

'In search of discontinuous innovation'

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Preface

With this thesis I will complete the Master of Business Administration at the University of Twente. As my specialization I have chosen the track Innovation Management. In this track attention has especially been paid on the different types of innovation and organizational thinking that are found in science, and what the implications of all forms of innovation are on organizations.

The University of Twente, with the DILab Benelux in particular, has provided me the opportunity to examine the behavior of organizations in the search for discontinuous innovations. Therefore I would like to thank Rick Middel and Klaasjan Visscher for giving me this opportunity and helping me through the 'rollercoaster' graduation is.

During my graduation I have held office at the department of Operations, Organization and Human Resources (OCHR), within the faculty Management and Bestuur of the University of Twente. It has been a pleasant and educational stay, in which the door was always open for questions or coffee breaks. I have shared an office with other fellow graduates, who have created an ambiance in which performance and fun walked hand in hand. Without them it would not have been possible for me to get to this result.

My research comprehended interaction with organizations throughout the whole country. I would like to thank the contacts within these organizations for their valuable time and their proactive role in this research. If they would not have cooperated in such a positive way, I would have left with nothing more but a theoretical review on the topic. Their positive, motivating interest in this research strengthens my opinion that there is a need for knowledge about discontinuous innovation and I sincerely hope that the attempts to shift the DILab Benelux to a higher gear will sort out.

Finally, I would like to thank my mother, family and friends for providing me a solid basis, from which I could start my education and fulfill this master thesis, even if things did not go as they were planned. Last, but certainly not least, I am Els very grateful for her patience, support and interest in the last period.

This leaves me with nothing but to wish you a pleasant stay in the story of my adventure in the world of discontinuous innovation!

Martin Wanschers

Barchem, 10 January 2009

Management Summary

Organizations need to innovate in order to sustain or create a competitive advantage and maintain a right of existence. This can be done through small steps on an existing basis or big steps in unknown places. In the field of innovation these big steps in unknown places are referred to as discontinuous innovations. These types of innovations have the common characteristic that they are hard to recognize for organizations and have mayor impacts on the way an organization is doing business. The problem is that if an organization does not develop these discontinuous innovations from time to time it faces the danger of losing ground to competitors; it endangers its competitive advantage. The process of achieving such discontinuous innovations is characterized with 3 different phases: search, select and implement. Organizations are continuously aroused at the front of this process by very different triggers of discontinuity, which may have big impacts on the way the organization does business. The problem for most organizations is to recognize these triggers, or in other words, to search for discontinuities.

A qualitative research has been executed in order to provide insights on how organizations search for discontinuous innovations. Therefore a distinction is made between 12 different search strategies, as formulated by von Stamm and Bessant (2007). These strategies have been examined in both a questionnaire and case studies. The central research question was as follows:

'In which way can companies organize search strategies for discontinuous innovation?'

The purpose of this research is to identify approaches that organizations use in their search for discontinuous innovations. The examination of these approaches has been guided by the 12 search strategies (von Stamm & Bessant, 2007) and the common organizational characteristics, as described by Burnes (2004). The qualitative part of the research has been done with use of a questionnaire and case studies.

Within the results of the questionnaire no relation has been found between the contingency sector and the necessary investment in resources for a search strategy, but what came forward is that the strategies that require few investments in resources are more successful than those that require medium investment in resources. Also, organizations that use a pull strategy use more externally oriented search strategies, organizations that use a push strategy do not discriminate between internally and externally oriented search strategies. The externally oriented search strategies of organizations with a market pull strategy are more successful when compared with their internally oriented strategies and also when compared with both the externally and internally oriented strategies of organizations with a market push strategy. Next to these general findings three patterns have been recognized in the data of the questionnaire:

1. Organizations choose to use the strategies that need few investments in resources more often than those that require a larger investment in resources.
2. Deep Dive is used as a logic addition to the use of Active Users, in which the main purpose is to increase the quality of the generated insights.

3. Corporate Venture Units is used by High-Tech and Medium to High-Tech manufacturers only, due to the specific characteristics of the strategy (it has the purpose to avoid risks that come with the innovation).

The results of the case studies have indicated several guidelines for the search for discontinuous innovations. At first a difference must be made in the maturity and experience of an organization in relation to the search for discontinuous innovations. Organizations that are relatively inexperienced with the topic or which have not developed their search for discontinuous innovation thoroughly will not be able to implement search strategies that require more resources and guiding. During the use of these strategies it is important that top-management gives the employee the necessary freedom to actively search for discontinuous innovation. This means that it is not necessary for the top-management itself to search actively, but it must create the necessary space and freedom to make it possible for discontinuous innovations to be recognized by employees. The role that top-management plays is best described as supportive, in which they need to create an atmosphere in which the exchange of knowledge and information on all levels is encouraged. The research indicated that in most instances the search for discontinuous innovations is still bottom-up, the employee needs to 'sell' an idea to the right person in the organization, a process of trial and error. That is why an employee needs to enjoy a high degree of freedom to make the process work, it asks a lot of patience from the organization.

If organizations are more experienced with the search for discontinuous innovations they can proceed to the use of search strategies that require more resources. To be implemented these strategies are compelled with a clear corporate strategy, they address very specific resources (whether internal or external) and are different in nature and outcome. Also, the actors that execute the strategy can be different, even top-management itself can use these strategies. For example, Futures on strategic level and Corporate Venture Units are best executed by top-management. The benefits of the more sophisticated search strategies, compared to the strategies that require less resources, lie in the sources of information they address and the information they gather. The more sophisticated search strategies address sources with very specific information and knowledge, they can be successfully used only if the organization provides a direction about the information and knowledge it wants to become. Therefore these strategies are better applicable on organizations that are more developed in the search for discontinuous innovation.

Another guideline that comes from this research is that some strategies are successful in specific situations. First, the use of Corporate Venture Units is applicable for High-Tech and Medium to High-Tech manufacturers in particular and can be very successful for these types of organizations. Second, when Deep Dive and Active Users are combined, if the context and characteristics of the organization allow this to happen, then Deep Dive creates major benefits for the use of Active Users.

Another important aspect that comes forward from this research is that all organizations underpin the importance of discontinuous innovation for their organization, but when they have to choose they prefer short term profit and growth instead of long term investments on discontinuities. This has negative influences on the development of discontinuous innovations in general and the search for discontinuities

in particular, because these activities ask for different actions of an organization. To prevent this of occurring the search for discontinuous innovations needs to be defined, in which the resources that have to be made available need to be described. This creates a situation that when the organization encounters difficult decisions on the investment for the short or long term, it has resources available for long term investment, which discontinuities often are.

Within this research very different interpretations on the operationalization of the search strategies have been found. The difference lies within the interpretation of the strategies and small adaptations to the context and specific characteristics of the organization. What almost all organizations had in common is that they used the strategies that were formulated, with exception of one. This specific organization uses an Innovation Studio next to the search strategies, in which employees have the opportunity to spend three months on research on 2 or 3 specific topics. This form of searching for discontinuous innovations was a unique practice which has not been seen within any other case. It creates major benefits for the organization, it makes it possible to investigate certain topics and innovations that would normally be left out due to a lack of available time and connectedness of the topic with the organization. Because the Innovation Studio was found in one organization only, it is not said that it is applicable on the specific situation of that organization. Actually, it creates opportunities for other organizations as well, as long as the resources, both financial and non-financial, are available it can create major benefits for almost any organization.

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1. What to search for

In this chapter the background and organization of this research will be presented. At first the motive of this research will be outlined. This will lead to a research question, which is divided into sub-questions. Subsequently the research approach will be discussed, but at first a short introduction will be given.

1.1 Introduction

Today's market economy is characterized by a continuously changing environment. Product developments and technologies are rapidly following each other and end-users are ever more demanding. Organizations need to cope with all dynamics within their environment. And not only by improving their existing products or technologies, but also by developing new ones.

Organizations need to innovate in order to sustain or create a competitive advantage and maintain a right of existence. This can be done through small steps on an existing basis or big steps in unknown places. In the field of innovation a distinction is made between two different types: continuous innovation and discontinuous innovation. Continuous innovation is characterized by the improvement of existing products and/or technologies, or as von Stamm and Bessant (2007) put it, 'Incremental exploitation innovation is about highly structured processes and often high frequency small scale innovation carried out within operating units'. The opposite of continuous innovation is discontinuous innovation, or as defined by Kassicieh et al. (2002): 'Discontinuous innovations provide step-function improvements to current product market paradigms or produce the physical and service products that initiate new industries or markets that define a new and differing product platform from which incremental innovations are generated'. This research will focus on the latter, discontinuous innovations.

The process of achieving discontinuous innovations can be characterized, as Gertsen et al. (2007) have done, by 3 different phases, which is visualized in Figure 1.

