Hart, 2007). Other studies have found that using customers in the NPD process increases the success rates (Thomke and von Hippel, 2002). This was in line with Ottum and Moore (1997) who also found that the use of customer information leads to more product innovations. This can be done by using customer surveys, customer panels or other forms of contact with the customer.

In a study using a sample of 118 high-technology companies, Pavia (1991) found customers to be a rich source of new product ideas. Other research shows this especially to be true for companies in an industrial market. A summary of various studies showing that a significant number of new product ideas came from customers was provided by von Hippel (1978). Von Hippel (1988) also found lead users to be an excellent source of new product ideas. He states that lead users are innovative customers, who often experiment with or redesign existing products to meet their needs better. Cooper and Kleinschmidt (1993) found that on average, ideas that came from customers seemed to do better than internally generated ones.

Similar to this can be the contacts with suppliers and distributors who can provide new ideas. Bonaccorsi and Lipparini (1994), looked at the relationship between manufactures and suppliers throughout the entire NPD process. They found that during the idea generating phase, informal networking and formal requests for information did happen. From this they conclude that systematic links with suppliers are important. Bessant and Tidd (2008) also say that the link with suppliers an distributors is important because they can provide information about improving the process to reduce costs, increase quality or some other form of performance criteria.

Competitors

Ideas can also be generated by analyzing what competitors are doing in terms of products, product range, and services. An example of successful product development is Canon's entry into the copier market. They performed an extensive analysis of the office equipment market in the US and in Europe. Based on this information they developed a range of products that were cheaper, more reliable, easier to use and were distributed via a wide network of office equipment retailers. The major competitor, Xerox, relied on a direct sales force. So by looking at the competitor and the market, Canon developed and introduced a new range of products (Baker and Hart, 2007).

Reverse engineering a competitors product is another way to get ideas. It offers an insight into the competitors product and offers a way to gather knowledge but it does require certain amount of skill. Another point that needs to be kept in mind is that the product can be protected by patents or copyrights (Bessant and Tidd, 2008).

It is also possible to learn by making a comparison between different products made by different companies in the same or in a different sector. This can trigger new ideas which can be further explored.

Scientific/ technological world

Another important source of information is having access to the latest scientific knowledge which can be of great value to companies. By working closely with universities or other research institutes, companies gain insight into these developments which can lead to new ideas (Löfsten and Lindelöf, 2002). Chesbrough (2003) provides an example about one of Intel's contacts with universities. They fund a technology professor for a two year period before moving on to another professor. This way they get access to a widespread network of university research.

Some companies are now moving towards a more open form of innovation which means they work together with others, sharing the costs of development and the possible innovation outcomes. This can be done by forming a joint venture or a strategic R&D partnership which enables complex problems to be addressed. There is however, always a chance that the partnership fails. Research has also shown that technologists forming a network outside of their workspace can be a source of ideas (Bessant and Francis, 1999). The internet has become a powerful tool for making such connections. The organization can also form a network with other companies in which knowledge and information are shared. This way the technology can flow to more channels giving access to network members.

Companies can also gain ideas by studying other companies patents or by going through databases. Another way is through licensing. This provides fast access to knowledge but at a price. If the company has enough financial resources it can also opt to buy the technology or buy the entire organization which has the knowledge. Another option could be to contract the R&D out to a specialized research institute which also offers speed and focus. However, here the company has no

learning effect at all and there is a lack of control (Bessant and Tidd, 2008). It has also been shown that keeping up to date on research by scanning scientific journals, attending conferences and visiting trade shows can be beneficial to the generation of new ideas (Bessant, 1999).

3.3 Sources of opportunities

According to Drucker (1985) successful innovators are always looking for new opportunities. To be able to pick up on these opportunities it is essential to actively search and scan the environment for signals.

3.3.1 Exploring markets signals

According to Bessant and Tidd (2008) companies need to use market research tools to understand the shape, size and dynamics of the market. Changing industries or markets offer opportunities. This can be illustrated by using an example from the telecom industry. When the mobile phone was first introduced it was a specialist, high price business tool. Due to technological and cultural change this product became a commodity good and moved into the general marketplace. If one can foresee this change, it is possible to gain an advantage. However, exploring a market can be difficult if this market does not yet exist or if it suddenly changes direction. Companies need to be able to pick up on these changes but getting an insight into markets requires various forms of communication and interaction, such as monitoring customers, customer panels and surveys (Guiltinan and Paul, 1991). The mobile phone manufacturers looked at how children used there phones and used this information for further developing their products.

3.3.2 Exploring technology signals

Opportunities can arise in part from the continuing changes in technology which allow for the making of new products. There are various ways a company can get hold of new technologies. One way is developing them in house. Another is acquiring them from an external source. Rothwell (1992) has shown that those organizations that actively seek out links with possible suppliers of technology or information are more successful innovators.

There is also the interrelationship between technologies. This means that a technology can only become successful if first another technology is made available. An example of this is the jet engine which required better metal for the plane which meant advances in metallurgy. Another signal can come from trying to predict breakthroughs to which the company can react. This is difficult because some breakthroughs are the result of lab work while others happen accidentally such as the well known Post-it note (Baker and Hart, 2007).

3.3.3 Exploring the future signals

No one knows what the future will bring but that does not stop some from trying to forecast what might happen. This can help identify what might be required in the future. For innovative products this is very hard to predict because products and markets are not well defined. A wide variety of techniques can be used to forecast such as: customer/ market surveys, brainstorming, Delphi or expert opinion, or scenario development. Which method is chosen depends on: what the company

wants to forecast, rate of technological and market change, availability and accuracy of the information, the company's planning horizon, and the resources available for forecasting. The forecast needs to be based on more than just sales-related information. Other factors that can influence the market need to be added, such as demographics, technology, politics, and the environment (Bessant and Tidd, 2008).

3.4 Techniques to support idea generation

In order to help individuals in the idea generation process, researchers have identified methods to stimulate creative thought and generate more ideas (Mattimore, 1993). According to Smith (1998) there are 172 idea generating techniques. Although many sophisticated methodologies have been developed, only a few will be mentioned and briefly described.

3.4.1 Techniques for internal idea generation

Techniques that can be used within the company to generate ideas from employees are job rotation, suggestion schemes, competitions, think-tank, or an invention group (Baker and Hart, 2007). Job rotation can be used to encourage employees to come into contact with another kind of work, which can lead to new insights and ideas (Maira and Thomas, 1999). Suggestion schemes is another way to try and get employees to come forward with ideas. It is important that this scheme be actively communicated (Baker and Hart, 2007). Innovation competitions are being used more and more by companies to stimulate ideas. They also form think-tanks and invention groups. The idea behind think-tanks is that smart people, working together in a concentrated session, are more likely to find a solution to a problem. An invention group is similar to a think-tank only that an invention group will leave the company for a short period to spend time together in a remote place and return with a set of new ideas. Both think-tanks and invention groups should be cross-functional teams (Baker and Hart, 2007).

3.4.2 Techniques for external idea generation

The techniques described here can be used with customers, suppliers and distributors (external).

Customer/ Market surveys

Companies want to know what is happening in the market. They want to be able to spot trends. Find out who the competitors are, what the consumers think of products and what needs they might have. All of this information is a source of ideas and can be gathered by using market research, customer surveys, in-depth customer interviews or by observing customers in a less obtrusive environment . With the latter is meant a location where consumers can use company products or product mock ups while being watched (Sony Store). Companies are particularly interested in usage/ needs analyses and attitude surveys. This can be a structured approach as in conjoint analysis or unstructured as in a focus group. A focus group is based on an interactive group setting where individuals are asked about their attitude towards certain products, services, packaging, concepts, or ideas (Lehmann and Winer, 2002).

Competitor analysis

Competitor analysis is an assessment of the competitions strengths and weaknesses. By studying what the competitor sells or is working on, might trigger an idea. Research shows that most new products are copies of competitors' products (Lehmann and Winer (2002).

3.4.3 Techniques for both internal and external idea generation

The techniques described here can be used with company employees (internal) and with customers, suppliers and distributors (external).

Brainstorming and brainstorming type techniques

The generation of new ideas can be difficult. This is why a large number of techniques have been developed. Osborn (1963) came up with a technique which involves a freewheeling discussion which generates a large number of ideas or solutions to a problem. It uses a set of principles which are said to increase creativity. These principles are group idea building, multi-disciplinary composition, and focus on the quantity of ideas (Baker and Hart, 2007). During this process, no ideas are evaluated and strange ideas are welcomed. It is encouraged to use each others ideas to trigger new ideas and sometimes ideas are combined to create a single very good idea. It can be used by groups or individually.

Some techniques that are similar to brainstorming are: brainwriting, brainwriting pool and collective notebook method. During brainwriting there is no verbal communication. Participants write down their ideas on paper and is then passed around. This is done to avoid the influence of dominant personalities. A variation on this method is the brainwriting pool. Here participants write down four ideas on a sheet of paper. These sheets are placed in a pool after which participant pick sheets from the pool and add an idea to the list. This is done until they run out of ideas and study the sheets of paper. Similar method are the gallery method and card circulating. Finally the collective notebook method is used by a group of eight to ten people. They each have a notebook in which they write down one idea per day. After a week, notebooks are exchanged. This process continues for about four weeks (Baker and Hart, 2007).

Attribute list

Attribute listing refers to taking an existing product or system, breaking it into parts and then recombining these to identify new forms of the product or system (Mindtool.com, 2009a).

Morphological analysis

The morphological analysis is used with problems which are often of technical nature and related to a product or process. This method uses a matrix in which the main problem is split up into problem segments and look for partial solutions to each, leading to generation of solutions to the original problem. It is also used for concept development an idea generation (Walraevens, 1994; Verhaert, 1998).

Mind mapping

Mind mapping is a creative technique to emphasize words, ideas, tasks or other items linked to and arranged radially around a central key word or idea. Mind maps are often used in generating ideas. By placing the ideas in a radial and graphical manner, it encourages a brainstorming approach (Buzan, 2000).

Synectics

The synectics method is in principle an idea generating technique, but can also be used for idea screening and selection. It is a group method in which the goal is to find one certain solution. This is an opposite of brainstorming where many ideas are wanted. Synectics is based on analogies and abstractions. A search process for parallels and connections between things that are totally different to find a solution to the problem (Verhaert, 1998).

Scenario analysis

This technique tries to focus on 20 to 30 years into the future. It analyses possible futures, based upon alternative assumptions and interpretations of outcomes (Bessant and Tidd, 2008). Inputs include quantitative data and analysis, and qualitative assumptions and assessments, such as societal, technological, economical, environmental and political factors. Clearly this does not provide a new product. It does however, provide an insight into possible futures and problems that might occur (Baker and Hart, 2007). These methods are often used by large multinational firms and might not be in reach for SMEs.

3.5 Conclusion

This chapter dealt with the idea generation phase of the NPD process. It can be concluded that there are different sources of ideas, various areas of opportunities, and techniques to stimulate the generation of ideas. There are various sources of new product ideas, which can be both internal and external. It was found that customers as well as employees are very important sources of ideas and that several techniques can be used both inside and outside the company to encourage ideas. These include a wide range of idea generating techniques referred to by the literature as: brainstorming, attribute list, morphological analysis, scenario analysis and others.

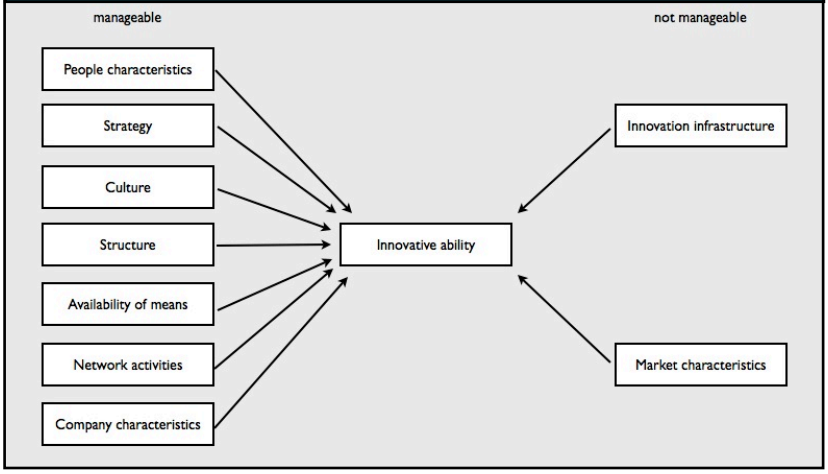
4 Capabilities for the idea generation phase

4.1 Introduction

In the previous chapter the idea generating phase of the product development process was discussed. It was mentioned what the sources of ideas are, where to look for opportunities and what tools can be used to stimulate the generation of ideas. In this chapter the discussion will now turn to what capabilities will be needed within an organization in order to develop a constant stream of new ideas. Bessant and Tidd (2008) say that firms can and do manage the process for success by consciously building and developing their innovation capability. One of the first scholars to address the importance of innovation capability for organizations was Drucker (1954). He suggested that companies need to be able to innovate in order to deal with the changes for the future. Sen and Egelhoff (2000) say that a wide variety of assets, resources and capabilities are needed to make innovation successful because innovation is becoming extremely complex (Guan and Ma, 2003).

In this chapter the subquestion: *Which innovative capabilities are needed during the idea generation phase of the new product development process?* will be answered. Various researchers have identified elements of innovative capability. Gaspersz (2002) says that leadership, challenge and creative excitement, tolerance of failure, diversity, entrepreneurship, sharing information, time, and knowledge are the critical elements of a company's innovative capability. Bessant and Tidd (2008) say that a strategic context, close relations with external parties, the need to facilitate and implement innovation, and the right structure and culture are needed to support the innovation process. In previous research de Jong and Brouwer (1999) looked at what determines the innovative ability of SMEs. They focussed on the search phase of the innovation process and described various factors that cause or stimulate the generation of new ideas. They developed a conceptual model in which they distinguished nine dimensions that determine the innovative ability of a SME (exhibit 6).

Exhibit 6: Conceptual model for explaining the innovative ability of an SME



Source: De Jong and Brouwer (1999)

Their literature study and model will form the basis of this chapter but will be updated in some places. However, within the model I will only focus on the dimensions which are manageable. I acknowledge the fact that the other two dimensions can be important factors of innovative ability but over which management lacks control. This model was chosen because of its comprehensiveness and clear dimensions for innovative ability. These seven dimensions will be discussed and success factors that are necessary per dimension will be identified. These success factors are described by Sebora et al. (2008) as those few things that are necessary for an individual or organization to achieve a successful business venture. Close attention must be paid to those few things in order to realize the formulated goals (Sebora et al. (2008).

4.2 People

People can make or break an organization. The organization must have the right people in place, both in management and in regular positions, who are able and willing to think out of the box. This means that recruiting has a key role to play. Well-educated employees are needed who might improve the company's ability to generate new ideas. Drew (1995) states that being without experienced product development staff can form an obstacle for many successful innovations.

4.2.1 Employees

Innovation depends on ideas. The main source for these ideas is talented people within the organization. With their knowledge and skills, they form an essential part of the innovation power of SMEs. Zien and Buckler (1997) point out that innovation should be the responsibility of the entire company and not just of a few individuals. Dobni (2006) also thinks that all employees should contribute, no matter what their status or position is within the organization. Without these talented employees, no innovation project would succeed. There are certain characteristics of people that contribute to innovative capability which will now be discussed.

Entrepreneurship

Entrepreneurship is not something that should be contained to the entrepreneur or management. Everyone within the organization should have the opportunity to act entrepreneurial. This means having the freedom to experiment and test new ideas which might influence others and lead to new developments (Gaspersz, 2002). According to De Brentani (2001) the willingness or unwillingness to try new things and actually take a risk on something is one of the most important factors of innovation. Employees should act entrepreneurial when it comes to developing activities, opinions about markets, opinions about customers and their opinions about the direction of the company. Gosselink (1996) believes that within each function and department there should be entrepreneurial activities and that this is a primary condition for innovative ability.

Willingness to take risks

Companies that want to be innovative, will need to allow their employees to take risks. This is part of that entrepreneurial spirit that people should have. Employees should have the freedom to put

forward their ideas and spend time on their own projects. They should not be afraid of mistakes but should see them as a learning opportunity for success. Tushman and O'Reilly (1997) are of the opinion that mistakes and possible failures should be tolerated in order to encourage new ideas and risk taking behavior. Gaspersz (2002) comes to a similar conclusion and feels that tolerance for failure is a major factor for innovation. According to Kanter (1984) employees who are worried about losing their jobs if a project should fail are less willing to take risks. In a study using companies from Singapore, Wan et al. (2005) found support for their hypothesis that a greater willingness to take risks is positively related to a greater firm innovation. Therefore, a culture that encourages risk-taking and tolerates failure is positively related to innovation.

Skills and competencies

Creating new products relies for a great deal on the firm's intangible assets (Teece, 1998). The knowledge within employees is of great importance and their skills and competencies can drive the organization to become more innovative. Although most employees think that innovation is not within their ability, most of them are capable of doing so much more. They might have hidden talents that can be valuable to the company but might think the company would not be interested. Employees need to be educated about innovation and education and training programs can support this. These programs increase the knowledge and skill levels which can improve the employees' creative and problem solving ability (Tidd et al., 2005). Albaladejo and Romijn (2000) emphasize that the education of a firm's workforce can contribute to its innovative capability. They found for technological companies that university trained engineers and designers contribute to the innovative capability but that the amount of technicians within the firm's workforce does not seem to be relevant. According to Dobni (2006) organizational learning should be more strategic and be closely related to the innovation goals.

4.2.2 Management

Commitment to innovation by management or the entrepreneur is very important as has been pointed out by various researchers (Gosselink, 1996; Gaspersz, 2002). They must have a certain degree of courage and leadership, to steer the organization into a new direction and away from what everybody else is doing (Bessant and Tidd, 2008). Management must lead by example and show their belief in innovation. They must share this belief with all employees because everyone should understand the importance of innovation to the organization (Rothwell, 1992). By using instruments such as a mission, vision and strategy, management can create awareness for innovation. Maybe the most important factor for innovation is creating a culture that stimulates creativity. These elements will be discussed in the following paragraphs.