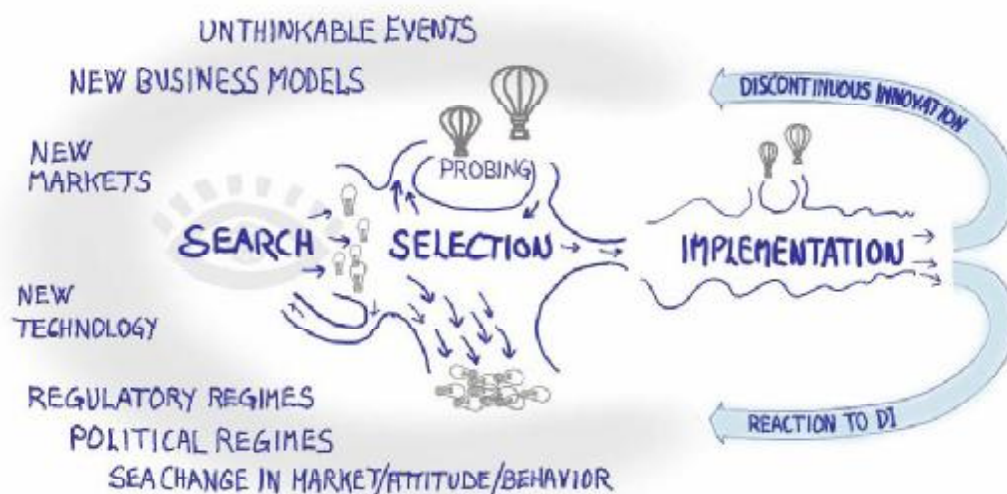


Figure 1: Discontinuous innovation process model (Gertsen et al., 2007)

As visualized, the process starts with the search for new innovations. At the front companies are continuously aroused by very different triggers of discontinuity (Bessant, 2005). The first trigger is the occurrence of 'unthinkable' events. These are events that are thought of they will never happen, because of their unimaginable character. The second trigger is the origination of a new business model, which may change the way of successfully doing business for organizations, like for example JIT or LEAN. Third, just as products, most markets evolve through a process of growth and segmentation, but at certain times completely new markets emerge. The problem with these new markets is that they cannot be predicted in advance using conventional techniques, but these need a whole different way of exploring. And just as markets emerge, technologies are replaced by more promising ones. The fourth trigger is the change in regulatory or political regimes. These pressures lead to shifts in the regulatory framework and enable the emergence of a new set of rules. A good example is the need for organizations in the automotive industry to equip their cars with a new way of measuring the timing and temperature of ignition of diesel-fuel. Therefore a whole new technology had to be invented in order to meet with the demands. The final possible trigger of discontinuity is the slow shift of the public opinion or behavior, until it tips over into a new model. For example, the society is becoming aware of the need to be more careful with the earth and its resources, which will at a certain point change a lot of markets.

The examples of these individual triggers all have in common that their impact is immense, at least a complete market or sample of organizations is affected by them. It might also be that do to a combination of triggers a specific organization has to innovate in order to stay in business. For example, Wadus BV (www.wadus.nl) has developed an application which exists of an air/water warmth pump and system regulation which is applicable in both private and commercial use and has the purpose to make it possible to meet the demands for durable building. The application fulfills a change in demands, caused by a regulatory shift, a new technology and a change in market/attitude/behavior. The regulatory shift has been formulated by the NEN in name of the government of the Netherlands. This so-called EPC-calculation is recorded in the 'bouwbesluit' and is compulsory when a new application is applied for. This is for a large part caused by the shift in attitude towards a more durable environment. To be able to fulfill these needs, a whole new technology is necessary which combines known technologies of absorbing energy from the earth with new potentials, absorbing energy from the air. This application has been invented by Wadus BV.

For companies it is most difficult to detect and recognize these triggers of discontinuity, whether it has an impact on a complete market or the organization itself. If the triggers are not detected in time, an organization faces the danger of losing its competitive advantage, perhaps even bankruptcy. In order to prevent this of happening, the organization needs to search for these triggers of discontinuous innovation, the search phase. In recent work a lot of attention has been given on the recognition of different search strategies in practice (Bessant, 2005, 2008; Gertsen et al., 2007; Lynn, Morone & Paulson, 1996; von Stamm & Bessant, 2007). Most of these studies have focused on the theoretical foundation of different search strategies. The more practical part of the research, how organizations actually organize for DI, lacks such a diverse source of scientific work. In order to try to fulfill the need for these practical insights, a group of scientists started the DILab at first in the UK, Denmark and Germany in 2006. These labs have the purpose of providing insights on how DI's work in practice. In autumn 2007 the DILab Benelux was established with the goal to translate and extend the research done in other

countries to the local environment. During the first conference by the DILab Benelux, it became clear that a lot of practical questions about DI are not answered. Therefore the DILab Benelux set the goal to at first give insights on how the first phase, the search phase, is organized in practice.

1.2 Research questions

The goal of the DILab Benelux is to gain insights on the topic of discontinuous innovation. As mentioned in the introduction, the innovator model can be divided into three different phases, of which the search phase is the first. For organizations it is very difficult to structure the search for discontinuous innovations, due to their unpredictable characteristics. This research has the purpose to provide insights how organizations can search for discontinuities, which is formulated as follows:

'In which way can companies organize search strategies for discontinuous innovation?'

The most important core elements of the main research question are defined below.

Core element	Definition
Discontinuous innovations	Innovations that provide step-function improvements to current product market paradigms or produce the physical and service products that initiate new industries or markets that define a new and differing product platform from which incremental innovations are generated (Kassicieh et al., 2002)
Search strategies	The search activity to create or identify sources of variation which might help an organization survive in competitive environments (von Stamm & Bessant, 2007)
Organizing	The deployment of organizational resources to achieve strategic goals (Daft, 1991)

Table 1: Definitions of core elements of the central question

The goal of this research is to answer the main research question, as formulated and defined above. To be able to do this the question needs to be decomposed into the following sub-questions:

1. *Which search strategies are being used by organizations?*
2. *How do companies organize their search strategies?*

Each of these questions serves a different purpose. The first question is formulated with the aim to investigate which strategies from the theory are used in practice. In this way insights can be given whether which and how frequently the strategies are used. The second question has a different purpose, it is formulated with the goal to retrieve insights on how companies actually organize these strategies. To be able to investigate this, question 1 needs to be answered at first. Both questions together will make it possible to answer the main research question and fulfill the purpose of this research.

To answer these questions and in the end the central question, a distinct number of methods will be used. The methods that are used to create the theoretical framework will be discussed in this chapter. The methods that are used to provide answers on the research questions and those that are used to analyze the data will be discussed in chapter 3. All methods will be discussed using the work of Cooper and Schindler (2003), Eisenhardt (1989) and Yin (1987). At first an overview will be given of the research approach in general.

1.3 Research approach

The research consists of 6 steps. The first step is the problem definition and methodology step, as discussed in this chapter and chapter 3. The second step embraces the development of the theoretical framework. Within the third step the questionnaire will be done and the results from the questionnaire will be analyzed. The fourth step encompasses the case studies that will be held with participating organizations. Within the fifth step the results from the case studies will be analyzed. Over the results of both the questionnaire and the case studies a cross-case analysis will be done. Eventually all these steps together will lead to the conclusions, which should provide an answer on the research question. These steps are visualized in Figure 2.

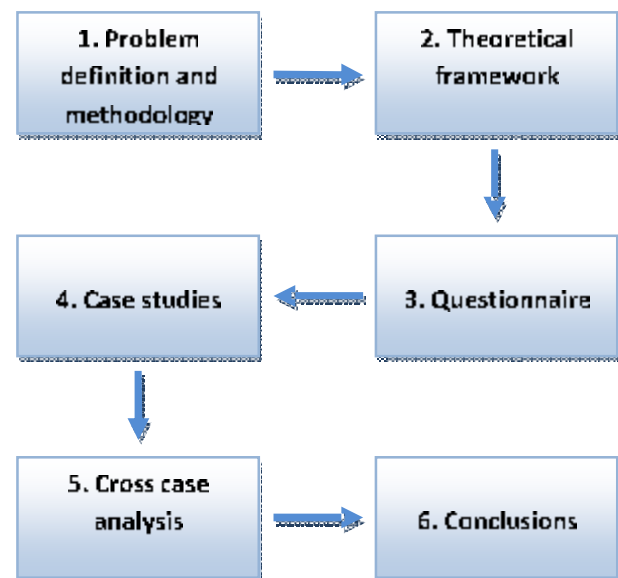


Figure 2: Research approach

1.3.1 Theoretical study

To be able to give the research direction and provide a firm ground for the further steps to be taken, a theoretical study is necessary. The search for literature has been done through a distinct number of databases and key-words. An overview of the used databases and key-words is recorded in appendix A.

Because of the wide range of articles that will be gathered with use of these key-words, a first selection has been made by reading the abstracts of the articles and selecting on times-cited. Most databases give the possibility to sort on the times that an article is cited in other articles. This gives a good indication on the relevance and quality of the article. This method has been used for the key-words that described the topic in general. The retrieved articles for each key-word had to be cited at least 10 times or more to be relevant and of high enough quality. One major concern needs to be taken for in account; recent published work will not be cited often. Therefore this criterion will only be used for articles older than 2 years. For the articles that are younger each individual abstract needs to be read in order to judge whether the article is relevant. The articles that have been retrieved with the key-words that apply on the search strategies have been first selected by reading the abstracts. There is not made use of the times-cited method, because the key-words are used to find articles on a very specific topic (search strategy), but they may also refer to other topics as well. This does not apply on the general key-words.