4.3 Strategy

Building capabilities to organize and manage innovation is of great importance to the success of the organization, but these capabilities must be pointed in the right direction (Bessant and Tidd, 2008). This can be achieved by innovation being part of the organization's strategy. Such a strategy reflects

the company's goals and the road to achieving these goals. It is a guideline for what the company will develop in the future. Two other important factors in relation to strategy are organization culture and structure. These will be discussed in the next paragraphs. In this paragraph indicators for innovation in relation to strategy are discussed.

4.3.1 Innovation: key element of the overall strategy

Fun and creative solutions to get innovative energy flowing can certainly add value and kick start innovation in the short-term. However, focussing on just these aspects is not going to be sustainable for the future. According to Rothwell (1992), incorporating innovation objectives into a company's strategy is a must. Being part of the strategy prevents innovation from being something that only occasionally receives attention. In order for innovation to be part of a long term strategy, management has to show that they are committed to innovation. Management focus is seen as an important factor for product innovation (Hadjimanolis, 2000). Long-term commitment can be emphasized by providing the necessary resources and setting clear goals and objectives for innovation, creating innovation programs and setting up a budget for innovation (Gosselink, 1996). These clearly formulated goals and innovation objectives can also provide incentives to innovate. It tells employees that innovation is important and that they need to aim at realizing these goals (Tushman and O'Reilly, 1997). According to Bessant and Tidd (2008) the continuous focus on renewal leads employees to come forward with ideas for new or improved products more easily.

Hadjimanolis (2000) argued that having a documented innovation plan as part of the strategy suggests that certain ambitions, goals and milestones have been formulated which was more likely to lead to innovation output. Brown (2007) found in her research that companies that are considered to be best practice organizations when it comes to innovation had clearly defined goals and objectives for their innovation efforts. They were also more likely to map their innovation development and progress.

Bossidy and Charan (2002) argue that the execution of the strategy is of great importance to the success of innovation. Dobni (2006, 2008) adds that the success of company's innovativeness essentially depends on the strength and support of management, the strategic architecture in place to support innovation, and the individuals that work for the organization.

4.3.2 Declaration in mission and vision

A possible difficulty concerning the company's innovation could be that employees do not care about innovation. This is why management needs to communicate with the employees to explain the importance of innovation. The employees need to realize that it is of the utmost importance for the future of the company.

One set of management tools that seems to have the potential for playing a significant role in helping unleash the innovation potential in employees are the company's mission and vision (Senge, 1998). By incorporating innovation into these tools, management can have an influence on

the workforce. Managers in smaller firms tend to have more direct influence on employees as compared to managers in larger companies.

Mission

A mission statement should be a short and to the point statement of goals and priorities. It tells everyone within the company why they are working together and how they are going to contribute to society (Senge,1998). For many business leaders, it is a critical element to motivate employees and to provide them with a sense of direction. Many authors have said that the main purpose of the mission statement is to influence the behavior of the employees (Drew, 1995) including innovative inducing behavior (Bart, 1996).

If innovation is clearly formulated as part of the mission statement and communicated to its employees in an appropriate way, it can have a positive effect on the innovative ability. Communicating the mission can be done in different ways but Bart (2004) found annual reports, posters/ plaques and employee manuals to be the top three communication methods. In that same study he says that the content of the mission statement is important for innovativeness but that the employees' commitment to the realization of the mission seems to have an even greater impact.

Vision

While a mission provides a foundation, it is also not enough to assess how the company is performing. This is why "an image of the future we seek to create" needs to be articulated (Senge, 1998). However, nobody can look into the future and see the end product from the starting process. They may have an idea of how it will look or how the experience of using it will be, but they cannot know for certain. A clear and stable vision is needed, but it may need to be revised to try something else if a product development has failed (Bessant and Tidd, 2008).

4.4 Culture and climate

Another important factor that can support innovation is culture. Culture can be described as a collection of values and beliefs people have about work, each other, themselves and about the organization. These can be reinforced through symbols, language, behaviors and the like. Having the right culture and climate in place provides the organization with the necessary ingredients to innovate. Such a culture would favor creativity, risk taking, freedom, trust and respect, solution orientated, and quick decision taking (Lock and Kirkpartrick, 1995). According to Jassawalla and Sashittal (2003) practices such as rigidity, control, predictability and stability hinder innovation.

4.4.1 Creativity

Creativity is the ability to come up with new ideas and can be influenced by time, people, places, settings, knowledge and strategy (Bessant and Tidd, 2008). Everyone has the ability to be creative but the way they release their creativity varies. Companies require a culture that gives employees the space to be creative and this can be stimulated by using creative thinking techniques. These

techniques force employees to abandon old ways of thinking and focus on thinking in a new way to come to new viewpoints and solutions. It can especially be useful during the idea generation stage, to help find new ideas or solutions for problems. In chapter three, various methods were discussed.

4.4.2 Trust, respect and belief in innovation

Trust is an essential part of a culture that is open to innovation. This eventually helps to open minds, bring employees together, and in the long run stimulate innovation. A strong level of trust results in individuals being able to make suggestions and offer opinions without the fear of being ridiculed or fired in case of failure (Bessant and Tidd, 2008). By recognizing that certain experts within the organization might have a different vision and incorporate these views into the strategy sends a message of trust to the employees. Trust has also to do with empowerment and job autonomy. If the tasks of the job are to narrowly defined, it constrains the decision making authority of the employee (Bessant and Tidd, 2008).

According to Wan et al. (2005), employees must realize that innovation is highly regarded by management and that innovation activities should be supported by the right group norms and organizational ideologies. Employees belief in innovation can be further enhanced by leadership focus for the topic. Innovation and creativity can be enhanced if the whole company supports it (Amabile, 1998).

4.4.3 Openness and willingness to exchange idea

Having an open and informal culture within an organization is often mentioned as being important for successful new ideas. According to Gaspersz (1998) companies that have an innovative climate also tend to have an open culture. With open culture he means that people with different points of view share ideas with each other and are open to change. Therefore, open-mindedness is needed to critically evaluate the organization's operational routine and to accept new ideas (Skinkula et al., 1997). It is said that because of the sense of mutual respect and trust within an open culture, the willingness to share ideas with fellow employees is increased (Gaspersz, 1998). Wan et al. (2005) found support for their hypothesis that a greater willingness to exchange ideas is positively related to greater innovation. Good internal communications facilitate the spread of ideas within a company. This can contribute to a culture in which ideas are more often translated into action. Problems of communication between specialists can slow down and decrease the success of innovative activities (Vermeulen and Dankbaar, 2002).

The willingness to exchange ideas keeps alive the knowledge and information gathered from various sources and serves as a reference for future action. For example, the marketing department's experience with customers may be valuable to the R&D department in developing products or services to fit customer needs (Moorman and Miner, 1998). This is similar to what Oden (1997) said because he states that sharing information among the employees and departments is necessary for the incentives to innovate.

4.4.4 Freedom to experiment

According to Zien and Buckler (1997) it is important for all employees to be able to experiment within their area of expertise. Giving them the opportunity to work on their own projects is a great incentive for innovation. Creating a climate where people are given the freedom to experiment, will give employees the opportunity to take initiative, to find and share information, and make plans and decisions about their work. If employees are given no freedom or only limited freedom, employees will follow orders and carry out their work in a routine way. This means employees will not take initiative for pointing out new or better ways of doing things (Bessant and Tidd, 2008).

However, having too much freedom is also not ideal. This will mean everyone will go in their own direction and focus on their own project instead of having the organization goals in mind (Bessant and Tidd, 2008). There should be a balance between flexibility and control. Dougherty et al. (1996) argue that the tensions between flexibility and control need to be managed in order for innovation to be successful. Flexibility allows for creativity, empowerment and change while control is needed for achieving long-term goals, fully utilizing core competencies, and meeting budgets.

4.5 Structure and systems

Organizational structure is important for the innovative ability of a company. The structure can either stimulate creativity and innovation or hinder it. Structure needs to support the other dimensions of innovative capability to allow for successful innovations to take place.

4.5.1 Organic vs mechanistic

Various authors use the organic and mechanistic terms to describe the desirable and the not so desirable structures. Burnside (1990) is of the opinion that innovation is generally supported by organic structures. These organic structures can be characterized by informality and flexibility, sharing of information, greater openness to new technologies, and enabling innovation (Matsuno et al., 2002). Bishop (2005) also points out that organic structures have more loosely defined tasks, horizontal communication links, decentralization of authority and a greater individual authority. In contrast to this is the mechanistic structure which is characterized by rigidity and inflexibility, clearly defined tasks, vertical communication links, centralization of authority and obedience to supervisors (Bishop, 2005).

4.5.2 Decentralization and de-standardization

Decentralization

The concentration of decision making authority is referred to as centralization. According to Cardinal (2001) this leads to fewer communication channels. It is also said to reduce the quality and the number of ideas generated (Sheremata, 2000) and gives a perception of less control over work and reduces the chance an employee will try something new (Damapour, 1992). This means that decentralization of decision making authority is favored for supporting innovation. Kanter (1983)

believes that an innovative organization should have few hierarchal layers, more horizontal communication lines, and a greater empowerment of employees.

De-standardization

De-standardization is having relatively few rules and procedures for work processes. Having to many rules and procedures can obstruct exploration and problem solving efforts. It is said that especially during the earlier stages of the innovation process, it is important to have a high level of de-standardization but less so during the development stage (Bodewes, 2000). Edvardsson et al. (1995) came to a similar conclusion and found that it was better to have few rules and procedures during that first stage which leads to more openness and stimulates the flow of ideas.

Damanpour (1992) says that strictly underlining the need to follow the rules and procedures can have a negative effect on innovation. Vyakarnam and Adams (2001) came to a similar conclusion and state that inflexibility in rules and procedures can make it very difficult for management to find new sources of information.

4.5.3 Multi-functional teams, interdepartmental co-operation and job rotation

Multi-functional teams

Various authors have argued that multi-functional teams are important for supporting innovation. It is said that those types of teams play an important part in the success of product development (Vermeulen and Dankbaar, 2002). Each of the team members has a different background in education, work, and experience that they bring to the group. The greater the diversity of the group, the wider the range of ideas can be (Hadjimanolis, 2000).

Interdepartmental co-operation

It can also be said that the cooperation between departments adds to a company's innovative ability. Especially the interdepartmental cooperation between R&D, Engineering and Marketing/ Sales is important (Souder and Moenaert, 1992; Zien and Buckler, 1997).

Job rotation

Job rotation can be done for different reasons. The first reason can be to provide employees with new insights and ideas by coming into contact with different work situations (Maira and Thomas, 1999). The second reason can be to gain an understanding of other peoples work which allows them to see problems in a broader context (Prakken, 1994).

4.5.4 Rewards, recognition and career systems

Creativity is a necessity for ideas so it is important to stimulate creativity. Amabile (1997) has written a great deal about this and identifies two forms of motivation: extrinsic and intrinsic, whereby intrinsic is the most important of the two. An example of an extrinsic form of motivation is money but Amabile (1997) found that people, when it comes to creativity, tend to be more motivated by things which they find interesting or personally challenging rather than money. She also found that people care about autonomy in the selection of work assignments and the ability to

grow within the organization. In case financial rewards are given, they should then be group based in order to stimulate innovation (Ayas, 1996). This stimulates people to share ideas with each other.

4.6 Available means

Product innovations are not something that just happens. Different resources need to be available within the organization. Time and money need to be spent in order to develop an innovation. In addition to this, knowledge and creativity are also needed for innovation to be successful (de Jong and Brouwer ,1999). However, not all companies have the necessary resources to be successful.

4.6.1 Time

In order to stimulate creativity, it is important to give employees or teams the time to work on their own experimental projects. Many organizations have implemented programs granting employees to spend a percentage of their time on their own projects (Gaspersz, 2002). A well known example of this is Google inc. Googles' employees get the opportunity to spend 15% of their work time on their own projects. This generates a stream of new products with which they gain market share. However not all products are successful but one that was successfully introduced and started out as personal project was Googles e-mail service Gmail. Gaspersz (1998) says that in order for employees to be able to work on these personal projects their workload should be low. If their day to day work is so demanding, they will not get the opportunity to spend time on these projects.

Time for creativity can also mean that everyone who attends a monthly meeting must provide two new ideas for improvement or change. By making time to listen to these ideas, management shows that creativity and involvement of employees is greatly appreciated (Gaspersz, 2002).

4.6.2 Technological capabilities

According to Gosselink (1996) the term technology includes the company's know-how that is incapsulated within the company. It is important that companies remain committed to the development of technology. The timely implementation of new technologies are needed to prevent falling behind the competition.

Cooper and Kleinschmidt (1995) state that the available technology is a critical success factor for the success or failure of product innovation. The reason for this is that without the latest technology it is difficult to meet the needs of the modern consumer. Not having new technologies also impacts idea generation for useful products. This is why technical competence is needed during the invention phase of the innovation process.

4.6.3 Financial resources

The success of the organization's innovations does not only depend on technical capabilities but also on financial resources. In order to react to fast changing markets or to cover the cost of non-recurring complications, companies need to have a financial buffer. Financial resources are an important part of the organizations innovative capability (Preisl, 1998). Companies that want to be

innovative need to be willing to invest. Some product innovations have come about spontaneously, however in most cases developing a new product is a process that costs both time and money. A lack of financial resources can cause employees to be less motivated to come up with new ideas because they know that investment capital is not available (de Jong et al. 2002). The reverse also holds true. When capital is available it has a positive effect on the innovation ability (Nagel, 1992).

Financial resources can also stimulate innovation if the organization has the ability to quickly fund new ideas. Pinchot and Pellman (1999) say that seed money can play an important role in stimulating intrapreneurship which allows the bypassing of normal approval processes.
Nijssen (1992) state that the amount of financial resources is dependent on the innovation strategy of the company. The amount of resources is a result of the strategic intentions that the company expresses. Nijssen uses the Miles and Snow (1978) typology to point out financial resources concerning innovation. These typologies are prospector, defender, analyzer and reactor. A company can only realize its favorite role when there are enough financial resources to do so.

4.6.4 Marketing capabilities

Because of the fast changing environments, it is important for a company to be able to identify opportunities and to act fast to take advantage of these opportunities. This requires that the company has certain marketing capabilities. Marketing capabilities that are of importance for the idea generation phase are mainly related to market research tools. Market research is about systematically collecting information, saving this information and analyzing it. According to Vorhies and Harker (2000) marketing research is defined as the set of processes needed to discover broad-based market information and to develop information about specific customer needs.

4.6.5 Education and training programs

As was mentioned in an earlier paragraph, education and learning programs increases peoples knowledge which can increase their creative capabilities. By constantly re-training and learning new things, employees broaden their knowledge base and will be able to solve new kinds of problems (De Jong and Brouwer, 1999).

The innovation processes are often pared with change. Employees are often hesitant to change because they do not know what skills will be expected from them. Education and training programs can help by providing training for the necessary skills and competencies in an early stage which can remove the resistance against change (Cozijnsen, 1996).

4.7 Networks

The mindset that all ideas come from a R&D department is not valid. Innovation is something that should run throughout the entire organization. However, the innovative ability of small firms are often constrained by the limitations of their internal resources. By working together with others in innovation networks, small firms are able to gain access to new technology and technical expertise

which it otherwise would not have access to. Romijn and Albaladejo (2002) point to the fact that the use of external contacts has frequently been related to successful innovation.

4.7.1 Working with external parties

In the previous chapter it was already mentioned that external sources such as clients, suppliers, distributors, and universities can be an important source of ideas. These relationships with business partners and clients are very important for a company's growth and survival (Evans and Volery, 2001) and increases its innovative ability. The purpose of cooperation can be gathering information about technologies and markets, but also for obtaining various other inputs to complement the internal resources, such as external staff training, parts and components, consulting services, ect.

Companies should see the customer as an important business partner because the products they create will need to fulfill the customers need. Being able to understand and respond to those needs, both in the short and long term, is an important factor for innovative ability (De Brentani, 2001). Heydebreck (1997) mentions that customers know the current product and probably know the competitors product as well. Therefore letting customers participate in the innovation process can add to the innovative ability.

Active participation in R&D and other innovation projects with other companies, universities or other research institutes is an important basis for innovation. Companies that have cooperative arrangements can improve their competitive position and performance by sharing resources (Ireland, Hitt and Vaidyanath, 2002). The advantages for these companies could be sharing costs and risks, and entering new markets together. This is why it is important to find the right partner with the right resources (Dess, Lumpkin and Eisner, 2004). The cooperation with universities can also be beneficial to both cooperating parties. Companies can use knowledge from universities to develop new products while universities can use funds from these companies to finance new research projects.

By working together with others, it is possible to gain knowledge faster and less costly than when it would be developed in house. Each participant adds to the partnership by looking at things from a different perspective and by bringing in its own knowledge and skills which leads to a wider variety of information (Hulshoff and Snell, 1998). Nooteboom (2001) mentions benefits for both parties in that new combinations of existing knowledge can be made and that knowledge can be produced together.

Empirical evidence demonstrates that small firms that form partnerships perform significantly better, although it has been argued that using external networks alone without investing in internal factors will not lead to better innovative performance (Oerlemans et al. 1998; Freel, 2003). Heimeriks and Schreiner (2002) state that through the combination of own resources with complementary resources of others, businesses can strengthen their competitive edge.

Albaladejo and Romijn, (2000) find in their study of U.K. SMEs that the frequency of networking is highest with clients, suppliers and service providers. However, the data showed no link with higher innovation capabilities. A different pattern emerged for networking with R&D and training institutions. For these agents the frequency of networking is low because not all sample firms interacted regularly with these types of organizations. None the less, those few companies that did network with these kind of firms, did achieve a greater number of major innovations and also had a higher degree of originality and technological sophistication in their innovations. The study showed that being close to these types of organizations is important but that the causality might not be strictly unidirectional. It is also reasonable to believe that companies with more innovative capabilities form established partnerships with these types of organization just because they make good partners.