After having selected the articles on the abstracts and citations, all articles have been read. When an article was found very useful, a closer look has been given on the reference list within the article, whether more articles that were not already retrieved are listed (snowball sampling (Zabbe, 1998)). When citations were found that on the first sight were ought to be useful, they were retrieved with use of Jstor and GoogleScholar. With the articles from these selection procedures a plain collection of articles is created, which provides enough insights to create a well funded theoretical framework.

2. Theoretical Framework

In this chapter the theoretical framework will be presented. The framework will start elaborating in short on the different types of innovation that are recognized in literature. Subsequently the difference between continuous and discontinuous innovation will be explained. The focus will then be on discontinuous innovation and the search phase of discontinuous innovation in particular, which will become clear in this chapter.

2.1 Innovation

As already mentioned in the problem analysis, today's market economy is characterized by a continuous changing environment, and organizations need to innovate in order to sustain some form of competitive advantage. In the field of innovation a lot of different definitions are used to label the type of innovation that is discussed. To be able to define what the different types of innovations are, it must be clear what an innovation is in general.

There is a difference between an innovation and an invention. A discovery of whatsoever that goes no further than the laboratory is an invention. If the discovery moves further into the process and adds economic value, whether positive or negative for the organization, it is an innovation. So if the idea is developed and eventually taken into production, whether successful or not, an innovation is at hand. The discovery or idea generation can be initiated in almost every layer of the organization and by any employee, whether top-management or blue collar. A clear definition of innovation is given by Freeman (1991): *'innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production and marketing tasks striving for the commercial success of the invention'*. As defined, an innovation is a process, and not just a product or task on its own. As said before, this process can have very different initiations and outcomes, depending on the type of innovation and the place from where the innovation is being looked at. An innovation can be experienced as just a minor change on an existing product or service by a manufacturer, but completely new by an end-user. The point is what the state of knowledge is of the actor through which one looks at the innovation. In scientific work done on innovation management a few directions can be recognized when discussing the impact of an innovation. This research will use the work of Tidd, Bessant and Pavitt (1999) as the guideline, which will be discussed in the following pages.

Tidd, Bessant and Pavitt discuss several different ways to look at innovations. In their work they argue that four different focuses of innovation can be recognized, which describe pathways that an innovator can use to search for good ideas. The first focus of innovation is the improvement or development of products or services (product innovation), like a new model of a mobile phone or a type of car (Nokia N95, VW New Beetle). The second focus is the improvement of a part or the whole process of an organization (process innovation), for example the use of Just In Time (JIT) in a factory. Once a process has become standardized for product innovations, process innovations will evolve to improve the output productivity (Calantone, 1995; Freeman, 1991; Utterback, 1996). The third focus is the repositioning of a product or service to create new markets (positioning innovation), like Lucozade, which at first used to be a medical drink and was repositioned as a sports drink. The last is a major shift in thinking which

causes change (paradigm innovation), for example the current change towards durable energy. The general opinion needs to be influenced, for which many resources are necessary, which in most cases only the leading, biggest companies have available (Davis, 2005).

2.2 Discontinuous innovation

An important stream in research on innovation management is the distinction between continuous and discontinuous innovation developed by Tidd, Bessant and Pavitt (1999). Continuous innovations determine a constant improvement of the product or service of an organization. With continuous innovations organizations search, select and implement product improvements, line extensions, market developments, etc. (Tidd et al., 1999, p. 13).

Discontinuous innovations can be seen as the opposite of continuous innovations. Where in continuous innovations organizations strive to improve what they already do, discontinuous innovations change the situation an organization is in. The precise perception of what discontinuous innovation really is defers in scientific work, but what all perceptions have in common is that it always has an enormous impact on the way an organization is doing business. A key part for organizations to deal with discontinuity is that it requires a very different set of capabilities for organizing and managing innovation. Searching in unlikely places, building links to strange partners, allocating resources to high-risk ventures, exploring new ways of looking at the business – all of these challenge the way organizations approached innovations in the past (Bessant & Tidd, 2007). To determine what discontinuous innovations actually comprehensively, the scientific work done on the topic gives useful handles. As discussed in the previous paragraph, many different directions can be found. Some of the most researched topics are radical and disruptive innovation. To be able to compare these two types of innovation with discontinuous innovation, at first these innovations will be discussed.

The disruptive innovation concept is at first used by Christensen, who differentiates between sustaining innovation and disruptive innovation based on technological performance and market segmentations (Christensen, 1997, 2003). Sustaining innovation refers to technologies that help companies to sustain their growth in the existing or established market place to ensure market growth and domination, in which the focus is on improving the performance of current products and services. Such improvements can be either incremental or radical. Disruptive innovation occurs when new technologies with lower performance are introduced, which may be attractive to certain markets owing to some features which are not valued by the established marketplace (Bower & Christensen, 1995). The common characteristics of these disruptive innovations is that they are cheaper, simpler, frequently more convenient to use, largely ignored by incumbents and applied by entrepreneurial firms (Danneels, 2004). Typically the disruptive technology is being introduced in the low-end side of an existing market or in a new market with lower demands. A low-end market contains users which are not looking for a product with superior performance features, but who are price-conscious, they judge price over performance.

In the radical innovation concept Leifer (2000) differentiates between incremental and radical innovation through a clear delineation of the technological features that are commercialized, either in existing or new markets. According to Leifer (2000), a radical innovation has at least one of the following potentials:

- ✦ To create an entirely new set of performance features
- ✦ To create improvements in known performance features of five times or greater
- ✦ To significantly reduce costs (>30 %)

Because of these characteristics radical innovation has been promoted as a means of gaining and sustaining competitive advantages to create growth potential for incumbent firms. A radical innovation aims at a high-end market, which contains users that are searching for superior performance features, they are not searching for a cheaper solution. Typically, they judge performance over price. When looking at the potentials discussed by Leifer (2000), the first should be interpreted as a set of performance features that have a whole new potential to outrun the existing products or processes. The second potential is based on the current performance features of a product or process, in which a huge step can be taken when applying the radical innovation. The last potential makes it possible to significantly reduce costs without affecting the performance features.

It seems that a disruptive innovation has many similarities with the third potential of a radical innovation, but the difference is in the change of performance features. Where a radical innovation reduces costs without affecting the current performance features, a disruptive innovation changes both. Actually, the basic principle of a disruptive innovation is that it satisfies demands for a product with a low price and performance features that do not have to be the same as that of existing products, they may be much lower. Another major difference between disruptive and radical innovations is the difference in the perception of the end-user, the market (Hang, Neo & Chai, 2006). A disruptive innovation is applicable on the low-end side of an existing market or a new market which has much lower demands on performance and different price perceptions. A radical innovation is typically applicable on high-end side of an existing market or a new market with higher demands on performance.

In favor of this research, the concept of discontinuous innovation of Hang et al. (2006) provides a way for the visualization of the relation between discontinuous, radical and disruptive innovation. This concept is visualized in Figure 3. When considering technological innovations, the concepts of radical and disruptive innovation together form the concept of discontinuous innovation. This means that a discontinuous innovation can both be a radical as well as a disruptive innovation. Both disruptive and radical innovations can be initiated in existing and new markets. For the introduction of radical innovations into new markets there are two possibilities. The first is that the innovation is based on the blank spaces between a firm's existing businesses. The second is that the innovation falls outside the firm's strategic context.

As both radical and disruptive innovations are discontinuous, they share four common characteristics that are different from those of continuous (sustaining and incremental) innovations (Christensen, 1997; Hang et al., 2006; Leifer, 2000). At first, it is very likely that the innovation will be ignored by incumbents. Second, these types of innovations are extremely difficult to execute. Third, they face a tremendous market uncertainty when a new market is involved. And last, there is a frequent need for creating a new business model to apply the innovation.

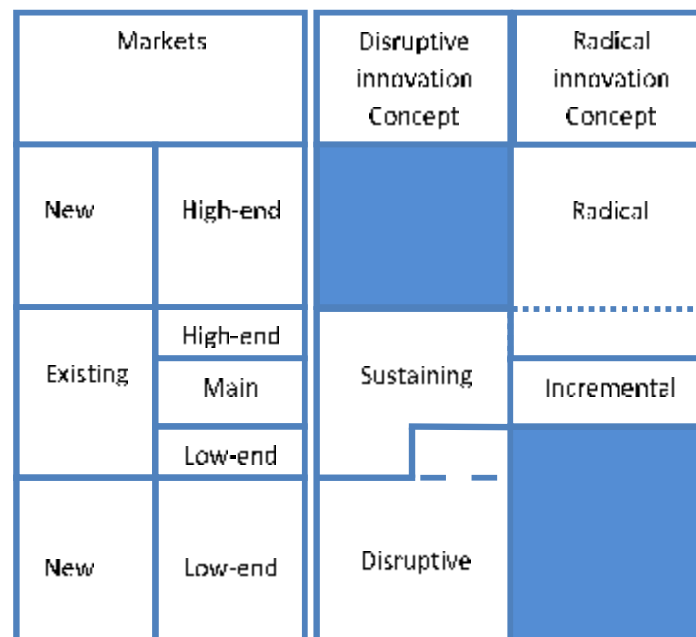


Figure 3: Concepts of discontinuous innovation (Hang et al., 2006)

Next to these similarities that disruptive and radical innovations have when compared to continuous innovations, there are also important differences between disruptive and radical innovations. First, radical innovations are driven mainly by technological breakthroughs where disruptive innovations only require well-enough technologies which have some special features not yet appreciated in the established market place. Second, the target groups of the innovations are different. Radical innovations typically enter the marketplace at the higher-end where performance is more important than cost and disruptive innovations are typically targeted at the low-end where the need is not satisfied in the past. The third difference is in the role that entrepreneurs have in entrant firms. Radical innovations take a very long time and require excessive resources, so they favor large established companies. Disruptive innovations are the opposite, it is possible for entrants to start small and become profitable very fast before expanding. Fourth, the way both innovations overthrow incumbents is different. Radical innovations have the characteristic that they put incumbents that are not aware of the entrance of the innovation out of competition. Disruptive innovations need two conditions to be present; there must be a performance overshoot and incumbents must find it attractive to move to higher-end, higher-margin markets when attacked by low-end, low-margin entrants. When these conditions arise, the incumbents will choose to 'runaway' each time they are attacked, until they run out of options (Hang et al., 2006).