4.7.2 Sharing knowledge

Sharing patents and licenses make the market for using certain technologies quite efficient (Tushman and O'Reilly, 1997). In this case it is about explicit knowledge. However, when a company is interested in developing certain capabilities or expertise from an other company, it might be more complicated. This knowledge is often imbedded in systems within the organization or is locked inside minds of people, the so-called tacit knowledge. Open-mindedness is a necessity for the transfer of tacit knowledge. One of the characteristics of tacit knowledge is that it is not equally available for all competitors. The access to this knowledge is harder to get compared with explicit knowledge. In this situation it might be a good option to work together with another company to gain access to these forms of knowledge and expertise to improve innovative ability (Bessant and Tidd, 2008).

4.8 Company characteristics

Company characteristics such as company size, location, product, and market also determine the innovative ability of a company. Larger organizations are expected to have more resources compared to smaller companies, more financial resources will mean more money can be invested in R&D. The product that a company makes also determines the possibility of innovation. There is a difference between mass produced simple consumer goods and complex capital goods. And finally the position in the market also affects the innovative ability. Is the company dealing with business to consumer or with business to business.

4.8.1 Organization size and location

Organizational size

Literature does not provide unanimous picture when it comes to organizational size and its effect on innovation. Some say that larger organization have access to more resources which can be invested in more formal R&D. This would increase their innovative ability (Freeman, 1982). Something similar to this was argued by Brouwer (1997) who said that larger companies have more employees

which leads to a greater variety of knowledge. Another argument that is made is that innovation is risky and that larger firms are more capable of dealing with this risk (van Vossen and Nooteboom, 1996).

Others on the other hand say that small firms need to constantly develop innovative products in order to survive in the market (Schumpeter, 1942). Scherer (1988) argued that the innovative process within smaller companies is enhanced because of more flexibility and less bureaucracy and that it is easier to get excited about innovations because of closer relations between challenges and employees. Almeida and Phene (2004) argue that employees at larger firms have less incentive to innovate because they are only a small part in an large organization. Nevertheless, it is often found that smaller organization (less than 100 employees) do not have a formal R&D department and that they are less likely to innovate, but those who do innovate, innovate more intensively (Felder et al., 1996).

Location

The location of the organization can be of importance to the innovative ability. Companies that are located in urban areas tend to be more innovative than those that are located in rural areas. The location of the organization may provide access to resources to be able to grow, develop and innovate. Löfsten and Lindelöf (2002) found companies and universities which are all located together at so called science parks, tend to be more innovative. Smaller firms might benefit from knowledge spillovers from large R&D firms because not all innovations are useable by the inventing company (Antonelli, 2000).

There are however also researchers who state that because of modern communication technologies it is easier to share knowledge without being in the same location. Instant communication such as videoconferencing via internet and intranet makes being at the same location unnecessary (Hitt, Keats and De Marie, 1998). However for some companies being close to others can still have positive effects.

4.8.2 Products and markets

Products

The difference between a complex product and simple product also influences the innovative ability of a company. Complex products in a business to business environment or mass produced consumer goods in a business to consumer environment will affect the coordination of innovation (Hobday, 1998). Having a complicated product design can stimulate innovative ability. Products that are difficult to reverse engineer, protect a company's secrets which gives them a competitive advantage and to reap more benefits from an idea. This can stimulate companies to produce extremely complex products because these are easier to protect (De Jong and Brouwer, 1999).

Arvantitis and Hollenstein (1994) found that the complexity of the product design is important for the number of product innovations. They also found that having a low lead time has a positive effect

on the number of product innovations. A low lead time means that a company can conquer a market in a short time and in this way be a first mover on the market.

Markets/ industry

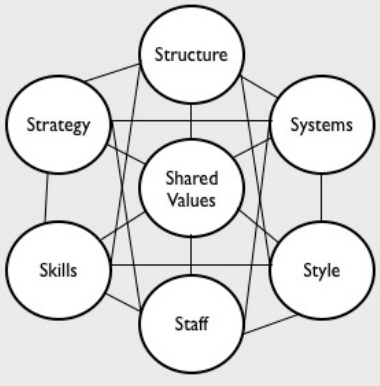
Acs and Audretsch (1990) state that the real issue is not if large or small firms are more innovative but in which industry characteristics favor either large or small innovators. They come to this conclusion because they found that small firms had a higher number of innovations per employee for certain industries while large firms had a higher number of innovations per employee for certain other industries. Another important factor is the place the company has within the value chain within its industry / market. If a company delivers machines to another company, the market will be small. If a company sells its products to consumers, the market is much larger. This will affect the coordination of innovation (Hobday, 1998). Companies with smaller markets will export faster. Baldwin (1995) found that exporters place considerably more importance on both R&D and innovation strategies than non-exporters. He also found that exporters score higher on developing new technology, refining technology developed by others and improving own existing technologies.

Research studies show that innovative companies have, in general, greater export probability (Love and Roper, 2001) and a larger proportion of exports (Wakelin, 1998) or export growth (Guan and Ma, 2003). The effects of exported innovations can take advantage of a larger market, which evidently enhances the possibility to achieve a positive cash flow quickly.

4.9 Adjustment of the model

These seven dimensions that were just described influence the innovative ability of a company. To illustrate the interrelationship between these seven dimensions a variation of the McKinsey 7S model will be used. The McKinsey 7S model (exhibit 7) also depicts seven elements but shows the interdependency of these elements and demonstrates how the change in one affects the change in the others (mindtools.com, 2009b).

Exhibit 7 : The Mckinsey 7S model



Source: Waterman and Peters (1980)

The seven elements are divided into ‘soft’ and ‘hard’ S’s. The hard elements (strategy, structure and systems) are workable and easy to identify. They can be found in strategy statements, plans,

organizational charts and other documentation. The soft elements on the other hand are much more difficult to identify and to describe. An organization culture is constantly changing and is often determined by what people do within the organization. As a result of these dynamics it is more difficult to control the soft characteristics, which in turn can have quite an impact on the hard elements (Recklies, 2001).

Waterman and Peters (1980), the developers of the model, based their model on the assumption that in order for an organization to perform well, the seven elements will need to be aligned and mutually reinforce each other. This allows the model to increase the performance by pinpointing the areas that need to be realigned or to keep the elements aligned when things are changing.

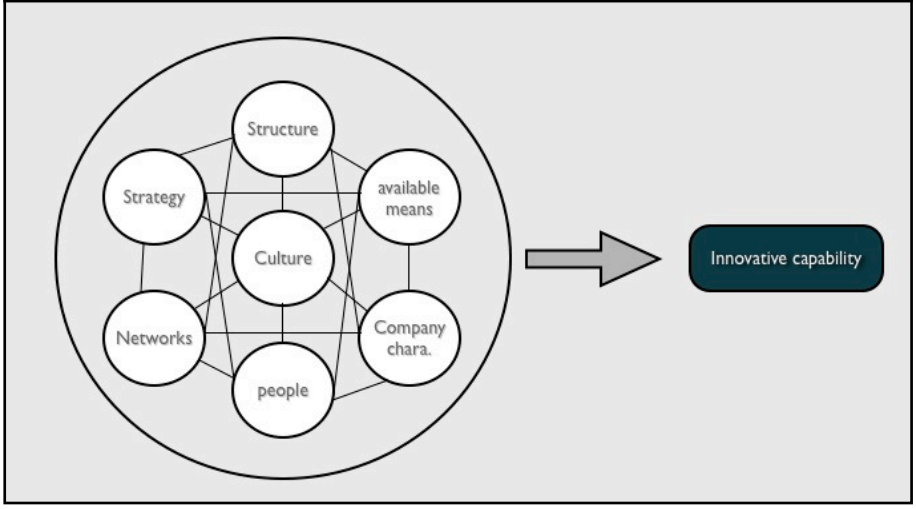
It does not matter what kind of change it is, but it should always be recognized that the wider impact of changes made in one area is taken into account given the interrelationship on the other elements within the organization (Mindtools.com, 2009b).

During processes of change, companies tend to focus solely on the hard elements and pay little attention to the soft elements. Waterman and Peters (1980) argue however that most successful companies pay a lot of attention to the soft elements and work hard at them. These elements can make the difference in a process of change because without the right culture in place it is difficult to make changes to the structure or strategy.

This 7S model can be used as a tool to analyze the current situation within a company and to describe an ideal future situation. By comparing these two situations, strengths and weaknesses will present themselves which can be dealt with by developing action plans to achieve the future state.

This kind of interrelationship can also be envisioned for the seven dimensions of the innovative capabilities because innovation is basically also a process of change within the organization. This has been illustrated in a new conceptual model in exhibit 8.

Exhibit 8: 7 dimensions of innovative capability



Source: the author

These seven dimensions can influence the innovative capabilities of companies but they also influence each other. Companies need to find a balance between these seven dimensions just like they need to achieve a fit between the seven elements when using the McKinsey 7S model. In addition to this, it is thought that when choosing a certain product development strategy, the balance between these dimensions will be different than when choosing another product development strategy which will be further investigated in chapter six.

4.10 Conclusion

The objective of this chapter was to find out which capabilities are required during the idea generating phase. A model, developed by de Jong and Brouwer (1999) was used and seven general dimensions (people, culture, structure, strategy, networks, available means, and company characteristics) have been discussed. This model was chosen because of it comprehensiveness and clearly formulated dimensions for innovative ability. Within these seven dimensions lie success factors which can increase the idea generation power of the company. These seven dimensions can impact each other when factors within these dimensions change. This has been illustrated in a new conceptual model which was shown in exhibit 8 in the previous paragraph.

5 Product development strategies

5.1 Introduction

In the previous chapters, the idea generation phase has been discussed and identified as the first phase of the NPD process. Still, it does not make sense to enter this process without setting up clear goals and a well defined product development strategy. A clear product development strategy is a prerequisite to provide clear focus and priorities to a company's NPD activities (Beerens et al., 2006). A product development strategy can be proactive or reactive by nature. A company that follows a proactive strategy will be constantly looking for the next big breakthrough. A reactive strategy will lead to the organization being more defensive and will follow while others lead. This chapter will provide an overview of the different product strategies companies can employ for their new product development. By doing this, the subquestion *What are the main new product development strategies?* will be answered. A limitation is that no attention will be given to the dimensions of why a certain strategy might be chosen and which strategies perform best.

5.2 Various product development strategies

The literature provides several views on new product development strategies and shows that it has been operationalized in a number of ways.

According to Porter (1985), companies can essentially compete on two strategic levels: *cost leadership* and *differentiation*. If cost leadership is followed, the company will seek to become the industry low cost producer which will mean lower prices, a narrower product portfolio and a high volume. When following a differentiation strategy, companies seek to be unique in its industry by distinguishing themselves from its competitors. They will select one or more elements that many buyers view as important and uniquely position itself to meet those needs. This will lead to a superior product, use of best technologies, and the most wanted features. The focus strategy selects a segment or a group of segments in an industry on which it focusses its full attention. This can be cost focus and differentiation focus.

Ansoff and Stewart (1967) developed a typology of strategies based on the timing of entry. They defined *first to market*, where the company aims to be the fastest to the market with a new product; *follow the leader*, where the company looks at what the market leader is doing and has an exceptionally rapid response time in product development to be able to react quickly; *application engineering,* where companies improve products for particular customers in a mature market; and the *me too strategy*, where a company performs no R&D but simply looks at the first to market and follow the leader types and copies them. By being more efficient in manufacturing they can keep costs down. Barczak (1995) used this classification scheme as the basis for her classification of new product development strategy. She describes three categories: *first to market, fast follower* and *delayed entrant*.

Miles and Snow (1978) created four strategic types based on the rate at which a company changes its products or markets in response to its surroundings. *Prospectors*, *analyzers*, *defenders*, and *reactors*. The prospectors are the industry leaders, because they recognize new market opportunities and launch new products. In contrast to this is the defender who focusses on a stable, limited range of products and does not concentrate on new products but more on resource efficiency, and process improvements to bring down manufacturing cost. Analyzers share elements of both prospectors and defenders. In some industries they might defend positions while in others they carefully choose which promising new product developments to follow. Although they initiate product development, analyzers tend to follow a second but better strategy. Reactors tend to only react to changes from their surroundings because they lack a clear strategy.

Crawford (1980) says that when it comes to innovation strategy, companies tend to explore or exploit. He describes four innovation strategies: *inventive*, which is basically a first to the market strategy; *adaptive*, which is a second but best strategy; *economic*, which means being low cost producer; and *innovative applications*, with which he means the creative use of existing technologies.

From research, Cooper (1985) concludes that firms adopt noticeably different types of new product strategies. He groups them into five overall product strategies. The first one is a *technology driven strategy.* This strategy is based on a high degree of technological sophistication and innovation with complex, high risk, innovative products. The companies that fell into this category were proactive in generating ideas, acquiring new technologies, and were strongly R&D focussed. However, he also found that new products ended up in unattractive, low synergy markets. A marketing orientation was clearly missing. The second category he identified was the *balanced focused strategy.* This strategy featured a balance between technological sophistication and innovativeness and a strong market orientation. The companies that fell into this group had highly focused product development programs and their products were targeted at very attractive markets. The third strategy was the *technologically deficient strategy.* Companies that fell into this category were weak technologically, with low technological synergy, yet involving new markets, and new market needs with superior products. *Low budget, conservative strategy* is the fourth category. This is a strategy with a low level of R&D spending and focusses on me-too products. This approach had high technological and marketing synergy and had high product fit and focus. He concluded this program to be safe , efficient and undramatic. The last strategy type is the *high budget diverse strategy* which can be seen as a shotgun approach. This type is associated with high R&D spending, poorly targeted new markets, highly competitive markets, and no program focus.

Another categorization is given by Beerens et al.(2006) who provide an overview of different product development strategies. They describe market driven *(market back)* and R&D driven *(technology forward)* strategy categories. The market driven strategies consist of *'the Follower'* and *'the Listener'*. The follower duplicates successful product innovations of market leaders and has very little consumer insight. Their marketing is intended to build awareness. The listener on the

other hand is very consumer aware and focuses on the 'needs' rather than the 'wants'. They identify a consumer need and then develop a product to meet that need. Their marketing is focussed on features and functionality of new products. The R&D driven strategies consist of *'the Skunk Works'* and *'the Market maker'*. The skunk works create breakthrough products and then put them out there and see which stick. This requires intensive, lab-focused R&D with which protectable new technologies can be discovered. They rely on early adopters, and on word of mouth marketing. Their customer insight is minimal and happens in the form of customer feedback. The market maker is the opposite of the listener. The market maker creates a product and then a market. They invest in new technology and constantly update existing products. They focus on the 'wants' of the consumer and the goal is to create a strong brand umbrella.

Jaruzelski and Dehoff (2007) conclude from a study of large multinationals, that innovation strategies can be grouped into three distinct innovation strategies. These three categories are: *Need Seekers*, *Market Readers*, and *Technology Drivers*. The need seekers identify unmet customer needs through direct feedback and then aim to be the first to market with the breakthrough product. The market reader on the other hand focuses more on incremental changes and uses a second-mover strategy to keep the risks to a minimum. This strategy is however just as customer focused as the need seeker strategy. The technology drivers tend to lean towards their own technological capabilities and unexpressed customer needs for generating ideas, rather than focusing on the market or direct customer input.

Rogers (2001) provides a summary of the available product and service strategies. These can be found in appendix I. These are more specific and combinations of strategies are also possible.

5.3 Conclusion

This chapter gave a brief overview of main product development strategies. From this overview it can be concluded that most of these strategies are based on either a market or technological orientation. A first to market strategy, requires being first to the market with a product. This can either be a market orientation, one sees an opportunity and reacts quickly to be the first to have a product on the market, or technological orientation whereby the company develops something by themselves and aims to be first to market. A follower on the other hand will require a market orientation in order to keep an eye on the leader. With a differentiation strategy companies hope to create a unique product by focusing on a few features that are important to customers and uniquely position themselves to meet those features. This means they will have to find out what customers find important, which requires a market orientation. Within these two strategic directions it is possible to position some of the product strategies mentioned in appendix I for example, a quality strategy or product modification strategy.

6 Capabilities for product strategies

6.1 Introduction

In the preceding chapters the idea generation phase, capabilities for the idea generation phase and various product strategies have been discussed. In this chapter these three elements will come together to answer the subquestion: *Which innovative capabilities are needed during the idea generating phase of the product development process when using a certain strategy?*. In the following paragraphs, two strategies will be discussed and critical success factors will be described. It should be kept in mind that it only concerns capabilities needed for the idea generation part of the innovation process and that the assumption is made that that both strategies are aimed at the business-to-business market.

6.2 Market driven product strategy

6.2.1 Listener strategy focused on performance and quality

The listener strategy is based on the concept that a customer need is identified and then a product is developed to fulfill that need. The assumption is made that the company is focused on the performance (higher capacity, speed, yield) and quality (reliability) of its products.

6.2.2 Capabilities needed for idea generation

A continuous flow of ideas is needed in order to have the right of existence in the future. Companies that are market-driven gain most of their product improvement ideas by focusing on the customers and the market. Hobday (1998) mentions that business-to-business companies tend to refer to their purchasers as customers, whilst the business-to-consumer oriented companies see their distributors as customers and the end-user as the consumer. Von Hippel (1988) and various other researchers have pointed out that customer knowledge is an important source of ideas for product improvements or new products. This means they must know their customers and market better than the competitor, which makes marketing capabilities an essential part of the innovative capability of a company during the idea generation phase.

According to Fowler et al.(2000) three dimensions of market-driven capabilities can be named: customer knowledge, customer access, and competitor knowledge. Sinkula (1994) argues that companies who are market-driven should have superior capabilities in finding, interpreting, disseminating, and capitalizing on information about customers. An effective way to enhance customer knowledge is by way of active collaboration such as customer panels, customer surveys or customer observation.