The concept of Hang et al. (2006) is suitable as a way to visualize the relation between the concepts discontinuous, radical and disruptive, but it has limitations as well. The strict positioning of both radical in a market with high-end characteristics and disruptive in a market with low-end characteristics can be questioned to be correct. A radical innovation can also be repositioned in a low-end market when only the first potential of Leifer (2000) is being fulfilled and a disruptive innovation can be repositioned in a high-end market when the performance features are reshaped to the boundaries in which it is relevant. Imagine for example the introduction of a car which has a maximum speed of 140 km/h. This will fulfill

the needs for drivers within the Netherlands, because one is only allowed to drive 120 km/h. This creates the possibility to reduce costs on many aspects of the car, but still serve the same market. A third limitation is, in line with the third potential of Leifer (2000), that a disruptive innovation can have high performance features that are not recognized as such by current players or markets, who may perform in a high-end market.

Because of these limitations a different definition of discontinuous innovation will be used in this research. The definition that will be used is derived from the work of Kassicieh et al. (2002). They define discontinuous innovations as *'innovations that provide step-function improvements to current product market paradigms or produce the physical and service products that initiate new industries or markets that define a new and differing product platform from which incremental innovations are generated'*. This definition is useful because it encompasses both disruptive and radical innovation, in line with the discussion of Hang et al. (2006). From this definition it seems that a discontinuous innovation can be recognized in two distinct ways. The first is that it is based on something already existing, a constellation of convictions, values and proceedings accepted by the members of a certain market or society. It is about how the market perceives the innovation, based on the perceptions of the market on what is 'normal', and the impact the innovation has on this 'normal' situation. The second way a discontinuous innovation can be recognized is in both the radical and disruptive side of innovation. It can create a new platform from which continuous innovations will arise. These platforms can be characterized by a high-end market and a low-end market, as in the market forms of Hang et al. (2006). In fact, it suggests that a discontinuous innovation will always precede a continuous innovation, which is true, because a continuous innovation must be done on something already existing.

2.3 Innovation model and the search phase

As mentioned in the first chapter, the process of innovation can be characterized through three different phases. The fundamental model of innovation is based on the work of Tidd, Bessant and Pavitt (1999), which is visualized in Figure 4.

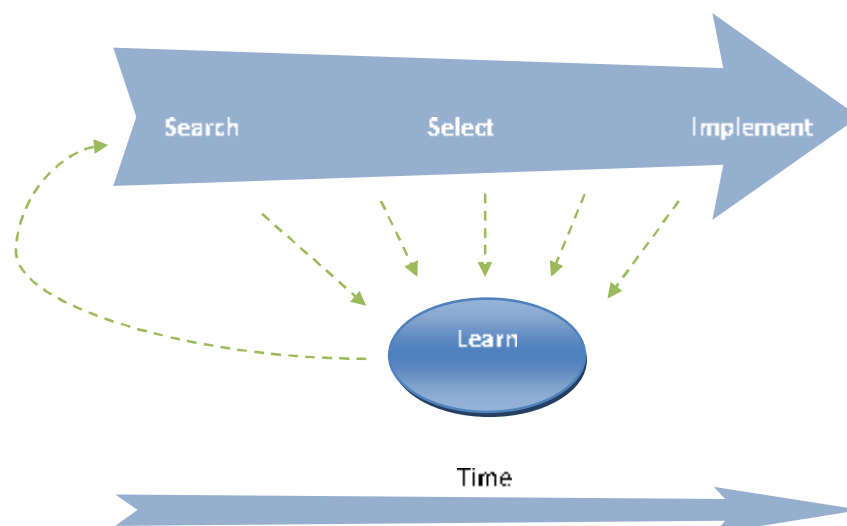


Figure 4: The innovation process (Tidd et al., 1999)

The model visualizes the process of innovation in a few steps. It starts with the search for new possibilities for innovation, called the search phase. From these possibilities a restricted number of options needs to be selected, the select phase. It is thus essential that a selection is made of the various opportunities, which fit with the overall business strategy and that these choices are build upon established areas of technological and marketing competences. When some options are selected and the strategic decision is made to pursue them, the next key activity is to put these ideas into practice, the implementation phase. With the implementation the available resources have to be connected to the possible innovations. This should, in the end, lead to new market opportunities, and the organization should be able to sustain some form of competitive advantage. The learning loop accomplishes the innovation model. The purpose of the learning loop is to create a cycle, which creates input for a new process of innovation.

This research has the goal to give insights on how organizations should organize their search strategies. Therefore the search phase of the innovation process will be discussed in more detail. As mentioned, the goal of the search phase is to generate possibilities for innovation in general and discontinuous innovations in particular. A discontinuous innovation is at some point triggered by different, diverging events. These might be about technology, markets, competitor behavior, shifts in the political or regulatory environment, new social trends, etc. (Tidd et al., 1999). For organizations it is difficult to be able to recognize these triggers and to value them the way they should be valued. The search phase is about recognizing these triggers, in order to create new products or services. With these new products or services some form of competitive advantage amongst their competitors can be maintained.

However, there is a difference between the search for continuous and discontinuous innovations. As can be imagined, the search for continuous improvements goes along the path that the organization has been following for a while. The search for discontinuous innovations contains in most cases a shift in paths. As defined in the previous paragraph, the nature of discontinuous innovations can be very divergent, but at a certain level they are all comparable – the impact of a discontinuous innovation is immense. Therefore organizations have to be aware of the changes a well thought-out search has on their competitive advantage.

The search for discontinuous innovations is characterized by Bessant in several articles with the use of a metaphor. Consider a man who has lost his keys in the dark. Near the man stands a lamp-post. As logic as it is, the man starts searching for his keys in the light: beneath the lamp-post, while its not said that this is the most logic place to search. The same happens with organizations. When looking for innovations, organizations are often searching in the known places, using the resources, networks and knowledge they have always used. This is in fact the problem with the search for discontinuous innovations, to search in and for the unknown.

When analyzing how firms search for discontinuities, different aspects of influence have to be taken for in account. Consider the impacts of environmental change, different cultures and hierarchical structures can have on the success of the search for discontinuous innovations. These influence the innovative capacities of individuals within organizations, not to speak of the effects on inter-organizational performance on innovation. *“The more dynamic and unpredictable top managers perceive the external environment to be, the more favorable they perceive it to be to innovation”* (DeTienne, 2002). An often

recognized trend in discontinuous innovation is that new organizations are the first to place a product or service into the market, giving the established order a problem. When the established firms are confronted with these discontinuous innovations, initiated by new entrants, they need to react. For example, they can choose to let the storm come over and see what the future brings. Also, they can choose to create a new venture and pursue the discontinuous innovation themselves. Or perhaps, one that is even more difficult, they could create some form of ambidexterity (Tushman & O'Reilly III, 1996), and even more options are imaginable. It is a simple logic that a firm does not prefer the first option, because in that case they are completely dependent on what others do. This means that, in order to prevent this, organizations need to search for the discontinuities themselves. The form they choose to pursue these discontinuities depends on the situation the organization is in.

2.4 Search strategies

The way organizations search for discontinuous innovations can be described with the use of 12 different strategies, which are based on the work of von Stamm and Bessant (2007). These strategies will be the primary guidelines for this research, because of their connectedness with the DILab. For each strategy a short description will be given. Where possible practical examples of the strategies, as found in literature, will be discussed. The important concepts of each strategy will be discussed, because they form a major part of the research in order to be able to answer both research questions.

The aim of these strategies is to give organizations the opportunity to develop a search capability for the detection of triggers of discontinuous innovation. This does not mean that these strategies are not useful for continuous innovation. If an organization aims to remain both competitive and durable, these strategies give them a yardstick to become that (Bessant & Von Stamm, 2007). The strategies are summarized in Table 2.