Mohr et al. (2005) suggest a more direct approach by systematically paying a visit to customers with multi-disciplinary teams. This enables them to see the product in actual practice, to talk to

actual users of the product, and to gain a better understanding of the project's role in the customer's total operation. This provides valuable insight into the customers' needs.

The multi-disciplinary teams need to consist of a wide variety of individuals from Product management, Sales, Marketing and R&D. This way there is a diverse group of people with a wider range of knowledge. It is also important that there is well functioning communication between these departments so that ideas and experiences can be exchanged (Calantone, Benedetto and Divine, 1993). The people that are part of this team should be passionate about working with clients and they will need to build close relationships with them. This ability to connect with the client is seen as a strength (Ulrich and Smallwood, 2004).

Atuahene-Gima (1993) defined marketing capabilities as a company's customer service, quality of sales force, strength and distribution of the networks, and its ability to perform market research. Vorhies and Harker (2000) also state various marketing capabilities that need to be developed by market-driven organizations. The one that is needed for the idea generation is market research. They define market research as " *the set of processes needed to discover broad based market information and to develop information about specific customer needs, and to design marketing programs to those needs and market conditions*" (Vorhies and Harker, 2000).

In order for the individuals to be able to perform market research and to build contacts with clients, it is essential to have the support of top management (Jaworski and Kohli, 1993). Enhancing the company's market orientation for idea generation requires building superior market sensing and customer linking capabilities (Day, 1994). This should not only be said, but should also be shown in action and time spent. This signals to employees commitment for innovation by putting the customers first (Ahmed, 1998).

Leadership of management is also needed to create a supporting culture that is innovation and customer focussed. According to Hurley and Hult (1998) market orientation is a source of ideas and therefore it promotes innovations. Leisen et al. (2002) say that market-orientations is a response derived from the culture. For a market driven company, creating superior customer value is the primary objective driving the formulation of the strategy (Day, 1994). This focus should also be found in the culture. Day (1994) defines a market-driven culture as " *a culture that supports the value of thorough market intelligence and the necessity of functionally coordinated actions directed at gaining a competitive advantage*". By having broadly shared values and assumptions about the market it is possible to act on the information in timely and consistent manner (Day, 1994). The other factors for culture described in chapter four are also applicable.

Hargadon and Douglas (2001) say that customer knowledge can reduce the risks of launching new products which increases the chances of success. However, companies producing complex products often need to be able to work in combination with other product suppliers so it is in everybody's interest to share information to reduce the risk of incompatibility (Garud and Kumaraswamy, 1993).

Customer knowledge also allows companies to anticipate certain actions by customer and design responses to keep or attract customers, improve channel relations, or prevent competitors from entering the market (Day 1994). This anticipatory capability is based on superiority in information gathering from the market and customer relationships.

In table 1 an overview is presented of the success factors needed for the idea generation phase when using a market driven product quality strategy. It is not attempted to provide an exhaustive list of possible capabilities that an organization might need for this strategy but rather to highlight the critical factors.

Table 1: Critical success factors for idea generation phase - product strategy 'the Listener'

Dimensions	Market driven product development strategy - 'the Listener'
Company characteristics	- Small or large organizations - Small or large markets (Domestic/Export) - Various industry sectors - Consumer or capital goods (complexity)
Strategy - Clear objectives/ goals - Alignment with innovation - Management support	Are driven by customer needs and satisfaction Connection between innovation strategy and business strategy Strong commitment, attention and support for generating ideas/ new product development.
Culture	Customer oriented culture based on trust and respect, collaboration, team spirit, flexibility and results driven
Structure - Organizational capability	Ability to adjust organization structure (flexibility) and to act quickly when opportunities occur (speed) Ability to build a high-quality idea generating process by centralizing resources resulting into: - Multi-disciplined team (marketing/sales/R&D/ manufacturing) - Cross-functional collaboration breaking down departmental barriers - Effective system of communication with information flows up and downwards - Emphasis on creative interaction
People	Ability to develop and deploy talented people with a positive commitment for customer satisfaction, superior performance and drive to improve based on: - Level of education (skills, competencies) - Business education (management/ entrepreneurship) - Managerial experience (willingness to take risk) - Industry experience Ability to develop effective inter-disciplinary teams
Available means - People/ Time/ Budget - Marketing capabilities	Ability to provide adequate resources of people, free time for projects and adequate funding with respect to idea generation. Ability to set up high quality marketing intelligence system and marketing information dissemination.
Networks - Market focused - Customer focused	Ability to scan the environment, analyze and understand the market focusing on: - Collecting information about market trends - Search for innovative ideas through market information - Knowledge about market segments - Knowledge of competitors Ability to establish long-term customer relationships for understanding diverse customer requirements and tracking customer satisfaction level.

Source: Ahmed (1998); Lukas and Ferrel (2000); Guan and Ma (2003); and Cooper and Kleinschmidt (2007)

6.3 R&D driven product strategy

There are however, also companies who choose not to focus on the market (Hunt and Morgan, 1995). These non-market orientated companies tend to rely on their in-house technical capabilities for developing ideas in order to fill the pipeline with new products. This leads to the second strategy which is a technology driven strategy.

6.3.1 The technology driver strategy

Companies that follow this strategy aim to make the organization a technological and market leader. The strategy is based on the concept of creating and launching as many breakthrough technologies as possible in the hope that some are received successfully by the market. These companies commit less time to finding out what customers want or need but tend to rely for generating product ideas on their own technological skills and on unarticulated customer needs. This usually happens in a special R&D facility where engineers are constantly trying new things.

6.3.2 Capabilities needed for idea generation

Companies that are technologically driven rely on their superior technological and engineering capabilities for their new products. According to Verona (1999) technological capabilities consist of R&D, Manufacturing, Design, and Technological complementarities. These factors are important drivers of product development outcome, but for the idea generation phase R&D is the main driver. For a more in depth understanding, the technological capabilities can be further broken down in the following three dimensions as mentioned by Gerybadze (1998): (1) the ability to identify technology trends, manage R&D projects and generate technologies; (2) the ability to design and produce new products or improve existing products; (3) ability to identify changing trends and to produce innovations. Customer needs are not ignored, but only play a relatively small part in product development within these organizations. Nonetheless, interaction between R&D, Design, Manufacturing and Marketing/ Sales needs to be encouraged and stimulated to share ideas and experiences. This cross-fertilization process can bring new ideas forward.

To stimulate the flow of ideas, an open and creative culture is needed. This means openness for new ideas, encouraging intrapreneurship, willingness to take risks on individual projects and providing time and resources to undertake these creative activities. According to Amabile (1998) a creative and innovative culture can be enhanced if it is supported by everyone in the organization.

To maintain a technological edge, it is essential that management is committed to achieving technological excellence and demonstrates this by investing heavily in both human and technological resources for their R&D team. Examples of these actions are hiring the best engineers and providing them with access to the best equipment and software available. The level of R&D expenditures, and the number and skill level of engineers, scientists and other technical personnel employed can be used as measures for technological capability.

According to Macpherson (1992), R&D is a key source of knowledge acquisition and is essential for innovation. Cohen and Levihnthal (1990) also found R&D to be key in creating new technological competencies and that this lead to support for making use of external knowledge. Belderbos et al. (2004) found something similar to this and said that the technological development within a company is influenced by its ability to attract external sources of knowledge such as knowledge from universities, research institutes or competitors. However, technological knowledge is different from scientific knowledge in respect to not much has been written down and is implicit in experience and skills (Dosi, 1984). This is why it is important to pay attention to tacit knowledge.

In table 2 an overview is presented of the success factors needed for the idea generation phase when using a R&D driven technology strategy.

Table 2: Critical success factors for idea generation phase - product strategy 'technology driver'

Dimensions	R&D driven product development strategy - 'Technology driver'
Company characteristics	- Small or large organizations - Small or large markets (Domestic/Export) - various industry sectors (High tech/ Pharma) - Consumer or capital goods (complexity)
Strategy - Clear objectives/ goals - Alignment with innovation - Management support	Having an explicit product innovation strategy which clearly defines the role and goals of new product development in the overall business strategy Relevance of R&D plan to the business strategy. Strong R&D commitment, involvement and support for generating ideas/ new product development, commitment to risk taking and accountability for new product results.
Culture	Open and creative oriented culture encouraging intrapreneurship; providing support (rewards, risk, tolerance, autonomy and expectance of failures without punishment); fostering the submission of new product ideas; and providing free time and resources to undertake creative activities.
Structure - Organizational capability	Ability to adjust organization structure (flexibility) and to act quickly when opportunities occur (speed) Ability to build a high-quality, rigorous new product process by centralizing resources resulting into: - Focus on in-house R&D - Properly resourced cross-functional teams with empowered leader (R&D, Marketing, Manufacturing and Engineering) - Knowledge generated through R&D is shared internally.
People	Ability to develop and deploy talented and creative people with a positive commitment to superior performance and passion for technological developments and opportunities based on: - Level of education (Engineering skills and competencies) - Managerial experience (willingness to take risk) - Industry experience Ability to develop effective cross-functional teams with empowered leadership.
Available means - People/ Time/ Budget - Technological capabilities	Ability to provide adequate resources of people, free time for projects and adequate R&D funding (R&D budget as % of sales) Ability to generate cumulative advanced technological know-how in specific directions being a key source of knowledge acquisition and ability to use latest technology and R&D equipment/ systems (R&D personnel as % of employment).

Table 2: Critical success factors for idea generation phase - product strategy 'technology driver'	
Networks - Third party focused	Ability to identify useful technologies from outside organizations, to build relationships with external interfaces and systematically monitor technology development trends. - Technical Universities/ Technical Colleges/ Research institutions/Industry associations/ Competitors
- Customer focused	Ability to capitalize on long term established relationships for understanding future customer needs.

Source: Ahmed (1998); Lukas and Ferrel (2000); Guan and Ma (2003); and Cooper and Kleinschmidt (2007)

6.4 Capability analysis

The capabilities for these two theoretical product strategies collectively represent the organization's idea generating capability enabling it to identify its innovation potential. Based on a review of the literature, eleven critical success factors have been identified for these two product strategies in order to be successful during the idea generating phase. However, in practice well-managed companies typically excel in as many as three to four of these critical capabilities while maintaining industry parity in the others (Ulrich and Smallwood, 2004). In other words it's better to excel at a few targeted critical capabilities than diffuse leadership energy over many. This means identifying which capabilities will have the most impact and be easiest to implement, and prioritizing accordingly. The remaining capabilities should still meet standard best practice. While focus and prioritizing are very important, it is also important to understand that capabilities have an interrelated impact on each other. As any capability improves, it will probably improve others in turn. Thus, a targeted critical capability should not be addressed on stand-alone basis, but rather in combination with the other most important ones (Ulrich and Smallwood, 2004).

Before discussing the differences in more detail, first the linkage between the dimensions Company characteristics and Strategy will be addressed. The primary business strategy of a company strongly depends on Company characteristics such as in which industry sector is the company active and what its position is within the value chain respectively in the horizontal or vertical chain as well as the distinction between a simple product (consumer good) and a complex product (capital good). Hobday (1998) argues that complex capital goods differ from mass produced consumer goods in that they tend to be made in small batches, are often tailor made for the client, and often require require several producers working together. User and supplier involvement are therefore the rule rather than the exception. He also says that organizations developing complex capital goods are often committed to a project based organization. These principle variables are important in determining the direction of the business strategy and results in many different available product strategies and corresponding company capability requirements that are important for the idea generating phase.

As discussed above the dimensions Company characteristics and Strategy determine to a large extent the required capabilities with respect to the dimensions People, Available means, Networks and Structure & Systems. Given the nature of the two selected product strategies, the capabilities

vary between the dimensions predominantly in the Human Resource area, marketing versus technological skills, competencies and know-how, internal versus external information gathering and networking, and organizational/ communication structure. In turn all these dimensions influence culture and an innovative climate. Therefore, Culture represents the core shared values and identity of a company and is the collective outcome of collective actions taken in the other dimensions.

6.5 Conclusion

This chapter set out to answer the sub question *Which innovative capabilities are needed during the idea generating phase of the product development process when using a certain product development strategy*? For two strategies, the market-driven 'the listener' and the R&D driven 'the technology driver', the innovative capabilities that are needed during the idea generation phase were examined. Based on literature, it can be concluded that different core capabilities are needed during the idea generation phase when following a market or technology driven strategy. For market-driven strategies the focal point of ideas are customers which means that the focus lies on marketing capabilities to be able to gather the information from and about customers. Technology driven strategies are focused on developing new technologies and focus for their ideas on their own technical capabilities. This means for the idea generation phase the focus will lie on the research element of R&D which requires a great deal of technical capabilities. Given the fact the selected product strategies are extreme, respectively market-driven versus technology-driven, these differences between the two strategies are primarily visible in the dimensions People, Available means and Networks. At the same time it is evident that there is no magic (standard) list of capabilities appropriate to every organization, but people always make the difference.

7 Methodology

7.1 Introduction

The previous chapters reviewed the relevant literature about NDP process, innovative capabilities, product strategies, and combined these three elements in chapter six to define specific capabilities for market and technology driven product development strategies. This chapter will provide a description of the research design, the data collection method, the quality, and the case selection.

7.2 Research design

For the empirical part of this research, a multi-case design was used in which two independent cases were reviewed. The study can be seen as descriptive and exploratory. The descriptive part is providing a description of the two companies product strategies, their NPD process and their innovation capabilities for idea generation phase. The exploratory research part is aimed at the exploration of the information gathered from the two cases which provides greater insight into the companies idea generation capabilities and can be used to create a diagnostic tool. These qualitative techniques were used to gather rich data on innovation capabilities and product strategies. This section will describe the research method and will justify its use.

7.2.1 Case study

There are many different forms of research method such as experiments, surveys, case studies, histories and archival analysis. For this research, the case study method has been chosen. A case study is an in-depth examination of a contemporary phenomenon within its real-life context (Yin, 2002; Babbie, 2004). An advantage of this method is that an in-depth analysis can be made but a disadvantage is that by using only a single or few case(s), there is no basis for a scientific generalization (Yin, 2002).

According to Yin (2002), the choice for a research method depends on a number of factors:

- the kind of research question,
- the control a researcher has over actual behavioral events,
- the focus on contemporary as opposed to historical phenomena.

These factors are summarized in table 3 where different research methodologies are compared.

7.2.2 Justification for case study

For this research, a choice was made for a case study approach. This can be justified based on two of the three factors. First of all, the subject focuses on contemporary phenomena because the research looks at the use of innovation strategies and innovation capabilities within existing companies. Secondly, the research is done within the company with management and the researcher has little or no control over behavioral events. In addition to this, Perry, Riege and Brown (1999),

mention that case study research also enables the researcher to better understand the interrelated categories that are being studied.

Table 3: Different research methodologies

Methodology	Kind of research question	Requires control of behavioral events	Focusses on contemporary events
Experiment	How, why?	Yes	Yes
Survey	Who,what, where, how many, how much?	No	No
Archival analysis	Who,what, where, how many, how much?	No	Yes/ no
History	How, why?	No	No
Case study	How, why?	No	Yes

Source: Yin (2002)

7.3 Data collection

According to Yin (2002) there are various sources of information when case study research is concerned. He names documents, archival records, interviews, direct observation, participant-observation, and physical artifacts. For this research, interviews and documents were used to collect the necessary data about the used product strategy and the innovative capabilities within the company.

Interviews

In depth interviews were held with managers directly concerned with innovative activities within the companies. Conducting in-depth interviews is a qualitative research technique that is useful for exploration purposes. The researcher's approach is very important and should be one of alert receptivity, and of seeking explanations rather than testing expectations (Yin, 2002). An open structured interview was chosen with a framework of themes. This way the respondents could talk freely about innovation without pushing them into a certain direction. Perry, Riege and Brown (1999) argue that by getting physically and psychologically closer to the phenomena by using interviews, the researcher can get a better understanding of the phenomena. However, it is not intended to use the collected data for generalizability but rather to confirm or disconfirm the theory (Perry, Riege and Brown, 1999).

In total three interviews were held within each of the companies. Interviews were held with the general manager and directors of R&D, and Marketing/ Sales. The interview started out with an introduction into the topic and discussing the relevance for the company after which the structure of the interview was discussed.

The questions were open ended and divided over different dimensions that had been pre-defined on the basis of the literature and on what had to be found out in the interviews. It was tried to keep the

structure of the interviews as open as possible to allow the respondents to talk freely about the different dimensions. The list of questions that was used can be found in appendix II.

Each interview was recorded which enabled the researcher to focus on the interview and not be distracted by the need to take notes. It also provides the opportunity to analyze the interview afterwards. Each interview had a duration of around one to two hours. After the interview with the R&D manager at both companies, a visit was made to the factory and R&D department to observe and gain an understanding of the company's production process.

Documents
Before visiting the company for the interview, an examination was made of the available documentation (websites, reports, media articles and so on) to obtain the necessary background information on their activities and products. Reports and presentations were also received during the visit to the company. It should be noted that this was not information of strategic importance.

7.4 Quality of the case studies

Validity
Validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept being studied (Babbie, 2004). In other words, am I in fact measuring what I intended to measure. Interviews were held with top level management who deal with innovation projects within their companies. In earlier studies it was found that senior level key informants with a high level of knowledge and involvement regarding the project, provide reliable, valid data on strategy and performance (Zahra and Covin, 1993). The assumption is made that those who are involved with a companies innovation activities are a valid source of information for innovation capability.

Reliability
Reliability is concerned with the findings of the research. When research findings can be repeated it is considered reliable. To be able to repeat the research reliably, it is important to minimize errors and biases so that if the same study was done again, it presents the same results (Yin, 2002). However, there are also researchers who criticize the reliability of case study research because of a lack of experimental control and for being to flexible (Sykes, 1991).

The information for the research was gathered as much as possible from a variety of sources associated with innovation activities within the company to avoid post hoc rationalization. When there were conflicting stories the person was re-interviewed via telephone. The case study results were then reviewed together with the company.

7.5 Case selection

For the empirical part of this research innovative companies had to be selected. The choice has been made for medium sized companies which means companies that have between 100 - 1000 employees. The choice for medium sized companies was made because very small firms were expected not to have the necessary resources to innovate on a constant basis (Felder et al., 1996) while larger organization have enough resources to invest in large scale R&D (Brouwer, 1997). Another argument for medium sized companies is that the literature does not provide a unanimous picture whether small or large companies are more innovative. The argument is followed ,made by Acs and Audretsch (1990), that in some industries small companies are more innovative while in other industries larger companies are the more successful innovators.

Companies were selected from the machinery/ equipment industry. This industry was chosen because research showed that in Oost- and Midden-Brabant innovations tended to come from industrial industries (Chamber of Commerce, 2007). ETIN (2007) performed research into the food sector of Oost- en Midden-Brabant. They also looked at related industries and found innovation to be relatively high for food related machine/equipment builders and that their innovations were mainly aimed at development and improvement of products/services, improvement of the production processes, and creating new markets.

Both companies that were chosen build machinery for the food industry and announced on their websites as being innovative. The companies were contacted by telephone to inform if they would be interested in participating in this research study. Both companies asked for more information which was provided to them by email. The companies that choose to participate in this study were:

Systemate Numafa B.V.
The first company that was investigated was Systemate Numafa B.V. which manufactures a full range of poultry processing systems. The company is located in Numansdorp and was founded in 1970 and has 350 employees worldwide. It grew to become one of only four companies worldwide to manufacture complete poultry processing systems. In 2006 all activities of Systemate Numafa B.V. were taken over by Meyn Holding B.V. including its R&D (Systemate.nl).

CSi Industries B.V.
The second company that was chosen was CSi industries B.V. which has more than 40 years of experience in material handling for the ‘Fast Moving Consumer Goods’ industry. CSi manufactures completely integrated logistical systems for material handling and product distribution with customers mainly in consumer goods and beverage industries. The company has around 300 employees worldwide (csiweb.nl).

8 Case study results and the diagnostic tool

8.1 Introduction

In this chapter the main findings of the empirical research will be discussed. Case studies were performed through company visits gathering information to further add to the literature review. These company visits and the interviews with management provided a useful insight on how innovation processes are applied in practice, in particular the idea generation phase. In the following paragraphs the main findings will be presented and the implications for the model are discussed. This will be followed by a description of the developed diagnostic tool.

8.2 Findings

Analysis of the two independent case studies, as presented in appendix III, reveals that the innovative capabilities needed for the idea generation phase per strategy show only minor variances with respect to attitude, substance, and proportionality, since both companies have recognized the importance of innovation. The differences are illustrated in table 4 on the following page.

The absence of major differences can be explained by looking at certain company characteristics. First of all the selected companies are both machine builders for the food and beverage industry and follow a product modification respectively a product quality strategy. It should be noted that there is no clear distinction between the two mentioned strategies, as a matter of fact both companies do follow a product modification strategy focused on quality. Both companies are customer-oriented (market-driven) since they develop and manufacture complex and capital intensive products for other companies in the food and beverage industry worldwide. This means that they do not supply products directly to consumers but Business-to-Business which subsequently narrows the market.

The second observation that can be made is company size. SMEs with limited financial and human resources who develop and manufacture complex and capital intensive machines for a relatively small number of potential customers can not afford to invest large amount in R&D. For these type of SMEs it does not make sense to develop new products on their own initiative with the risk that customer will not buy such a new product because it does not fit their needs. Consequently Business-to-Business SMEs are customer focused and depend for their ideas for a great deal on specific requirements and future needs from customers, and will then be further developed by R&D. Thus, the innovation process is user-producer driven.

It was also found that with respect to the dimensions Strategy, Culture, and Structure, both companies more or less used the same capabilities for each dimension applying standard best practice, whereas both companies try to excel in applying critical capabilities for the dimensions People, Networks and Available means. Both companies mentioned that people make the difference and that it is extremely important that the employees are strongly committed and passionate about

the product, which is in turn of great importance for the morale, culture, and company identity as well as being known as an attractive employer for new talented people. It is also worthwhile mentioning that both companies have a common threat namely that there is no retention system in place for critical tacit knowledge.

Table 4: Summarized findings of case studies

Innovative capabilities	Market driven Product modification strategy	Market driven Product quality strategy
	Systemate BV	**CSi Industries BV**
Company characteristics	- SME - machine builder - Food sector - Poultry processing - Slaughterhouses worldwide - Complex product/ system - Capital intensive - Business-to-Business - Primarily export - Owned by private equity	- SME - machine builder - Food and beverage industry - Processing & packaging and Distribution & warehousing - Top 50 fast moving consumer goods companies worldwide - Complex product/ system - Capital intensive - Business-to-Business - Domestic and export - Owned by management
Strategy	- Management support for innovation, but not incorporated in mission or strategy	- Innovation incorporated in mission and strategy
Culture	- Open and informal communication	- Open and informal communications
Structure	- Flexible and decentralized - Multi-functional teams - Implemented system to support idea generation (Roadmapping)	- Flexible and decentralization with short communication lines - Multi-functional teams - Ideation not clearly defined
People	- Dedicated sales staff with passion for product - Experienced R&D staff	- Dedicated sales and technological personnel with commitment for the product
Availability of means	- Sufficient financial resources - Sufficient human resources and time - Strong technological capabilities - Weak on electronics/ software - Small R&D unit (solution driven and design) - Defined R&D budget - No retention system for tacit knowledge	- Sufficient human resources and time - Cost of innovation paid by client - Small R&D unit (solution driven and design) - R&D budget not clearly defined - Technological resources are available - Strongly depends on creativity, knowledge, and expertise of technical director - No retention system for tacit knowledge
Networks	- Innovation process user-producer driven (customer specific requirements) - Limited contacts/ cooperation with third parties	- Innovation process user-producer driven (customer specific requirements) - Works closely with third parties (suppliers) - Partnership with Technical College

Source: the author

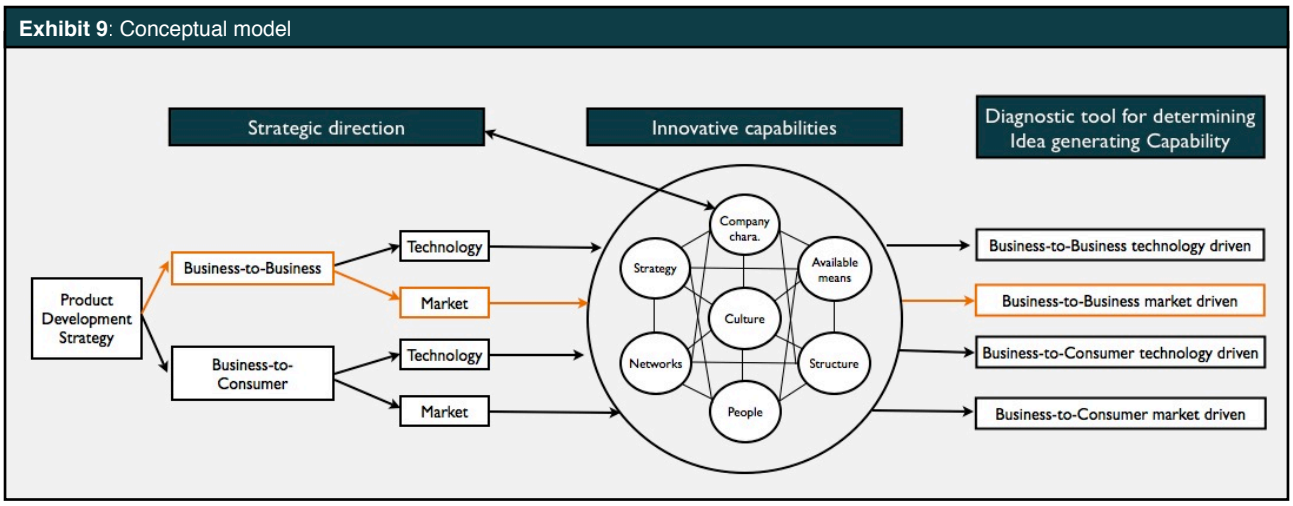
The most important findings derived from the two cases with relevance for the central question of this thesis are:

- The company's position and activity within the value chain in an industry sector, which is an important variable in determining the strategic direction and corresponding product development strategy having an impact on the required capabilities for the idea generation process.
- In a Business-to-Business environment product development is strongly customer driven (user-producer) as a result of product complexity.
- Innovations were predominately incremental aimed at product improvements or adjustments.

8.3 Impact on the model

In chapter four a conceptual model was presented and it was concluded that the seven dimensions relevant for the innovative capability are interrelated. From the findings, both from the literature and the two case studies, it can now also be concluded that company characteristics determine to a large extent the strategic direction having an impact on the composition of the required idea generating capability. In exhibit 9 a new conceptual model is presented taking into account these findings. The argumentation is that it does not add value to determine the idea generation capability for each product strategy mentioned in appendix I, since for example the required capabilities will not be much different for a product modification or a product quality strategy. However, the emphasis on each dimension could differ and consequently the idea generation capability could be marginally different due to proportionality rather than having a significant impact on the innovation potential. Therefore, in this new model a given product development strategy will end up in one of the four identified groups based on strategic direction in order to simplify the concept.

Exhibit 9: Conceptual model



Source: the author

Working of the model

The model starts with a given product development strategy. It is assumed that an SME currently has some kind of product development strategy. It must then be determined if the SME is orientated towards businesses or towards consumers. This will also give an indication in which industry sector

the company is active. Subsequently the next question to be answered is whether the company is technology or market orientated. With these factors as starting point, one of the four predefined capability diagnostic tools will be selected appropriate for the idea generation phase. One of these diagnostic tools will be discussed in paragraph 8.4. The other three will need to be developed at a later stage.

8.4 Diagnostic tool

Based on the literature review, the case studies, and the described model in the previous paragraph, a diagnostic tool has been developed for one of the strategic directions. This tool can be found in appendix IV. The tool determines the idea generating capability of a Business-to-Business, Market-driven organization whereas in practice earlier tools have mostly been focused at measuring the total innovative capability of a company. When looking at exhibit 9, the following route can be described if one of the companies from the case study is used. In the first case study it concerns a product modification strategy in a business-to-business environment and market (customer) driven. In particular, they build complex and capital intensive products/ systems that fulfill specific customer needs. It shows that for this case the *business-to-business market driven* diagnostic tool is needed to determine the idea generating capability of the organization.

The diagnostic tool is based on the seven dimensions with for each dimension predefined needed capabilities for a business-to-business market driven product development strategy. For the sub capabilities, a questionnaire developed by Koen and Kleinschmidt (2009) has been partly used and adjusted to meet the needs of the model. The tool consists of 54 sub capabilities divided as follows: Strategy 5; Culture 12; Structure 8; People 8; Available means 10; Networks 11.

Measurement of idea generation capability
The answers to the diagnostic sub capabilities are weighted on a scale of 1 to 5 whereby 5 is rated with strongly agree and has a positive effect on the idea generation capability and 1 is rated with strongly disagree and has a negative effect on the total score for idea generation capability. Adding up all the scores of the diagnostic sub capabilities results to a total score, which is of an ordinal nature (minimal score of 54[54*1] points and a maximum of 270 [54*5] points). The higher the score, the better the idea generating potential for innovation. It should be noted that since there is no benchmark, the total score only provides an indication of being on the right track and where there are opportunities for improvement.

Using model in practice
It is recommended that when using the diagnostic tool in practice, it be used by someone who is not biased. This person could be an objective researcher who will, based on interviews, fill in the diagnostic tool and determine the idea generating capability of the company. The researcher will then need to report to the company about the current state of their idea generating capability and advise them where extra attention and action is needed. The tool can not only be used to analyze the current situation but also to determine a future desired situation.

8.5 Conclusion

In this chapter the case study findings were discussed, the impact of these findings on the model was examined and a diagnostic tool was created. The most import findings derived from the two independent case studies were that in a business-to-business environment the product development is strongly customer driven, the innovations were mostly incremental, and that a company's position in the value chain within an industry is an important factor for the strategic direction. These findings, together with the earlier findings from the literature, lead to an adjustment in the model. In the new conceptual model, the product development strategies will end up in one of four identified groups based on strategic direction simplifying the conceptual model. As part of this model, a diagnostic tool was created incorporating the seven dimensions consisting of predefined capabilities for a business-to-business market driven product development strategy.

9 Conclusion

9.1 Introduction

This study aimed to find out if different product development strategies require different innovative capabilities for the idea generation phase of the product development process. The preceding chapters have provided information building up to answer the central question. It has been investigated which innovation processes there are, which innovation capabilities are needed for the idea generation phase, and specific capabilities have been identified for Market-driven and R&D driven product strategies. Two case studies were performed adding further input to these literature findings which resulted in a conceptual model and the creation of a diagnostic tool. This chapter concludes this thesis by providing an overview of the findings together with comments where appropriate. Additionally, the limitation of the research and recommendations for future research will be discussed.

9.2 Overview of the main findings

This thesis set out to answer the following research question:

Do different product strategies require different innovative capabilities during the search phase of the product development process?

Based on the literature review and the two case studies it can be concluded that the research question can be answered with: Yes, different product development strategies require different innovative capabilities for the idea generation phase. This will now be further explained by summarizing the findings from the literature review as well as the findings from the case studies.

With respect to the subquestion *What are the stages of the product development process?*, it can be concluded that there is a variety of models extensively dealing with the process of developing new products, but that all models do recognize the importance of the idea generation phase as a front-end homework activity before starting up actual product development.

With respect to the subquestion *Where do ideas come from and how can they be generated?*, the conclusion is that are various internal and external sources for information gathering available to generate new product ideas. It was also found that customers as well as employees are very important sources of ideas.

With respect to the subquestion *Which innovative capabilities are needed during the idea generation phase?*, a model developed by de Jong and Brouwer (1999) was selected and seven general dimensions (People, Culture, Structure, Strategy, Networks, Available means, and Company

characteristics) have been discussed in detail, since each dimension contains a range of capabilities required to be successful in increasing the idea generation power of a company. More importantly, these seven dimensions can also influence each other when factors within these dimensions change. For that reason companies should focus on optimizing the balance between these seven dimensions for a certain product development strategy, since in particular the dimension People can make or break an organization.

With respect to the subquestion *What are the main new product development strategies?*, it was found that there are numerous product strategies applicable in the marketplace. However, for the relevance of this study (the focus on idea generation) it can be concluded that most product development strategies tend to have either a market or a technology driven orientation. Accordingly, it is possible to categorize the variety of applied product strategies within these two strategic directions.

With respect to the subquestion *Which innovative capabilities are needed during the idea generating phase of the product development process when using a certain product development strategy?*, it can be concluded from literature that different core capabilities are needed during the idea generation phase when following a market or technology driven strategy. When following a market-driven strategy (the Listener) the focal point of ideas are customers which means that the focus lies on marketing capabilities to be able to gather information from and about customers. On the contrary, following a R&D driven strategy (technology driver) the focus is on developing new technologies and capitalize on their own technical capabilities for new ideas. At the same time it is evident that there is no standard list of 'magic' capabilities appropriate for every organization, but that people always make the difference.

From a theoretical perspective this last subquestion provides a positive answer to the main research question by showing that a market-driven Listener strategy requires different capabilities during the idea generation phase than an R&D driven technology driver strategy. The findings derived from two independent case studies also provided input for this conclusion. The most important findings were that in a business-to-business environment the product development is strongly customer driven, the innovations were mostly incremental and that a company's position in the value chain within an industry is an important factor for the strategic direction.

Based on this conclusion together with the other findings from the literature, it was possible to develop a new diagnostic tool for SMEs thereby achieving the goal set for this thesis.

The practical relevance of this tool is that it can be used by management of SMEs who want to identify in their company which innovative capabilities are available for the idea generation phase of the product development process when choosing a certain product development strategy and how they should be used to get the most out of them in an optimal way. Subsequently, they can then start

improving their idea generating activities by using the right balanced set of capabilities for a certain product strategy in an effective and efficient way.

9.3 Limitations of the research

There are several limitations to this research. First of all, this research only addresses the idea generation phase of the NPD process. Secondly, various product strategies were described but it was not mentioned why a certain strategy is applicable. In addition, only two case studies were used for the case study, which is not enough to make generalizations and to assess the validity and reliability statistically. Furthermore, only three people were interviewed for a limited amount of time at each of the companies. It should also be noted that the interviews rely for a great deal on managers perceptions and recollections of innovation activities. The final limitation that can be mentioned is that both cases were industrial product manufacturers. This means no difference was made between consumer and industrial product practices and finally the difference between radical and incremental innovations, between durables and nondurables, between products and services, etc. was not explored. Therefore, this research should be considered a pilot study.

9.4 Future research

Further qualitative and quantitative research is needed to obtain a better understanding of the use of innovative capabilities with different product strategies. In this paragraph some recommendations are made for future research.

- Future research should focus on the whole NPD process and clearly describe the various capabilities for each phase for each product strategy,
- the developed diagnostic tool should be further tested in practice, with a number of SMEs from various industry sectors,
- the remaining three diagnostic tools should be developed and tested,
- future research should make a distinction between consumer goods and industrial goods, to see if there is a difference between the capabilities needed when using a certain product strategy.

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Company websites

- www.systemate.nl
- www.csiweb.nl

Appendices

Appendix I : **Overview of product strategies**
Appendix II: **Interview guide**
Appendix III: **Case Studies**
Appendix IV: **Diagnostic tool**

Appendix I : Overview of product strategies

The following table presents an overview of various product strategies summarized by Rogers (2001).