Search Strategy	Mode of operation
Active Users	Seek out and work with those users who actively want to change and improve existing offerings
Idea Hunters	Someone who is proactively looking outside their organization for interesting and/or potentially threatening developments
Using the Web	Use the power of the web to access and explore different developments – connecting to multiple sources of information and operating various forms of web-enabled marketplace
Deep Dive	Term coined by design and innovation consultancy IDEO (www.ideo.com) to really understand how users operate, what they want and need, building heavily on an ethnographic approach
Brokers	Brokers are people who are making connections, internal as well as external.
Futures	Develop ways of looking at the world which do not necessarily follow the current trajectory. Can be trend extrapolation or 'standard' forecasting techniques but can also be more advanced scenario-based approaches
Intrapreneurs	Various ways of mobilizing high involvement innovation across the organization around not only continuous improvement but radically new ideas. Very simply put, Intrapreneurship is Entrepreneurship practiced by people within established organizations
Deliberate Diversity	Bringing-in and nurturing people with a mindset that is different from the organization's cultural norm
Corporate Venture Units	A fund set up by a company to be invested in internal or external ventures
Mobilize Mainstream	Refocus the core tasks of groups like procurement, sales or finance staff to pick up peripheral information about trends in the wider world
Probe and Learn	Deliberately think up alternative hypotheses and then explore them – for example, look for opportunities in the segments of the market you are not active or strong in. Look for the opportunities at the 'low end' low price/good enough product/service offerings
Idea Generators	The use of third party agencies to do the scanning and searching for you

Table 2: Twelve search strategies (von Stamm & Bessant, 2007)

For each strategy the same routine will be used when describing what it enhances. At first a short description will be given on the strategy in general and what is perceived with the strategy by von Stamm and Bessant (2007). Subsequently the different forms that may be found in literature will be discussed. The implications for organizing these strategies within an organization, as described in literature, will fulfill the description of each strategy.

2.4.1 Active Users

Active (or lead) users are active players in the innovation process, not passive players as in the previous strategy (using the web). Organizations try to recognize discontinuities by involving these users in their innovation process, because of their knowledge and experience about the topic. These users are known to be well developed in the knowledge that the organization wants to become. The integration of customers into the innovation process, for example by soliciting new product concepts from them and pursuing the most popular of these ideas, can help organizations avoid costly product failures (Ogawa & Piller, 2006). The position active users take is visualized by von Hippel et al. (1999) in their lead user curve, which is visualized in Figure 5.

Consider the programmable Lego toys Mindstorms RCX (<http://mindstorms.lego.com>). Within a few days after the introduction of the first version of the toys, advanced highly skilled users already cracked the sourcing code and developed updated versions. Lego took its lessons from it, and in the development of a new version of Mindstorms they invited some leading users to participate in the development of the next generation.

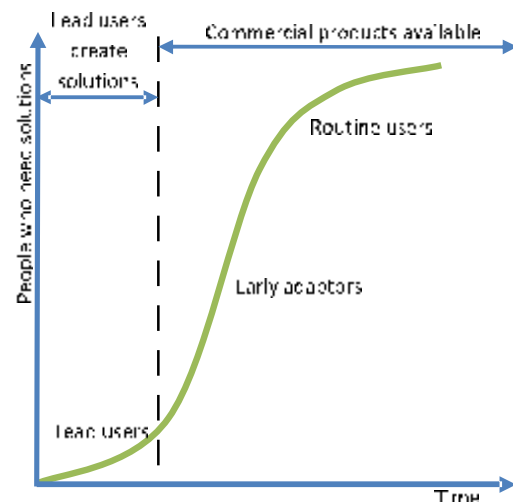


Figure 5: The lead user curve (von Hippel, 1999)

The use of active users can add value to the development process of concepts for needed new products (Herstatt & von Hippel, 1992). The annual sales of lead user product ideas at 3M are projected to be more than eight times higher than forecast sales for the average traditional project (Lilien, Morrison, Searls, Sonnack & von Hippel, 2002). When using active users as a search strategy for discontinuous innovations an organization needs to be aware of the fact that the strategy is applicable on product and process innovations only (Desouza et al., 2008). These scholars developed a model which connects the use of users in the innovation program to the phases in innovation.

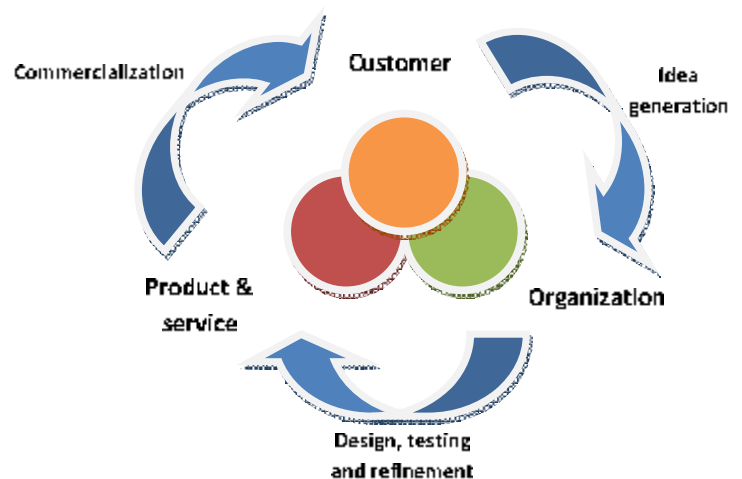


Figure 6: The customer innovation program (Desouza et al., 2008)

Their concept, as visualized, shows some connection with the innovation model of Tidd, Bessant and Pavitt. Where the innovation model starts with the search phase, the customer innovation program starts with the idea generation. This is sort of the same, because one of the ways to search for

innovations is the generation of ideas. The idea generation is then followed by the design, testing and refinement, which can be connected to the select phase. The commercialization of the customer-based innovation can be seen as the implementation phase. The major difference is the learn phase, which is the fourth phase in the innovation model but is not as such at stake in the customer innovation program. The major reason is that the customer innovation program looks at a specific product or process, in which the customer has a big influence in the development and the product or process at the end is made available to the customer again (whether direct or indirect), which does not have to be the case in the innovation model.

The idea generation phase of the customer innovation program has a major implication of which an organization needs to be aware. The way an organization communicates with its customers is very important. As Desouza et al. (2008) stated '*organizations need to have the right communication tools to get the right kinds of ideas from the right resources, who may reside anywhere*'. This means that in order to access these global customers and their knowledge, an organization needs to have information and communication technologies that can reach them virtually and communicate with them in their local languages and in real time. The customers that participate in the innovation program need to be appropriate for the purpose of the program. This means that customer segmentation is very important (Desouza et al., 2008) for organizations in order to be able to get access to the right type of knowledge, because ideas from novices are different than the ideas of super-users.

2.4.2 Idea hunter

This strategy involves the use of an Idea Hunter, who's role is to search actively for new ideas to trigger the innovation process (Bessant & Von Stamm, 2007). An Idea Hunter is also referred to as a scout, which can be full time or part time attached to the search for discontinuities. The primary task is to search things out, often in unexpected places. The task of these Idea Hunters is to anticipate connections between currently unconnected fields, which are often outside their sector. The purpose of an Idea Hunter is to generate new directions for an organization in which it could develop itself. Howell and Shea (2006) discuss in their work that the use of Idea Hunters has a positive impact on the outcomes of an innovation process. A good example of the use of Idea Hunters is Procter & Gamble's use of 80 'technology entrepreneurs', which are scouts that are licensed to roam the world with a wide remit to find and bring back interesting new ideas (Huston, 2006).

Many organizations that incorporate some form of a R&D department within their organization are not aware of the fact that they already employ potential Idea Hunters. Consider employees from the R&D department that attend conferences and workshops on their field of knowledge, whether it is private or businesslike. Because of the new knowledge that will be available at these meetings the employees will continuously develop and extend their own knowledge base. The problem with this kind of knowledge is that when an organization is aware of the opportunity, it often lacks the formalized systems procedures that are necessary to make the knowledge accessible.

The use of Idea Hunters is one of the purest forms of searching for discontinuities by organizations. The scouts have the purpose only to recognize opportunities and deliver them to the resources that have to develop these opportunities. It is important for an organization that when it uses Idea Hunters it creates an appropriate culture. Culture refers to the unique configuration of norms, values, beliefs, ways of

behaving and so on, that characterize the manner in which groups and individuals combine to get things done (Burnes, 2004). It defines how those in the organization should behave in a given set of circumstances.

To operate effectively in a dynamic environment Idea Hunters need to work in a loose structure and a high degree of decentralization. So for Idea Hunters it is necessary that they have freedom within their tasks to search where they think opportunities will arise. Reid and de Brentani (2004) propose that the process works in the direction that the timing and likelihood of organizational-level involvement is at the discretion of individuals. Such individuals perform a boundary spanning function, by identifying and understanding emerging patterns in the environment, with little or no direction from the organization. Often, these individuals also act as gatekeepers by deciding on the perceived value of externally derived information, as well as whether such information will be shared. Consequently for discontinuous innovations, information search and related problems/opportunities are unstructured and are at the individual level during the search for discontinuities. As such, the direction of initial decisions about new environmental information tends to be inward, toward the corporate decision-making level, rather than the other way around.

2.4.3 Using the Web

This strategy can be used for different purposes. A distinction is made between the use of the web as a supportive tool for search activities and as a place to search in for discontinuities (von Stamm & Bessant, 2007). When it is used as a searching place it has different levels on as well breath as depth in which this can be done. In its simplest form it is a passive information resource to be searched. Consider it as an additional space where organizations can search for discontinuities. In a more sophisticated form organizations are offered focused search capabilities by specialized companies, or they perform a more in-depth search themselves.

The second possibility for the web as a tool to search for discontinuous innovations is the use of the web as a supportive tool, which can be done through both intranets and extranets. With the use of a web-based communication system organizations make it easier for themselves to get the information that is gathered with the use of search strategies for discontinuities at places where it is needed. Consider the upcoming online laboratory of Second Life (www.secondlife.com). Founded by Linden Lab, Second Life is an online role playing game with millions of users. People can assume themselves as what they want to be through different identities, and live a different life. This creates the possibility to recognize trends (perhaps discontinuities) that might be applicable to the real world.

As Woolgar et al. (1998) discuss, the necessity for SME's to search outside their own organization for discontinuities, in this case technologies, is high because these types of organizations lack in most cases the resources to create discontinuous technologies themselves. Because of the fact that discontinuous technologies are often developed by universities, they suggest that the use of a web-based databank with technologies discovered by universities should be created in order to make it possible for SME's to access these technologies more easily. Large organizations can also profit from the use of such a databank, but in most cases these organizations use different methods.

2.4.4 Deep Dive

Deep Diving is a technique which is more often used in current business, which aims to indicate what the cause is of an expression of customers (von Stamm & Bessant, 2007). This means that an organization is not interested in the first expression of customers, for example the demand for an electric drill, but in the actual need to put a whole in a wall. Organizations and scientists have recognized that what people say and what they actually do is quite different, a topic referred to as customer need assessment.

An essential objective for customer need assessment activities in companies is to produce useful information for the early phases of product innovation, to be utilized for instance in the planning, evaluation and prioritization of new product development projects (Kärkkäinen & Elfvingren, 2002). Customer need assessment is understood broadly as the activities concerned with the recognition, gathering and clarification of customer needs and their importance to determine need specifications and objectives for new products (Holt, 1984). In most firms there are few key people, if any, who understand the critical importance of properly assessing user needs, who will insist on making such assessments before embarking on major R&D projects and who will make the necessary arrangements for systematic need assessment studies. As Holt suggests (1984) a successful product innovation represents a coupling between a user need and an appropriate technology, in which the technology should not be considered as an end product, but rather as a means of satisfying human needs. It is not the development of a new technology but its application which is the basis of economic and social progress.

The planning, introduction and application of a system for need assessment will be influenced by factors such as business concept, corporate strategy, type of market, driving force behind technological development, structure of the user sector, access to the user sector and attitude of management. The responsibility for maintaining and developing the system for need assessment should be clearly stated. Normally it should rest with the unit or committee in charge of product innovation planning (Kärkkäinen, Piippo & Tuominen, 2001). However, all persons participating in the innovation process should master and use appropriate methods in connection with their work. Also, implementation of systematic need assessment requires top management support, and participation of one or several staff members who are thoroughly trained in need assessment methods and can assist in introduction and diffusion within the company (Holt, 1984).

Holt (1984) discusses that an array of methods is available for need assessment purposes. Existing information within the firm, such as complaints, inquiries and suggestions from customers and oral and written reports from salesmen or service staff can reveal existing needs and in rare cases future needs. Outside information such as government laws and regulations, products and activities of competitors, trade fairs, proper literature and expert contact can provide useful information about existing needs and in some cases future needs.

Kelley et al. (2001) have done an intensive research on how Ideo (<http://www.ideo.com>) makes a continuous stream of innovations through different markets and technologies work. One of Ideo's most important techniques is to carefully observe the behavior of people who will be using a product or service. The analysis of the behavior creates the foundation for the whole development trajectory.

2.4.5 Brokers

As von Stamm and Bessant (2007) suggest, much innovation happens at the boundary between one knowledge set and another rather than at the frontier of any one particular knowledge field. This means that organizations have to be aware of the fact that many opportunities lie in combining multiple knowledge fields. There are two possibilities on how the organization can use the unconnected sets of knowledge (Rose, 1999). First, they can transfer the knowledge from one domain to another (Figure 7: part A). Second, they can combine the knowledge from both sets in a new knowledge set (Figure 7: part B).

When organizations use Brokers it is important that they recognize that they have to make a choice which knowledge sets the brokers can access. Burt (2004)

describes the importance of structural holes in a network or knowledge set. With the use of structural holes a broker can access more resources, because less activities need to be done in order to maintain a bigger amount of (non redundant) resources.

2.4.6 Futures

According to von Stamm and Bessant (2007) a way of sourcing for ideas about possible innovation triggers is to imagine alternative Futures, especially those which do not necessarily follow the current trajectory. A good way of exploring such Futures is the use of scenario planning (or scenario learning). Scenario planning is, as Fahey and Randall put it (1998): *'the development of scenarios and their integration into decision making'*. The use of these scenarios has two purposes. First, it has the goal to enlarge the decision makers' understanding of possible Futures. Second, it enhances the decision making. The scenarios have the purpose to give direction to the strategy a company tries to achieve. The focus of Futures is on the long run, which also is the bottleneck. Because of their long horizon they are inconsistent with the short-term focus of most larger organizations. As de Geus (1997) puts it: *'in the language of economics, companies are expected to operate with profits as their primary goal'*. With other words, a large organization can pursue a long run strategic planning as ambitious as one can imagine, but eventually it will be forced to pursue short term profit and growth, and will find trouble in investing in what on the long term is necessary.

Schwartz (1991) describes that scenarios should be used in on-going "strategic conversations" within organizations. Rather than using them as a one-shot method for evaluating a specific decision or direction, organizations should make them a consistent, informal and creative part of organizational dialogue and learning. The implication of the use of Futures is, as in line with de Geus (1997) and Fahey and Randall (1998), that they are most applicable on the larger organizations, because of its purpose of

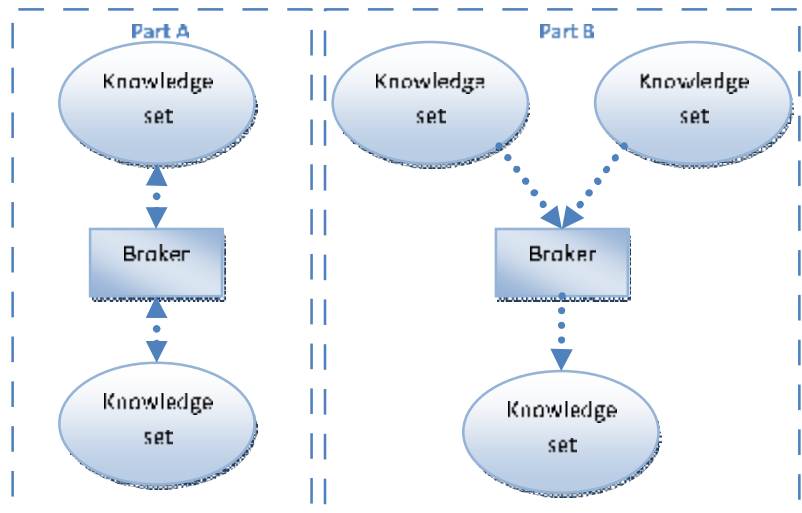


Figure 7: Two ways of transferring knowledge by Brokers (Rose, 1999)

providing the organization a grip to combine the short term targets with a long term strategy (Smith, 2006). For example, Shell has pioneered the use of exploring Futures in their Game Changer program. Through a dedicated space (www.shell.com/gamechanger) extensive use is made of alternative Futures to help identify issues that may have impact on their business and change the Future.

This strategy is very different when comparing it with the previous strategy, Idea Hunters. Where the strategy of Idea Hunters actually embraces people within an organization, the use of Futures is a form of information generation that encompasses input for the strategic decision making within an organization. The most important aspects for the implementation of this strategy are the awareness of an organization on the antinomy between the short and long term goals of the organization. Also, an organization needs to realize that for the source of Futures it needs to be open-minded, just as with Idea Hunters.

When an organization wants to use Futures, it needs to keep a few important aspects in mind. First of all, for each issue a number of scenarios needs to be laid out, in which each scenario represents a different picture of the Future that is carefully developed around clearly identified trends (Fahey, 1989). The driving principle is that the Future of an organization is pluriform, which means that there is not one predictable Future, but several scenarios are thinkable (de Geus, 1997). Second, the purpose of scenarios is to recognize opportunities and threats, to create new insights and ideas about the landscape of the organization. To achieve this, scenario planners need to go into 'wide world' and look at the organization from a different perspective. Third, the people who will fulfill the role of scenario planner need to be open-minded and innovative, and have to be placed in the core of the planning process (de Geus, 1997). This can be either in a separate department, or in the form of a multi-task strategic team. Fourth, the number of scenarios that are developed is essential for the decision making on which scenario to adopt in the strategy of the organization. Too many scenarios confuse the manager. An uneven number of scenarios give the manager the possibility to flee, because he has the opportunity to choose for the middle course. Fifth, after the scenarios are formulated they need to be tested and quantified with the use of simulation models. By quantifying the scenarios are judged on consistency, which will result in a set of consistent, plausible Futures (de Geus, 1997; Fahey & Randall, 1998).