Table: Overview of product strategies

Product strategy	Description
Speed to market strategies	
Pioneer (or first to market) strategy	Offer a product that no other company does, or offer it before anyone else does.
Early in strategy	Offer what the first to market strategy company offers soon after they introduce their product. This strategy focuses on early adopters and the early majority.
Late entry strategy (or follower) strategy	Wait to see what works and get into the marketplace after the dust has settled. Offering of this type are called “me-too products.” This strategy has been broken down into four subcategories which relate to competitive strategies:
- Counterfeit strategy (illegal)	Duplicates the leading product in every detail and is sold on the black market.
- Clone strategy	Imitates the leading product but introduces slight variations in design and packaging.
- Imitation strategy	Copies several features but has different strategies for pricing, packaging, advertising, and promotion.
- Benchmarking strategy	Evaluate the best products on the market and copy the most important features.
- Adaptation strategy	Picks up the general idea but improves the product, often moves into different markets, and becomes a future challenger.
Improvement strategies or new product strategies	
New product strategy	There are three choices: improve or modify your existing product, imitate competition (perhaps by offering features touted by your competitor), or develop a totally new product. The word “new” can be used to describe a product only for its first six months of distribution.
Up-market stretch strategy	A mid-range product may reach for a more affluent market segment by introducing a prestige brand with improved quality, added features, and or increased price.
Line extension strategy	Use your existing known brand name on a new product in the same general product category, often to enter a new market segment. This usually works best if the new product is in the same category as the old one.
Product modification strategy	Alter characteristics such as performance, reliability, or appearance of an existing product to make it more appealing.
Product adaptation strategy	Alter your product to meet conditions or preferences of your existing markets.
Differentiation focus (or product differentiation) strategy	Use significant points of difference in your product to appeal to one or more special market segments.
Just-noticeable difference strategy	A form of differentiation strategy wherein you create one aspect of the product that will set it apart from competition in the eyes of the customer.

Product strategy	Description
Postponed obsolescence strategy	When technological improvements to products could be made, but are not made until the demand for existing products declines.
Augmentation strategy	Add features to your product that competitive products don't offer. These add-ons, of course, should satisfy customer and prospects needs or potential desires.
Continuous innovation strategy	Usually reserved for industry leaders, this means that the company concentrates on developing new products and improving services, distribution, and pricing.
Dynamically continuous innovation strategy	Develop products that disrupt the consumer's normal routine, but do not require totally new behaviors.
Discontinuous innovation strategy	Involves the development of new products that require entirely new consumption patterns.
Forward invention strategy	Create a new product to satisfy new or unmet needs.
New-uses strategy	Increase consumption by developing new ways to use your product.
Gap-filler (or line-filler) strategy	Develop products that fill empty places in your product or service line.
Quality, Reliability,Robustness	
Total quality management (TQM or quality) strategy	Produce a product of the highest quality you reasonably and affordably can. this strategy is dependent on continuous measurement, and is generally not recommended for companies seeking government contracts, where low price normally beats high quality.
Value strategy	Aim at total customer satisfaction with regard with regard to the perceived value of your products.
Prestige strategy	Offer a significantly better product at a significantly higher price. This is also related to pricing strategies.
Collaborative strategies	
Licensing strategy	Allow other companies to manufacture and market products with your established brand name. It is important that you maintain control of product quality to assure continued respect for your brand name.
Joint venture strategy	Work with another company with regard to manufacturing and marketing your products.
Partner-supplier strategy	Instead of relying on many suppliers, develop close relationships with a few reliable ones. This normally relates to obtaining materials for production.
Outsourcing strategy	Really a manufacturing strategy, but related to marketing insofar as better products may be produced at lower cost when produced by or obtained from sources outside the company.
Product performance strategies	
Positioning strategy	Try to set one or more of your products apart from your competition as unique in the minds of your target market individuals.
Technology driver strategy	Akin to positioning, in that you develop an image for your organization as a new product innovator.
Repositioning strategy	Develop a new position for your product based on quality, design, price, or some other factor.

Product strategy	Description
Scope strategy	Take your pick of offering a single product, limited variety of products, or a system of products. This strategy is akin to positioning in that you are perceived as offering something special to special customers.
Design strategy	Choose from three possibilities: a standard product to suit a broad market segment, a basic product modified to suit special customers, or a fully customized product to compete with companies that offer only standard or slightly modified products.
Service strategy	
Service strategy	Link your product with reliable and needed services.

Source: Rogers (2001)

Appendix II : Interview guide

The following interview guide was used for all interviews carried out during the case studies.

Questions
Strategie
Hoe zou u de huidige strategie van uw bedrijf kunnen beschrijven? *(Cost-based, product differentiatie, niche, growth-based, survival, innovative ect.)*
Heeft het bedrijf een specifieke product innovatie strategie? Wat kunt u daarover vertellen?
Wordt de strategie, missie, visie en het belang van innovatie naar de medewerkers gecommuniceerd?
Innovatie
Wat is de noodzaak van innovatie voor uw bedrijf?
Hoe bent u betrokken bij innovatie?
Hoe ziet product innovatie proces er binnen uw bedrijf uit?
Welke succes factoren zijn voor innovatie van belang voor het bedrijf? Zijn deze verschillend per fase van het innovatie proces? *- technologie* *- leiderschap* *- mensen* *- kennis en vaardigheden* *- strategie* *- enz.*
Wat ziet u als een blokkade voor innovatie? Hoe probeert het bedrijf deze te voorkomen? *- gebrek aan tijd* *- gebrek aan financiën* *- gebrek aan gekwalificeerd personeel* *- regelgeving overheid* *- enz.*
Welke rollen zijn er te benoemen in het innovatie team? (team leider, gate keeper enz.) Wordt de team samenstelling per fase tegen het licht gehouden en waar nodig, rollen en/of invullen van rollen aangepast?
Idea generation
Welke processen zijn er te benoemen bij het genereren van ideeën?
Welke methoden worden gebruikt bij het verzamelen van ideeën?
Hoe gaat het bedrijf opzoek naar mogelijke ‘opportunities’? (customer surveys, market research enz)
Welke succes factoren zijn hier te benoemen?
Wat zijn belemmeringen?
Hoe beheersen jullie dit? *(Goed - niet goed)*
Human Resources

Hoe effectief is het human resources gedeelte in het ondersteunen van innovatie?
- *Recruitment and retention*
- *opleidingen en training*
- *beloning en erkenning*
- *autonomie en empowerment*
- *performance measurement*

Welke eigenschappen van mensen ondersteunen innovatie?
- *Doelbetrokkenheid*
- *ondernemerschap*
- *vindingrijkheid/ creativiteit*
- *kennis/ vaardigheden*

Structuur en systemen

Wat zijn de structuurkenmerken van uw organisatie mbt
- *Regels en procedures (richt op routine of vernieuwing)*
- *Management lagen (weinig of veel)*
- *Besluitvorming (autoritair of participatief)*
- *Multifunctionele teams*
- *Job rotation*
- *Interne communicatie (open, formeel, hiërarchisch)*
- *Taken uitdagend en afwisselend*
- *Veel autonomie*
- *Beloning innovatief gedrag (extrinsiek vs intrinsiek)*
- *Is kennisontwikkeling ingebed in personeelsinstrumenten zoals: functie beschrijvingen, beloningssystemen en opleidingsplan?*

Cultuur en klimaat

Hoe zou u de huidige cultuur binnen de organisatie beschrijven?

Wat zijn volgen u de succes factoren voor cultuur om innovatie te ondersteunen ?
- *management toegewijd aan innovatie*
- *open staan voor ideeën*
- *omgaan met fouten*
- *nemen van risico*
- *goede samenwerking tussen de afdelingen*
- *bereidheid tot delen van informatie*
- *ondernemerschap*

Welke factoren binnen de cultuur belemmeren volgens u innovatie?

Netwerk activiteiten

Met welke bedrijven en /of kennisinstellingen wordt samengewerkt bij innovatie en wat is de geografische spreiding van deze bedrijven/ instellingen?
- *klanten/ leveranciers enz.*
- *joint ventures, strategische allianties, M&A*
- *universiteiten/ andere onderzoeksbureaus*

Wordt er kennis gedeeld met anderen buiten het bedrijf?

Van welke ondersteuningskanalen maakt uw bedrijf gebruik bij innovatie?

Overige

Beschikbare middelen (tijd, geld, technologie, mensen)

Bedrijfskarakteristieken (size, locatie, complexiteit product)

Appendix III Case Studies

Case 1: Systemate Numafa BV

The information used to describe this case study was gathered by interviewing the following people:

- **Hans Tieleman** - *General manager Poultry Processing Systems*
- **Jacques Kramp** - *Sales Director Poultry Processing Systems*
- **Wim Steenbergen** - *Head of R&D Poultry Processing Systems*

Company profile

Systemate Numafa B.V. manufactures a full range of poultry processing systems and is located in Numansdorp. The company was founded in 1970 and has 350 employees worldwide. It has grown to become one of only four companies in the world to manufacture complete poultry processing systems. The others are Meyn Holding, Stork Food, and Linco Food. In 2006, all activities of Systemate Numafa BV were taken over by Meyn Holding BV. Since then the Systemate Numafa/ Meyn combination continue their activities side by side; two organizations, supporting two brands with a sales volume of 225 million euro and 1000 employees. Meyn and Stork Food aim at the high end segment while Systemate and Linco Food are more focussed on the lower end segments.

Products

Many years ago someone came up with the idea to automate the process of slaughtering chickens. This process and the functions of these machines have not changed much throughout the years and Systemate has a variety of machines dealing with this process in their product portfolio. They build forth on these machines and further improve them, resulting in the machines to run faster, be more efficient, creating a higher yield, be computer driven, and so forth.

Their products are aimed to automate the process of slaughtering chickens and increasing productivity by using as less people as possible in that process and to generate the highest yield from the chickens. This means getting as much meat from the chicken as possible. The process is not solely aimed at a whole chicken but also at cutting the chicken into pieces which creates a certain added value. A chicken can be sold as a whole for six euros while a chicken can also be cut into different pieces and packaged and sold separately which results in the revenue of that chicken being three times higher.

Market

The market in which Systemate operates is very small. There are only a few competitors and only a small number of customers who buy these machines. This combination leads to a competitive environment which means the company can not stand still. On the one hand products need to be constantly improved and on the other hand new products need to be developed. If they fail to do so, the competitor will do it and a customer might be lost and in this market not many new customers will emerge. Only in regions were there are few chicken slaughterhouses growth is possible such as

in India. China and Russia are coming along nicely but in all other regions Systemate claims to know all of its potential customers, give or take a few.

Strategy

Systemates' overall strategy is keeping price and costs low while offering standard quality rather than total quality in their products. Nonetheless, quality is important because the cost of dealing with malfunctioning machines is very high. The goal of their product is to slaughter as many chickens as possible and to get a maximum yield from a chicken with a minimum of technical problems. Their product strategy can be described as a market driven product modification strategy because they mostly alter the characteristics of their existing products such as performance, reliability, chicken yield, or eliminate manning from the process to make the product more appealing for the customers.

Product development process

Before Systemate was taken over by Meyn it did not have a formal process for innovation. In the current situation they do. In this section a brief description will be given of this process.
Meyn and Systemate's NPD process is based on Coopers' Stage Gate model and has an ideation stage, a creative R&D stage, a definition stage, and a product control stage.

Ideation

The process starts with an idea. These ideas can come from the market or the organization. In 90 percent of all cases, the ideas come from the market in the form of questions about a particular product. For example, a customer can deliver a certain chicken product to a supermarket and needs a machine to be able to produce this. This question is received by Sales. Ideas can also come from Sales, R&D, and Mechanics who all visit clients. During these visits opportunities can present themselves. By looking around how different clients operate and observing where a lot of people are standing during the process, can possibly trigger an idea for a machine. Moreover, it is difficult to develop machines without certain specifications from customers. Systemate is a supplier of chicken slaughtering machines. Their customers are slaughterhouses and their customers are the supermarkets and their customers are the consumers. So if Systemate develops a brand new machine, the slaughterhouse must be able to sell its product to the supermarket and the supermarket must be able to sell it to the consumer. If one of the players in the chain can not sell it to its customers, the new machine will not be sold.

The idea proposition is then presented to the Technical Commission (multifunctional team consisting of people from Sales, R&D and Services). They ask a set of questions such as: do we have a machine that can perform what is being asked? If the answer is yes, they can build the machine. If the answer is no, the next question can be asked: do we have a machine that can be slightly modified to be able to achieve what is being asked? If the answer is again no, then two things need to be done. The first thing the idea owner together with product management must do is initiate a 'project letter' and the second thing is writing a business case. (market research and feasibility study). These two documents should show what the customer wants to do with the

machine but most importantly what the size of the market will be for that machine, can it be sold worldwide or only regionally?, how many can we sell?, does the competitor already have such a machine?, what kind of cost reductions will this proposed machine realize? what should such a machine cost and for what price can we sell it?
The product manager will then submit the 'project letter' and 'business case' to the Innovation Board Operational (IBO). This is a multifunctional team made up of individuals from R&D, Sales and Marketing departments who determine the chances of success and perform a risk analysis for this project. A deadline is often set because now a certain need is signaled but this need might not be there when the machine is completed. Next the IBO submit the documents to the Innovation Board Strategic (IBS) which is made up out of top management members. They decide if a project can start based on the presented documents. Deciding factors are revenue and the yield. This happens for new products and for drastic changes to existing products. If the IBS says 'GO' the project goes ahead and moves to R&D. If they decide against the project, the process ends.

Creative
R&D Creative receives the documents with the specifications of the kind of machine that needs to be build. This project is then assigned to a project team. The size of these teams depends on the machine that needs to be developed but most often the team consists of two to four people. Before they start, a brainstorm session is held to exchange ideas about the project. This can also be done together with R&D personnel from Meyn in case they are working on a similar project. They start with an existing machine or an old prototype and rebuild it to get to a starting point. There are certain technical steps that are followed in this stage which will not be discussed. After a beta design is finished it will be tested in a slaughterhouse. The test findings are compared with the specifications that were described in the project letter. If they match and the machine is technically ready the project will be transferred to the next stage, Definition. If the findings do not match the machine is further developed and tested. Each project within the creative stage is supervised by a program manager.

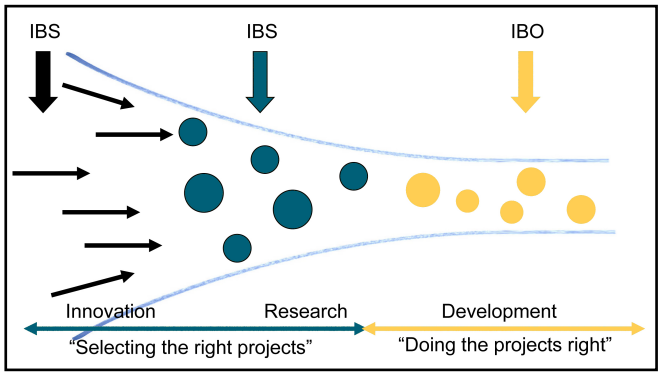
Definition
In this stage the technical drawings, manuals ect. are developed. The creative stage is not time bound but the definition stage is. This is because a release plan needs to be set up. During this stage a senior engineer keeps the overview.

Product Control
In this stage the final checks are performed before releasing the machine from R&D back to the entire organization. A launch gathering is held with various groups of people from within the company. The machine is explained in detail to the attendees and input is welcomed. People from manufacturing can have an idea for something that might have been overlooked. Often these things have to do with the manufacturing process and how it might be shortened (Process improvements). This get together is done with the intention to involve the people and to create more awareness for R&D.

IBS -IBO

The IBS makes sure the company selects the right projects. They focus on the strategic fit and project rationale. The IBO makes sure the company does the project right. They focus on the project execution. During the process there are four decision points for IBS to determine whether to continue with the project or not (Exhibit I).

Exhibit I: R&D funnel



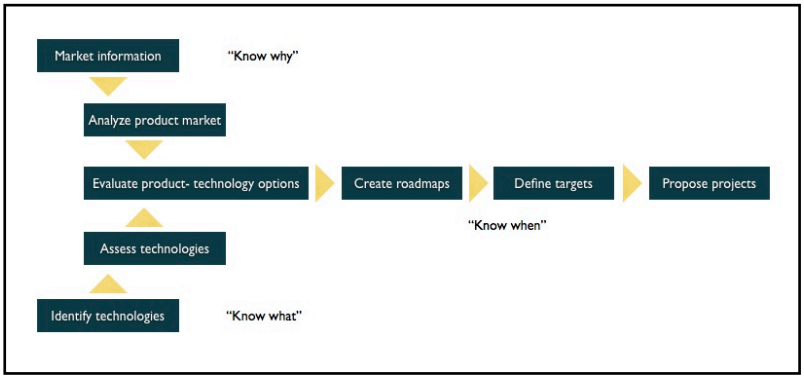
Source: Meyn Holding B.V.

Idea generation phase

In the ideation section above the ideas are gathered responding to a need from a customer. However, Meyn and Systemate recognize the need to fill the product development pipeline with market-driven projects and to have a longer term view without getting caught up in today's problems so Meyn is currently introducing a roadmapping technique to proactively listening to the voice of the customers, which is the most important source of ideas (Exhibit II). Systemate will also profit form this and eventually implement a similar model. By using roadmapping they try to obtain information from the customer by answering four questions:

- What are the customer needs?
- What products and services will fulfill these needs?
- Which technologies, know-how and competences are necessary to realize these products and services?
- When do our customers need these products and services?

Exhibit II: Roadmapping process at Meyn



Source: Meyn Holding B.V.

They describe two roadmaps: an issue roadmap and a cluster roadmap. They start by setting up an issue roadmap which identifies *market trends, regulation trends, and opportunities*. These trends and market developments need to be divided per market segment and assessed for market potential. Next these issues need to be turned into cluster roadmaps which identify *products, required technology, required know-how, and the weaknesses in the organization or skill-set.*

How it works?
Team - The departments working on this are Meyn R&D, Meyn Sales, Meyn Product Management, and an external consultant. Eventually, an innovation manager will take on these tasks.

Preparation - The first thing that needs to be done is set up an interview guide with a multidisciplinary team. Then different customers need to be selected. For the first roadmap, customers were chosen that carried mainly their own products, customers that mainly bought the competitors products, and it was a mix of small and large customers. Next the interviews need to be organized with people in different functions. It is crucial that you interview the right people.

Interviews - The interviews were done by external consultants. This way the customer could not go into discussion with the company about their current products. The interview team consists of an interviewer, observer, and a scribe. They used open questions and tried to find root problems by discussing issues, challenges, and the vision for the poultry industry. These customer responses were then turned into issue roadmaps, which were subsequently turned into cluster roadmaps.

Capabilities supporting innovation

People

Management
Innovation is supported by both the management of Meyn and Systemate. They see innovation as the basis for an ongoing close relationship with their customers and continue to invest time, energy and financial resources in the development process. Management wants the innovations to be practical, while meeting existing and future market requirements. The focus is more on improving or modifying the existing products than on developing totally new products. Existing products need to be improved because of certain restrictions that they might have which leads to less sales.

Employee characteristics
Employees should have an entrepreneurial spirit. They must be able to look past certain things to make the difference. If Sales employees, R&D employees or Mechanics walk into a clients slaughterhouse they should be alert of opportunities that might arise. They should be eager to know why the client works a certain way and not another way and the interest in how things work are of great value. This has to do with being able to identify oneself with the customer which requires experience. One week you might be with a client who works a certain way, while the next week one will be with a client who works another way. People need to take initiative to find out why they

work differently. Is there a possibility for a new machine somewhere? Everyone who visits clients should be aware of this.

People need to be passionate about the product they develop, make or sell and about chickens. A Sales person should be extrovert and able to express himself to transfer this passion for the product to the client. It was mentioned that it is often more difficult to sell the product to the Sales department than to the actual customer if the idea did not originate from them. They need to be committed to the products. For R&D, creative, technical individuals are needed because they have to be able to build something out of the blue. Also they should have perseverance because the job requires being able to work on something for a while and then throw half of it away because they come to the conclusion it does not work. Taking risks is part of being R&D. You have to try things that might fail but it is necessary to come to the final product.

Skills competencies and learning

Having practical knowledge about the product with which one works is also very important. When working with chickens the anatomy is always different. No two chickens are the same. Experience is the most important source of knowledge for the R&D employees at the creative stage. They have worked with the existing machines for years and have gained critical knowledge. Many R&D employees are former mechanics who used to install and fix these machines. They know what has been tried before and what will work or not work. All from experience.

Most employees of the Sales force also have lots of experience gained from working in this industry. They know about the market, clients, and have knowledge about machines. When visiting a client, a sales person can do two things. He can either sit in the clients office and walk through the quotation and that's it or he can do that but also ask to visit the slaughterhouse and walk around to see how they do things. Where are a lot of people standing? Is it possible to automate that task? This is stimulated by constantly hammering on the importance of doing this. Go into the slaughterhouse, talk to people, and look around. Sometimes it is not permitted to do this but in most cases permission is given. The definition stage requires people with technical backgrounds in the form of engineers. Skills that are needed is being able to make technical drawing, write manuals, make production drawings ect.

Strategy

Systemate does not have the word innovation explicitly formulated in their strategy. However, they do focus on improving the machines speed, the yield, and on less technical problems which can be seen as innovations. As was mentioned earlier, Systemate focusses more on improving and adjusting existing products than on radical new products because the product they work with is chicken related. There is only so much that one can do with a chicken.

Performance improvement is also incorporated in the mission statement. Again no clear mention of innovation but improving performance requires innovation. The mission and vision of the company are not communicated to the employees. Most of the employees have been with the company for

many years and are aware of the fact that Systemates' goal is to keep costs low which allows the products to be kept as cheap as possible in order to protect certain margins and to stay competitive. The need to constantly improve products and the importance of innovation is communicated but not by way of posters or banners or special gatherings but by use of the company's magazine that is released six times a year. This magazine provides a platform to inform employees about new R&D projects, sales of new machines or what the company is working on. It also provides an opportunity for department heads to place articles about innovation/ product development.

Culture

The company culture is described as being open and informal. Different departments communicate with each other in an informal way and there are no barriers for talking to a superior.

Willingness to share ideas

The cooperation between the sales department and the R&D department is described as being excellent. It is realized that R&D every now and then needs to get feedback. Sometimes it happens that a R&D employee is totally stuck and can not continue. In this case feedback can be given by other R&D employees or the supervisor but these individuals are also from the R&D department. Sometimes it can be helpful to talk to someone from Sales. Sales people pop into R&D at least once or twice a day. They ask how things are going? , what they are working on? and such things. This way Sales shows involvement and interest in the project which they brought forward. R&D are open to new ideas from others including Sales which is partly due to the fact that most of the Sales force has a lot of experience.

Trust

Systemate is a small company which brings with it close contacts between people. Most of the people know each other which enhances the feeling of trust. The philosophy of management is to put the responsibility as low as possible within the organization. By doing this most employees can give their own interpretation to their job as long as the results are excellent and the costs are kept under control. One can of course think of disaster scenarios in which this does not apply but overall the employees have a lot of freedom. People are encouraged to help find solutions to problems and employees who are on the road also have to make decisions on their own.

View on mistakes

Mistakes have to be accepted if you want to move forward as a company. By acknowledging the fact that people make mistakes and by showing people that it is accepted to do so, they will come forward much sooner which enables the company to deal with these mistakes sooner. Also, if leadership constantly points out mistakes and makes a big deal out of it, employees will not be willing to try new things. One should not try to create rules and procedures for problems if something goes wrong. You should accept that from time to time things might not go according to plan. From a sales perspective mistakes are never welcomed because the cost of the machine is important but mistakes are needed to develop great products.

Structure

The structure can be described as organic because it is characterized by informality and flexibility, decentralization of authority, horizontal communications, openness to sharing ideas, and loosely defined tasks. Some of these factors will be further highlighted while others have been described in the culture section.

Decentralization of authority

Systemate is a small company which results in a flat structure. The director is appointed by Meyn and is responsible for the manufacturing process. Next in line are the heads of departments such as R&D, Sales, Engineering, Human Resources ect. Some of these department heads report to the directors of these departments at Meyn. The company has few management layers and employees have direct communication links to decision makers.

Systemate put the responsibility as low as possible in the organization. People operate within a certain range within which they can make decisions. If they go outside of this range a superior needs to be consulted.

For R&D it is also important to have someone who can say this project is not going anywhere, end it. This is often signaled by the R&D employees themselves and reported to the supervisor. He in turn contacts then the head of R&D at Meyn who officially stops the project.

De-standardization

During the creative R&D stage there are limited rules and procedures.

Job rotation

The company does not make use of job rotation. It does not make sense to put a sales person in a R&D department. Very different skill sets are needed for these jobs. Sales people do however walk into the R&D department and talk with R&D about ideas. Rotating sales people by region is also not being done. The argument for this is, is that it is difficult to place a sales person in a different region after ten years because dilution of knowledge can happen very quickly. The same can be said for mechanics. Some mechanics have a certain feeling with a particular region and another factor is that some mechanics can be sent to some regions but not to another region. For example, senior mechanics are needed for Asia because in their culture older people are wiser.

Within the R&D department if a person has always developed a certain type of machine it will be difficult to transfer that person to another machine. The person has a lot of specific knowledge which will then be diluted. Depending on the kind of machine that needs to be developed a R&D man is selected. If a cutting machine needs to be developed, a person with cutting machines experience will be chosen. If a weighing machine is needed, a person with weighing experience is needed.

Reward systems

There is an idea/ suggestion box in which individuals can deposit ideas. Everyone can do this but history has shown that these are usually technical ideas/ suggestions. These ideas/ suggestions are

reviewed by the technical commission and evaluated from a cost reduction perspective. Based on this evaluation there is a table method to determine the amount of the reward for the person who brought the idea forward.
Within R&D there are no special reward structures for developing or improving a machine. It is the R&D employees' job for which they are paid. It is however, important to give them a pat on the back and tell them that they are doing a great job. R&D people are constantly working on projects and often by themselves. This verbal stimulus is often more effective than a financial bonus. It is also mentioned that it is difficult to say that a product is finished. A machine might work well for one customer but might not function properly for another customer. However, they do receive non financial incentives. R&D employees who developed a certain machine are mentioned in the patent (company is patent owner) and they get to travel, together with sales and the mechanics who have to install the machine, to clients all over the world. This way they get a chance to see the machine that they developed in a working state in a real life situation. This gives them a certain sense of recognition and they get to visit different countries.

Multi functional teams
Both Meyn and Systemate work with multifunctional teams. The IBS, IBO, and Technical commission are all teams made up out of different functions from different departments.

Availability of means

Time
R&D employees work full time on developing new machines. However, this is always done from the specifications given in the project letter. Sometimes a small machine might be developed because they run into something while building a larger machine but in general larger machines are not build without a formal and approved request.

Technological capabilities
Systemate has strong capabilities for dealing with metals and synthetic materials but when it comes to electronics or software the capabilities are mediocre. External assistance is often required. The problem is that this is often only realized when the project has already started or that it turns out to be more difficult than anticipated.

There is no system in place to store specific and valuable knowledge. Most of the knowledge about these machines is incapsulated in the mind of the individuals. Transferring tacit knowledge is difficult. This is a problem that many companies face. When an employee retires, a lot of knowledge leaves the company. In addition, they have years of experience but this is difficult to transfer because not everybody is a teacher. They are not pro-active in teaching but if someone asks them a question they will answer. It does not mean that they are not connected to the company because they are motivated until the last day. It has more to do with the training and coaching skills of the individuals. It is not that people are willingly holding back information but more that there is no instrument/ tool to store that knowledge. This weakness should be addressed because keeping

criterial knowledge within the organization is of great importance to the innovative capability of the company.

Currently Systemate holds 80 active patents and receives 3 or 4 new ones for machines every year. Applying for a patent is an expensive process so before applying for it, it is closely studied whether it is worth it because there is no certainty that you will be awarded the patent.

Financial resources
The Meyn/ Systemate budget for R&D is nine million euros which is 4% of total revenue. They also qualify and receive wage subsidies for innovative activities.

Creative thinking techniques
Brainstorming is used when the project letter first arrives at the R&D department. The team discusses the possibilities for developing a machine.

Education and training programs
Systemate's parent company Meyn has an education centre. It has a wide variety of training programs which are available for all employees. For all specialties there are training courses such as service mechanic, project management, various sales courses, ect. In addition to this, employees can also bring forward a training course they might have found somewhere else and would like to follow. It is self-evident, that arguments should be presented as to why this course is necessary for there work. A worker behind a workbench does not need to learn Spanish but a mechanic who travels a lot to Russia can follow a course to learn Russian enabling him to better communicate with the client.

R&D employees do not follow many training courses. Some who are good at working with metal but less in working with electronics, follow an electronics course and vice versa. It can also be a training that supports them in performing their jobs.

Network

Working with clients
As was mentioned earlier, customers state a need for a certain kind of machine. They want to do something and need a machine to do it. This 'need' forms the idea for a machine. However the customer, does not have any idea of what this machine might look like and are not involved in designing the machine. It is up to R&D to come up with a concept and build a machine that can fulfill that customer need. Sometimes it does happen but it depends on the kind of product and the customer. For example: Tyson, a large producer of chicken products in the US, has its own R&D. If they come to Systemate with something, they work together to find a solution.

Using a roadmapping technique, information about the customer is gathered and an issue roadmap is developed which identifies market trends, regulation trends, and opportunities. This roamapping tool was discussed in the section about idea generation.

Working with other companies
Systemate has access to two slaughterhouses where they can test a prototype machine. During this testing, employees of the slaughterhouse can have suggestions about improving the machine. They are however not consulted before hand.

Sometimes Systemate also works with suppliers. An example of a partnership is with the company DVC in Breda. This is a company that develops vision systems. Systemate uses the camera in there machines for screening the chickens to check for damaged wings or spots. If Systemate wants to keep control it can license the product or pay royalties for the use of patents.

Working with universities and other institutions
Incidentally, knowledge is gathered form specialists in certain areas. The university of Bristol is well known for its work with poultry and has been consulted in the past for dealing with the suppression of the chicken. TNO is sometimes used by Meyn but not often by Systemate.
Internships are often given to students with technical backgrounds. Most often they are placed at engineering.

Sharing knowledge
Systemate does not share information with others outside of the organization. However, attention is paid to what is new in the industry and what competitors are doing. There are product managers who attend seminars and visit trade shows and Systemate receives trade magazines for technics and poultry industries. A notification is received every time a patent is given to someone in the industry. These patents are then studied to gain ideas. If Systemate wants to use a certain technique in a machine and it has already been developed by another company, it will try to license the technology.

Company characteristics

Company size
Before Systemate was taken over it was a small privately owned company with limited resources. There was no formal R&D vision or strategy and it was up to the director/owner to decide on projects. Now, Systemate is part of Meyn Holding and has access to more resources. Systemate already had an extensive Sales network and agents all over the world but as part of Meyn they have access to an even larger network. Systemates' R&D department consists of nine people. Meyn R&D consists of 80 people (including engineers).

Export
Almost al of Systemate's products are exported. This is because of the limited size of the domestic market.

Products
The machines that Systemate develop and builds are rather complex and capital intensive. This means the lead time to market is relatively long but the lead time also depends on the size and configuration of the machine.

Conclusion

Strengths

- Management support for innovation
- Has developed disciplines systems for product development
- Roadmapping technique for idea generation
- Flexible and decentralized organization structure
- Strong Sales network
- Experienced R&D personnel
- Open culture
- Good communication and contacts between colleagues of different departments (R&D and Sales)
- Close contacts with clients

Weaknesses

- Skills and capabilities are incapsulated in people's mind who can leave the company
- Limited potential for what can be done with a chicken
- Not as good in electronics as in metal and realizing this during the project
- Only incidentally work with other companies, suppliers or knowledge institutions.

Case 2: CSi Industries BV

The information used to describe this case study was gathered from the CSi website and by interviewing the following people:

- Technical director/ part owner
- General manager/ Head of Sales/ part owner
- Head of R&D/ Engineering

Company profile

CSi Industries B.V. is a privately owned company (three owners) that designs, produces, and implements fully integrated logistic systems for material handling and product distribution. The company was founded in 1964 as Conveyor Systems B.V. and through mergers and acquisitions it became CSi industries BV in 2001. The company currently employs around 300 people worldwide and has a sales volume of 50 to 60 million euros. The company is located in Raamdonksveer, the Netherlands but also has sales offices in Germany, United Kingdom, Mexico, France, Russia and has agents in the far east. Recently they also opened a production factory in Romania.

CSi's goal is to find innovative solutions for the customers logistics requirements in terms of conveying, product handling, palletizing and warehouse interfaces by offering a turn key solution, completely designed and engineered in house, incorporating third party machines that go together to offer an integrated solution for the clients.

Products

CSi build total systems that fully automate the materials handling process based on the clients individual requirements. It has a complete range of products to design a materials handling system, from the packaged product, conveying and sortation to palletizing right up to automatic truck loading. In general a project can be divided into three product subcategories namely:

- *Standardized modules* - these are products for standard situations.
- *Modified standardized modules* - these are products which are modified to fit a particular situation
- *Special modules* - these are complex products which will be specifically designed for a particular client.

Market

The market in which CSi operates is predominantly one of local/regional competitors. CSi is only one of a few companies in this business who aims to follow and support clients worldwide. They focus on clients who are leading producers or distributors of fast moving consumer goods mainly in the food and beverage industry. Examples of CSi's clients are: Philip Morris, Nestle, Unilever, Procter and Gamble, Tetra Pak, Mars Nederland BV, Heineken ect.

Strategy

CSi's mission statement is: *"To be a reliable partner for the top 50 international producers of Fast Moving Consumer Goods and for large national operating companies and the related distribution companies by designing and implementing innovative packaging and logistic solutions on a turnkey basis. Both mechanical handling and controls with IT for systems handling and transportation, from consumer packaging to automatic truck loading"*.

CSis' strategy is to design and implement innovative material handling solutions for fast moving consumer goods production and distribution and to support their customers enabling them to supply their brands reliably at attractive prices via retail outlets to the end consumers worldwide.

Because CSi aims at clients who are leaders in the fast moving consumer goods industry who deliver quality products themselves and therefore expect a certain level of quality from whomever they do business with. CSi delivers machine performance that meets the expectations of interested parties and guarantees the continuity of operations for the clients. Those clients want maximum uptime and minimum delay/maintenance in their 24 hour operation.Therefore CSi's product strategy can be described as a quality strategy that is market driven.

Product development process

For CSi, two development processes can be described. One process takes place through the normal sales channel and starts when a client asks a specific question. The second originates from strategic necessity.

Client request

CSi works as a project organization, which means a project gets started when a customer comes to CSi with a question or a problem. The first thing that is done is to investigate what is needed for this project. As was mentioned earlier, a total system project usually consists of standardized modules (conveyer, truck loader), modified standardized modules (for example a wider or narrower conveyer or a palletizer) and specials (specially built machine such as a palletizer, dock loader). Nonetheless, it is also possible to order just a standardized module, a modified standardized modules or a special module.

The sales process starts with a consult whereby the client makes clear what needs to be done and what the requirements are. A visit is often made to the client in order to be in a position to judge the products that need to be handled by the machines and to examine the size of the location in order to check the possibilities of the conveyor route and space available for the machines. Subsequently an in-depth study is performed to come to a design of the total system consisting of standardized modules, modified standardized modules or special modules (only if the standardized modules do not work). In principle CSi opts for modular construction.

If the order only consists of standardized modules or modified standardized modules than no new development needs to be done. A commercial quotation (system description, technical

specifications, scope of the delivery and detailed lay-out) is setup which can be handled by the regular sales and engineering departments and after which it can be sent to production.