2.4.7 Intrapreneurs

With intrapreneuring organizations start up a new organization within an existing organization, in order to be able to do different things than the organization is used to do (Carrier, 1996). In this way problems can be overcome, because innovations can be used within the organization without affecting the current operations of the organization. The difference between entrepreneurs and intrapreneurs is the fact that the first innovate on behalf of their own and the latter innovate on behalf of someone else.

When intrapreneuring is used in the search for discontinuities it includes various ways of mobilizing high involvement innovation across the organization and attempts to build on ideas generated within and across the organization. The most important variable to make it possible for intrapreneuring to be successful is the climate of an organization. Intrapreneuring requires a commitment of resources but also a set of mechanisms to take bright ideas forward. This includes various internal development grants and an often complicated and fickle internal funding process (von Stamm & Bessant, 2007). Fry (1987) has developed a number of important factors which are primary meant for the management, because they are the controlling factor over the organization:

1. Provide intrapreneurship the necessary time and resources
2. Be sure management sponsors the concept. Management also must convey:
 - Trust
 - Expectation of excellence
 - A long term focus
 - The practical rewards of the sponsorship
 - An openness to criticism
 - A willingness to facilitate change
3. Give intrapreneurs freedom; a lot of rope. Sponsor, do not manage their program
4. Forgiveness, freedom to fail, leeway to change directions
5. Enrich the climate by sharing goals. People like to work in realistic directions, and do not want to have their time wasted.

Intrapreneurs differ from Idea Hunters in the fact that they not only recognize an opportunity, but also have the possibility to actually develop and commercialize it. The success of an intrapreneur can be enlarged by forming a team, in which the members of the team compensate each other's weaknesses. The use of a team will lead to better results, although it still is a long process and to reach success a long time passes.

2.4.8 Deliberate Diversity

This strategy suggests that organizations should think about how they bring together teams that handle discontinuous innovations. As imaginable, the composition of a team is highly dependent on the purpose for what it is called to life. For example, for a new design of a production plant different knowledge is necessary than in the creation of a promotion campaign for a new cellular phone.

When discussing the search for discontinuous innovation in teams, organizations should be aware of the advantages of a team which consists of a diversity of members. Ancona and Caldwell (1992) discuss the two core properties of a team member; its specific function and background and its tenure. These two properties have their own distinct effects on the team's performance. As they found, the greater the functional diversity, the more team members communicated outside the team's boundaries. This communication was with a variety of groups such as marketing, manufacturing, and top management. And maybe even more important, the more the external communication, the higher the managerial ratings of innovation. Tenure diversity had its impact on internal group dynamics rather than external communications. Tenure diversity is associated with improved task work such as clarifying group goals and setting priorities. In turn, this clarity is associated with high team ratings of overall performance.

On the same principle Cummings (2004) discussed that a structurally diverse work group is one in which the members, by virtue of their different organizational affiliations, roles, or positions, can expose the group to unique sources of knowledge. When discussing a team's composition an organization should look at: the core capabilities and properties of an employee. The analyses showed that external knowledge sharing was more strongly associated with performance when work groups were more structurally diverse. This counts for organizations that search for discontinuous innovation as well, because of the importance of thinking out of the box in order to be able to recognize discontinuities.

But as Ancona and Caldwell (1992) discuss, the diversity of a team does not only have a positive influence on the outcome. A diverse composition does produce internal processes and external communications that facilitate performance, it also directly impedes performance. As their research shows, the overall effect of diversity on performance is negative, even though some aspects of group work are enhanced. The problem solving and product development aspects of the teams purpose benefit from the team's diversity, but when it comes to the implementation the team's diversity has a negative influence when compared to homogeneous teams. The general conclusion is that when an organization chooses to use teams with a diversity of members, it should think about how to harvest the positive process effects of diversity and to reduce the negative direct effects. As Ancona and Caldwell suggest (1992) *"at the team level, greater negotiation and conflict resolution skills may be necessary. At the organization level, the team may need to be protected from external political pressures and rewarded for team, rather than functional outcomes."*

2.4.9 Corporate Venture Units

This strategy involves the setting up of special units with the remit and budget to explore new diversification options with the aim to secure some ring-fenced resources dedicated to the exploration of new opportunities that may not be acceptable in the parent organization (von Stamm & Bessant, 2007). The reasons why organizations choose to create Corporate Venture Units are very diverse. It might be that the innovation at hand has a too small potential for the firm and it falls outside the strategy of the organization. It may also be that the innovation is expected to be so risky that a possible failure would have a tremendous negative effect on the current business. A last possibility is that the innovation is not close enough to the existing portfolio.

The ways Corporate Venture Units are actually organized range from a simple venture capital fund for investments in internal and external generated ideas through to pro-active search for investment opportunities, unrelated to the organization's current range of activities (von Stamm & Bessant, 2007). There is a distinct difference in the way large organizations and small organizations benefit from the use of Corporate Venturing (Smith, 2006). A larger organization uses in most cases the possibility to take a financial stake in a smaller one in return for a share in its development. According to Smith these types of arrangements occur most often in high-technology sectors. It reflects the developments towards the trend that larger organizations invest in smaller ones, as is the case in Silicon Valley. The larger organizations then have the opportunity to let the innovation evolve and see whether it has the potential it is ought to have. When the innovation does, the organization can more easily adopt it into the organization, but when it lacks the potential that is necessary for success, it can easily step out without big consequences. The reason why the smaller organizations choose to use Corporate Venturing is that they can benefit from the resources of a larger firm when they lack the opportunity to obtain them on their own. Also, when considering for example expensive technologies the use of Corporate Venturing makes it easier to obtain funds and the managerial expertise that is necessary to make an innovation work is also easier to access.

Von Stamm and Bessant found that the success of Corporate Venturing, measured in terms of their strategic and financial contribution, is driven by the degree of engagement by Corporate Venturing units with the wider venture capital community. Those Corporate Venturing units that engage actively with

the wider venture capital community are more successful than those that do not (Buckland, Hatcher & Birkershaw, 2003).

2.4.10 Mobilize Mainstream

This strategy deals with the issue that whilst understanding the need to search for potential discontinuities most organizations are already stretched, lacking resources for new and different search activities. They are used to do things the way they used to, and have developed over time a certain standard in working, even with discontinuities. The choice in how to use their resources by organizations is very important, because they can only use those ones.

The basic principle is that organizations look at how they use their resources, and then relocate these resources in order to be able to, in this case, generate discontinuous innovations. Von Stamm and Bessant (2007) found that companies have developed new ways to amplify their search capacity by making better or different use of existing resources, i.e. mobilize mainstream players that could offer insights as by-products of their day to day activities. For example, sales personnel is in constant contact with customers and tries to generate new customers, in which they should be aware of changing demands in the market and innovations come by competitors at their customers.

2.4.11 Probe and Learn

This strategy aims at the problem that comes with the development of Futures. Futures can have the troubling characteristic that they are so radically different than the way organizations are used to, that it is hard for them to get a clear understanding about the future (von Stamm & Bessant, 2007). The Probe and Learn strategy gives a possibility for organizations to investigate whether a future has potential. The basic principle of the Probe and Learn strategy is that organizations put prototypes and/or concepts into the market before the actual product is going to be put into the market, in which they focus on the reaction and perception of the users.

The strategy can have two different purposes. The first is the visualization of the future as soon as possible. As Thomke (2003) proves visualization of a future has a positive influence on the innovation process. Often the problem with discontinuities is that they are so radically different with the way organizations are doing business that it's hard to imagine for them what these discontinuities actually look like. When discussing a product a picture can help, when discussing a process a rough model can give good support. The second purpose is the pilot-scale testing of an innovation before taking it to the market. The selection of a small but relevant testing ground offers a deliberate learning strategy. It may also be that experiments are designed with the prime intention of getting more information about what and what not to do (von Stamm & Bessant, 2007).

Lynn et al. (1996) suggest that the experimentation with an early version of a product or process only adds value if it serves several purposes. First, it should create a vehicle for learning about the technology, and whether how it can be scaled-up. Second, it should indicate important characteristics about the market, and which applications and market segments are most receptive to the various product features. Finally, the influence of exogenous factors should become clear, such as changes in government regulations and the need for regulatory approvals. They also say that *'the development of a*

discontinuous innovation becomes a process of successive approximation, probing and learning again and again, each time striving to take a step closer to a winning combination of a product and a market.'

When it comes to searching for discontinuities, the Probe and Learn strategy does not create major benefits for the recognition of triggers. The strategy is based on an already known product or process, which has such abstract characteristics that the organization is not able to get a full understanding of the innovation. This means that when an organization uses the Probe and Learn strategy, it will not be to search for discontinuities, but rather to examine whether an innovation has any potential.

2.4.12 Idea Generators

An Idea Generator can be found in two different ways within organization. First, organizations are recognizing the opportunity of using their stakeholders as sources of new ideas, including its customers, software developers, managers, and support staff (Florida & Goodnight, 2005). Their framework for managing creativity rests on three guiding principles:

- ✚ Help employees do their best work by keeping them intellectually engaged and by removing distractions.
- ✚ Make managers responsible for sparking creativity and eliminate arbitrary distinctions between "suits" and "creatives."
- ✚ Engage customers as creative partners so you can deliver superior products.