If the order is complex and the configuration can not be solved by just standardized modules, it is sent to the technical director. Within the company, he is the 'creative genius' who deals with the complex problems and specials. Based on the criteria set by the customer he develops a concept that will meet the requirements. He starts by thinking about technical solutions for the problem and makes a few sketches and feasibility calculations. He does this concept development on his own and also makes the decision to do the project or not with feedback to the client. If he can convince himself that the concept can technically work, he will go to the R&D department and will ask one of his team members to build a test setup. If the test results provide the same findings as the criteria being asked for by the client the concept phase is completed. However, this concept is not the final product, it is just a concept of how it might technically work. The technical director will then go back to the client with a commercial quotation and the concept drawing of the system which he will try to sell. Sometimes customers are invited to the factory to see the concept test setup, which makes it easier to sell the concept. If the client says yes, a sale is made and the concept moves to the engineering department for further development.

Depending on the concept of the machine, engineers are appointed to the project who will further develop the special module. During this further development, others such as suppliers of third party parts will be consulted if necessary. If engineers can improve on the concept, they are allowed to do so as long as the criteria meet the requirements the technical director is consulted.

When the engineering is finished, the project moves to production. CSi manufactures the majority of the components in-house in a customized form to deliver the individually designed systems. Only after extensive checks on the individual components have been carried out, permission will be granted for final assembly. Following assembly, clients are invited to witness trials on the individual machines which make up the total system before the machines are finally shipped to the client where a team installs the systems.

Strategic decision

The second process originates from strategic decisions that need to made in order to be able to continue in their business. CSi's strategy is to focus on large companies in the fast moving consumer goods industries. To serve these type of clients, CSi must realize a certain quality and reliability in their products. CSi has an innovation team who deals with these kinds of strategic decisions. This team consists of the Technical director, Sales director, head of R&D/ Engineering, and the Production director. The goal of this group is to determine what is needed to keep serving these clients in the future. Based on research, strategic decisions are made concerning criteria for existing products. There are three possible strategic directions:

Improving products - improving existing products by adding extra value to be able to meet future customer needs. More speed, more capacity, more efficient, less maintenance ect.

Standardization of specials - specials are often only suited for one client. Currently the focus lies on trying to standardize a special machine or standardize parts of the system which can then be used in other products.

Value engineering - improving existing products by from a value perspective. Value is defined as a ratio of function to cost. Which means value can be added by adding functions or by lowering costs. At CSi, they only look at cost reduction for value engineering. Can it be built with other materials? Can it be built more efficiently? ect.

The strategic criteria for the existing machines are then passed on to the R&D engineers who will have to find out if it is possible to achieve the desired criteria for the machines. The technical director also develops products from a strategic perspective.

Idea generation phase

Within the company, the technical director is the 'creative genius' who comes up with product ideas/ solutions. This can be either reactive in the case of a customer request or proactive in the case of strategic necessity. Together with his supporting engineers, the ideas are turned into products. Employees can deposit ideas or suggestions in a suggestion drop box, but the response if very low.

As was mentioned before, customers provide a certain problem for which a solution needs to be found. This can be seen as a trigger for a project. However, they can also provide valuable information for the future because the customer is always one step ahead. During the engineering phase, input can be requested from suppliers who can provide new insight into problems. Ideas can also be generated by analyzing what competitors are doing in terms of criteria for machines, the range of machines and the offered services. Together with the company's expectations for the future market, market research, competitor research and customer interviews can be used to gather information and to formulate the strategic goals. The research is performed by marketing and sales with the help of external consultants.

Capabilities supporting innovation

People

Management

CSis' management sees innovation as a need to be able to survive in their business. In order to be able to serve producers and distributors of fast moving consumer goods, they need to continuously improve their products. This is needed because customers are always one step ahead with their questions and wishes. Management sees this as an enormous drive for innovation. An innovation team is used to guide this process. This team determines the strategic choices which are further developed by R&D.

Employee characteristics

The usual characteristics are named such as being entrepreneurial, taking initiative, be willing to take risks ect. but the most important thing according to CSi is having people who are committed to their job and are enthusiastic about the products that they either design, develop, manufacture or sell. If people do not have this feeling with the product, it can be a obstacle for innovation. Another important aspect is that people are interested in technology and technical equipment.

Skills, competencies and learning

Different capabilities are needed for different stages of the process. In the beginning, creative people are needed who can translate a problem into an engineering solution. For engineering, different capabilities are needed for the various products that CSi develops and manufactures. Although, there is only one engineering department, there are different disciplines within this department. For example, building a machine requires a different engineering philosophy than building for instance a conveyor. There used to be different departments for the different disciplines. However, this has changed into one department with one manager having the oversight. Employees are assigned projects based on there individual capabilities.

Strategy

Management strongly believes that innovation is key for the survival of their business and that it should be a mindset that runs throughout the organization. This means the whole company needs to be aware of this. CSi uses a number of tools to communicate this message to the employees. First of all, innovation is explicitly formulated in CSi's mission and strategy. By doing so, management wants to show that it delivers innovative solutions for their customers. Secondly, once a month all employees are gathered in the company cafeteria to discuss important business issues. During these meetings various things can be discussed such as the progress of innovative projects or such projects can be presented. Other topics that can be discussed are things like who are our important clients, why do we focus on these types of clients and what kind of products do these clients want. Often a member of management will give a presentation after which a discussion can take place. Everyone can give his opinion and it is al very informal. By involving everyone in this process, management tries to stimulate a participative climate. Thirdly, by use of narrowcasting, the employees can be reached through television displays that are located in the cafeteria. During coffee and lunch breaks employees can read the information. The content can be customized for any specific audience or for a specific event. Currently the screens are displaying information about the strategy, mission, products, and clients combined with current events such as local news and weather. Finally, banners are used to promote goals. In the factory banners with slogans such as: *"CSi is the number one for the tobacco industry" or "CSi is the number one for beverage industry"* hang on the walls.

Culture

According to CSi, a supportive culture for innovation is of great importance. This is why management tries create a climate in which everyone has the right to give their opinion and that people can bring issues forward for discussion. Because the company is relatively small, the culture

is informal and open which stimulates people to come forward with ideas. The most important success factor mentioned is commitment for the product. It is without saying that knowledge, skills, and technology are of the utmost importance but if employees lack commitment or have their doubts about the product, the product will not be as successful as when the commitment is broadly carried out in their daily performance.

Willingness to share ideas

Given the complex projects, with which almost every discipline within the company is involved, sharing ideas is of great importance. It is said that throughout the ranks, there is a willingness to share ideas, which is stimulated by placing key departments in the same office space. All the disciplines within the engineering department are located together. Across the hall are the sales people, purchasing agents and project management. These departments are located in open space which stimulates the flow of ideas.

Trust

CSi is a relatively small privately owned company with the owners being part of day-to-day management. Because of its size, everyone knows each other which increases the feeling of trust and respect. By giving people freedom and flexibility to act in their job, provides employees with the sense that management trusts them in using their time in a wisely manner.

View on mistakes

If you are designing something from scratch, it is inevitable to make mistakes and that things can go wrong. At CSi people are not penalized for failure and risk taking but this is seen as part of a learning process for the individual and for the organization.

Structure

Until recently there were three owners in a relatively flat organization structure, who developed the organization into 50-60 million euro turnover company. To be able to grow further new management will be hired who will have to further streamline the organization and add more structure. Currently, because of its relatively small size, CSi's structure can be described as an organic structure which is characterized by flexibility, decentralization of authority and short communication lines.

Decentralization of authority

CSi is a project driven organization which means that everything originates from specific customer needs or questions. Because of these projects employees are free and flexible in performing their jobs. The engineering department has various disciplines which all fall under the same manager. Within these disciplines teams are formed but the responsibility is placed as much as possible at individual level.

De-standardization
Rules and regulations are tried to be kept as minimal as possible. For safety reasons, rules and procedures do apply in the factory. The technical director during his design stage, does not have to comply with any rules or procedures as long as the concept he develops is inline with the clients' requirements.

Job rotation/ Multi function teams
Multifunctional teams are set up as broadly as possible and particular in the Engineering department. There are different disciplines within this department and there needs to be a basis for better integration of mechatronic solutions. Sometimes mechanics are asked to run the electronic cables and wiring while the electricians do another task. This might not go as smoothly as liked but it provides the mechanics new insights into problems that electricians have, which they can keep in mind when building a machine. This approach allows for a more integrated approach to problems.

Reward systems
No use is made of reward systems. Incidentally an employee can receive an extra financial compensation for an extraordinary performance but there is no specific benefit scheme for this.

Availability of means

Time
There is enough time to work on projects. The technical director and engineering are constantly working on ideas that might be of strategic importance.

Technological capabilities
CSi has a full range of capabilities in-house to develop material handling projects. One of the most essential resources are the technical capabilities located in the engineering department which consists of:

- *Layouts* - for detailed AutoCad layouts of projects.
- *Mechanical Engineering Standard Components* - for re-engineering the project with standard pre-engineered components for cost effective results.
- *Mechanical Engineering Specials* - for offering a customized solution if standard components cannot be used for a specific function in the total system.
- *Mechatronic engineering* with 3d Cad for palletizing machines, robot palletizing grippers etc….
- *Electrical Hardware Engineering* - for detailing and building electrical hardware.
- *Software Engineering* - for developing and writing the software in house for the full function, operation and monitoring of the installed system.

If the knowledge is not available within the company, CSi will turn to external help for development.

Financial resources
The development of special modules are paid for by the client and there is also a budget for R&D to achieve strategic goals.

Creative thinking techniques
During the engineering stage when translating the concept from functions to technical possibilities, brainstorming is sometimes used. This can be done with people from different departments but also with suppliers or other external partners who are consulted during the development.

Education and training programs
CSi offers its employees various training possibilities for keeping up to date with the latest technology. For all disciplines within the company, training courses are available. CSi also has partnerships with Avans Hogeschool which also offers technical courses. These training programs are particularly important for after sales and service mechanics who need to teach the client to operate the machines and who need to service those machines.

Network
CSi uses various external channels for supporting their innovation efforts.

Working with clients
As was mentioned earlier, the customer states a need for a machine or total system which CSi will then develop. The customer provides various specifications and in most cases their input will stop there.

Working with other companies
During the engineering phase when an idea or concept needs to be transformed into a technical product, input from suppliers will be used. For example, CSi developed a muscle cylinder but seeing that this is not part of their core business, a supplier of a similar type of part was consulted. Their input leads to a better product which is needed to be able to serve the strategic clients.

CSi uses a lot of third party products or parts in their own products or systems and focusses on large strategic clients. Suppliers know this which leads them to be very willing to participate and offer input in product discussions. Very often CSi invites suppliers to come to the CSi office/ factory to discuss the possibilities of a certain part. This stimulates the flow of ideas.

Working with universities and other institutions
CSi works with external research companies if it does not have the knowledge to further develop a concept. In the case of the ‘Powerball’ (a part for a sorter machine) which was thought up by CSi but which was further developed by an external party. Incidentally CSi uses knowledge from technical universities or HTS. Currently there is someone from a technical university working on computer simulations.

CSi also has a partnership with Avans Hogeschool in which they promise to support each other in various education areas. For Avans Hogeschool it is important to be able to place students for internships or graduation projects in technical companies and for CSi it is important to have access to Avans Hogeschool's knowledge for innovation and future potential employees.

The students that receive an internship with CSi are usually placed in the engineering department. CSi tries to place these students in disciplines which are not CSi's core business. This way a fresh pair of eyes can look at things from a different perspective. This new insight provided by a student can trigger ideas in employees from which new things can arise. But it is not only good for ideas. It can also have an effect on the execution phase within engineering. For example, a student might come up with a totally different material choice or something else that has been overlooked during the process.

Sharing Knowledge
Employees are free to visit trade shows and technical seminars whenever they want. No one will be denied if they ask to attend one. It is often encouraged to go to a different trade show than the ones the competitors are visiting. This allows for different views and possibilities that others miss.

Company characteristics

Products and Export
The machines that CSi develop and builds could be rather complex and capital intensive. This means the lead time to market is relatively long but the lead time also depends on the size and configuration of the machine. These machines are exported all over the world.

Conclusion

Strengths

- A committed focus on the customer throughout the organization.
- An innovation process managed by a multidisciplinary team consisting of people from engineering, marketing, sales, production and management.
- Leadership focus for innovation.
- Continuous focus on strategic improvements to products.
- Gain insight into the market by performing research and customer surveys.
- Working with suppliers on developing products.
- Culture with focus on, openness, communication and sharing of ideas.

Weaknesses

- Technical director is the creative brain behind the innovative products. CSi strongly depends on his creativity, knowledge and experience, if he decides to leave the company, a new way of doing things will need to be found.
- The process for developing new products is not clearly defined.
- No storage possibility for specific knowledge.

Appendix IV: Diagnostic tool

Diagnostic tool for Business-to-Business Market-driven

Company characteristics	
Industry sector	
Position in the value chain	
Product complexity	
Type of product	
Strategic direction	

Strategy	Strongly Disagree				Strongly Agree
The mission of our organization clearly establishes areas for new product development and generating ideas	①	②	③	④	⑤
Our organization's mission gives clear directions for new product development and generating ideas	①	②	③	④	⑤
Our organization has clear goals for our new product development and generating ideas	①	②	③	④	⑤
Our organization's strategy assures that all new product development and generating ideas efforts are aligned with our core competencies	①	②	③	④	⑤
Management supports and is strongly committed to new product development and generating ideas	①	②	③	④	⑤

Culture	Strongly Disagree				Strongly Agree
Most people in our organization trust each other, are open and honest, and count on each other for personal support	①	②	③	④	⑤
Open informal communication among employees is encouraged across functions	①	②	③	④	⑤
Most people in idea generation activities are highly motivated and committed to the goals of the organization	①	②	③	④	⑤
Most people in our organization frequently take independent initiatives to acquire information, make decisions and plan their work	①	②	③	④	⑤
Our organization encourages and supports relationships between our marketing and technical people	①	②	③	④	⑤
Most people in our organization take the time to consider and test new ideas and ways of doing things	①	②	③	④	⑤
We actively encourage people to bring forward new ideas	①	②	③	④	⑤

New ideas are received in an attentive and professional way by supervisors and peers	① ② ③ ④ ⑤
People in our organization tolerate uncertainty and ambiguity in being first to put an idea forward	① ② ③ ④ ⑤
Most people in our organization discuss and consider opposing opinions and a diversity of viewpoints	① ② ③ ④ ⑤
Most people in our organization do not set traps for each other and engage in territory struggles	① ② ③ ④ ⑤
The importance of sharing knowledge, expertise and information is recognized	① ② ③ ④ ⑤

Structure	Strongly Disagree				Strongly Agree
Our organization has the flexibility to act quickly when opportunities occur	①	②	③	④	⑤
Our organization has teams dealing with idea generation that are multi-disciplinary (i.e. cross functional) with team members from different functions (R&D, Marketing, Sales, Engineering ect.)	①	②	③	④	⑤
Team members are well networked across all departments within the organization	①	②	③	④	⑤
When a team does a good job on a project, team (or team members) are recognized within the organization	①	②	③	④	⑤
Our organization has a systematic method for capturing and sharing ideas	①	②	③	④	⑤
Our organization has a company wide system for recording ideas	①	②	③	④	⑤
Our organization has a company wide system for providing feedback for ideas received	①	②	③	④	⑤
Our organization has an IT based system for sharing, capturing and easily addressing information developed for idea generation	①	②	③	④	⑤

People	Strongly Disagree				Strongly Agree
Our organization has talented people with a positive commitment for customer satisfaction	①	②	③	④	⑤
In our organization we use employee development programs, training, and job rotation	①	②	③	④	⑤
Our organization applies Human Resource style tools to select idea generation team members	①	②	③	④	⑤
Idea generation team members are selected based on their high levels of specialized knowledge and experience	①	②	③	④	⑤
Our teams dealing with idea generation are well balanced between creative, analytic, and practical personnel	①	②	③	④	⑤
Idea generation team members are passionately committed to their project	①	②	③	④	⑤
Idea generation team members spend time and effort well beyond their expected job requirements	①	②	③	④	⑤
Our team leaders enable and support commitment of all team members	①	②	③	④	⑤

Availability of means	Strongly Disagree				Strongly Agree
Our organization has a sufficient budget for idea generation	①	②	③	④	⑤
Our organization has sufficient human resources available for idea generation	①	②	③	④	⑤
Our organization has sufficient resources (time) for working on non-official projects	①	②	③	④	⑤
Idea generation projects are sufficiently resourced to allow team members to concentrate on project work	①	②	③	④	⑤
Our organization has marketing capabilities available for opportunity identification and marketing analysis and information	①	②	③	④	⑤
Our organization's external review approach is a formal, documented process	①	②	③	④	⑤
Our organization understands customer's buying behavior and what drives their purchase decisions (needs)	①	②	③	④	⑤
Our organization has the capability to perform thorough analysis of the market potential (e.g. size of market, buying power, etc.)	①	②	③	④	⑤
Our organization has the capability to use established methods to identify/obtain new ideas (e.g. focus groups, market surveys, brainstorming)	①	②	③	④	⑤
Our organization uses tools like roadmapping and scenario planning	①	②	③	④	⑤

Networks	Strongly Disagree				Strongly Agree
Our organization has enduring relationships of trust with targeted customers	①	②	③	④	⑤
Our organization observes customers in their own environment	①	②	③	④	⑤
Our organization observes potential customers in their own environment	①	②	③	④	⑤
Our organization understands the unarticulated customer product choices	①	②	③	④	⑤
Our organization has a system to track complaints and suggestion from customers	①	②	③	④	⑤
Our organization works with lead users on new products and product improvements	①	②	③	④	⑤
Our organization uses traditional market research methods (e.g. focus groups, market surveys, etc.)	①	②	③	④	⑤
Our organization collects information about competitors	①	②	③	④	⑤
Our organization collects information about market segments	①	②	③	④	⑤
Our organization collects information about market trends	①	②	③	④	⑤
Our organization uses alliances, partnerships, licensing and joint ventures	①	②	③	④	⑤

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