The underlying idea of the framework is to create an organization in which interaction is stimulated. Through this interaction new possibilities open up, and people stay motivated in order to perform better each time.

The second way Idea Generators can be found in organizations is in the use of external agencies. These agencies help an organization with the creation of ideas with discontinuous potential. They serve as an early warning system for weak signals about changing trends (vor Stamm & Bessant, 2007). Trend agencies are a good example in their provision of general insights to organizations on, for example, socio-demographic development. The point at which value is added is the interpretation of the company specific context.

Iwamura and Jog (1991) discuss the difference between innovative firms and non-innovative firms. They found that innovative firms have developed better communication channels, both internally and with their customers, but the most significant difference that separates innovators from non-innovators is the management of the idea generation process, including concept generation and management's support. As they conclude *'innovators tend to approach idea generation in the following ways: they employ a variety of idea sources, both internal and external; they assign a specific person or group to be in charge of developing new ideas; they encourage employees at all levels to generate new ideas; they use a variety of innovative techniques to stimulate creativity; they reward their employees by non-monetary means; and they encourage group-level participation in evaluation decisions.'*

This shows that when searching for discontinuities the use of external Idea Generators can be most helpful as a source for recognition. But an organization needs to be aware of the danger that the

external Idea Generator is not conscious of the organization's specific characteristics, and that it still needs to make its own judgment on the applicability of the discontinuity.

2.5 Theoretical discussion

In this paragraph the previous discussion of the search strategies will be taken forward into a theoretical discussion. In this theoretical discussion the specific characteristics of the search strategies will be connected to the common organizational characteristics, in which use will be made of the contingency theory.

The contingency theory emerged in the 1960s out of a number of studies of organizational structure and management (Scott, 1987). In essence, the contingency theory is a rejection of the 'one best way' approach (like the Classical approach (Taylor, 1911) and the Human Relations approach (McGregor, 1960)), previously sought by managers and profound by academics. The view of the contingency theory is that the structure and operation of an organization is dependent on the situational variables it faces. The main variables are the environment, technology and size (Burnes, 2004). From these variables it follows that no two organizations will face exactly the same contingencies. Because of this fact the structures and operations of these organizations will differ to. This implicates that the 'one best way' for all organizations is replaced by the 'one best way' for each organization. Scott (1987) mentioned that one of the clear distinctions between the 'one best way' approaches (Classical and Human Relations) and the contingency theory is that *'the previous definitions tend to view the organization as a closed system, separate from its environment and comprising a set of stable and easily identified participants. However, organizations are not closed systems, sealed off from their environments but are open to and dependent on flows of personnel and resources from outside.'*

One of the main characteristics of the contingency theory is that the organization is influenced by situational variables, contingencies. The same argument can be vouched for the search strategies. The strategies are influenced by specific situational contingencies, which determine the applicability and chance of success of these strategies. The contingencies influence the specific characteristics of the search strategies, which will be discussed in the next paragraph. The contingencies itself will be discussed afterwards, from which propositions will be formulated.

2.5.1 Variety in search strategies

To structure the strategies, at first a distinction is made between strategies that are internally oriented and strategies that are externally oriented. The difference between internally and externally oriented strategies is caused by the window in which the strategy operates. The internally oriented strategies work within the boundaries of the organization, the externally oriented strategies go beyond these boundaries. This does not mean that the people or resources that are used are within or outside the boundaries of the organization; it is about the origin of the triggers that are searched for. There are also strategies that combine both fields of orientation. The alignment of the strategies is at first given in Table 3, after which the place of each strategy in the table will be discussed.

Internally oriented	Externally oriented	Internally and externally oriented
Intrapreneuring	Idea Hunters	Active Users
Deliberate Diversity	Futures	Using the Web
Corp. Venture Units	Deep Dive	Probe and Learn
Mobilize Mainstream	Brokers	Idea generators

Table 3: Internal and external oriented search strategies

The first strategy that is internally oriented is **Intrapreneuring**, a strategy that focuses on the creation of internal vehicles, which have the purpose to create new discontinuous innovations or examine the potential of such innovations (Carrier, 1996). It always stays within the organization and encompasses ways of mobilizing high involvement innovation across the organization. This includes various internal development grants and an often complicated and fickle internal funding process (von Stamm & Bessant, 2007). The strategy focuses primarily within the boundaries of the organization, so it's internally oriented. The second internally oriented strategy is **Deliberate Diversity**. This strategy focuses on the consciousness of organizations how they should create and bring together teams that handle discontinuous innovations. Attention should be given to two core properties of a team's members: its specific function and background and its tenure (Ancona & Caldwell, 1992). This indicates that the strategy focuses on the creation of the optimal composition of a team, it does not give direction to the actual goal and strategy of the team. This indicates that the strategy is internally oriented, it does not pass the boundaries of the organization. The third internal oriented strategy is **Corporate Venture Units**. The specific reasons why organizations choose to create Corporate Venture Units are very diverse, but the general purpose of the use of Corporate Venture Units stays the same; to make it possible for an organization to investigate the potential of a discontinuous innovation, which may have negative effects on the organization, without losing total control over the innovation. The control is maintained by keeping the Corporate Venture Unit near or even inside the organization. Also, the innovation is in most cases already internally available. This means that the strategy focuses primarily within the boundaries of the organization, so it's internally oriented. The fourth and final internally oriented strategy is **Mobilize Mainstream**. The basic principle within this strategy is that organizations look at how they use their resources, and then relocate these resources in order to be able to generate discontinuous innovations (von Stamm & Bessant, 2007). One of the ways this can be done is to make better use of mainstream players (i.e. sales personnel) and make it possible for them to offer insights on discontinuous innovations next to their day to day activities. This strategy focuses on the optimal use of mainstream players within the organization in the search for discontinuous innovations.

The first externally oriented strategy is **Idea Hunters**, who have the goal to search for new ideas to trigger the innovation process. One of the primary tasks of these scouts is to anticipate connections between currently unconnected fields, which are often outside their sector (von Stamm & Bessant, 2007). As Reic and de Brentani (2004) discuss the Idea Hunters perform a boundary spanning function, by understanding emerging patterns in the environment. This clearly indicates that the use of Idea Hunters in the search for discontinuous innovations is externally oriented. The second external oriented strategy is the use of **Futures**. Futures have the purpose to solve the antinomy between short term and

long term goals within an organization (de Geus, 1997; Fahey & Randall, 1998). As de Geus (1997) also discusses, one of the most important aspects of the use of Futures is the recognition of new opportunities and threats, to create new insights and ideas about the landscape of the organization. The landscape of an organization is an external factor and the use of Futures makes it possible to look at the landscape and the organization from a different angle in order to be able to recognize discontinuities. The third strategy that is primarily external oriented is **Deep Dive**, which is also referred to as customer need assessment (Kärkkäinen & Elfvengren, 2002). It has the purpose to indicate what the cause of an expression of a customer is. This means that the strategy focuses on the recognition of external needs and behaviors, in order to be able to adapt to these needs, which indicates that the strategy is externally oriented. The last externally oriented strategy is the use of **Brokers**. Much innovation happens at the boundary between one knowledge set and another rather than at the frontier of any one particular knowledge set. The opportunities, or discontinuities, for organizations are found between these boundaries. As Burt (2004) discusses, when crossing these boundaries and combining insights from these fields new knowledge sets can be created. These fields between the knowledge fields have in common that they are unknown to the organization, which characterizes the discontinuous part of it and explains why this strategy is externally oriented.

The first strategy that can be internal and external oriented is **Active Users**. Within this strategy users that are known to be well developed in the knowledge an organization wants to become are given an active role in the innovation process. These users are in most cases consumers or business customers, but can also be internal parties (Ogawa & Piller, 2006). These users are integrated into the innovation process to pursue the most popular ideas, because it is proven that this strategy enlarges the success and avoids costly product failures. The strategy can be both internally and externally oriented, it focuses at the integration of parties within the innovation process. The second internal and external oriented strategy is **Using the Web**. As discussed by von Stamm and Bessant (2007), the strategy can be used for two different purposes. When it is used as a searching place for discontinuities, the purpose is to recognize possible triggers of discontinuities which lay outside the organization (Woolgar et al., 1998). When it is used to serve the other purpose, the use of the web as a supportive tool, it has the purpose to serve the other search strategies. In this situation the orientation of the strategy can as well be external (extranets) as internal (intranets). The main purpose of the strategy will be to serve as an additional searching place for discontinuous innovations, which is externally oriented. The third strategy that can be as well internally as externally oriented is **Probe and Learn**, which can, as discussed, have two different purposes. The first purpose is the visualization of a future (Thomke, 2003), which has the goal to create a clear understanding of what the innovation looks like, which is internally oriented. It has the goal to amplify the understanding of a discontinuity for internal stakeholders. Within the second purpose of the strategy, pilot scale testing (Lynn et al., 1996), the strategy can be both internally and externally oriented. It depends on the origin of the testing sample, whether these are internal or external entities. The last internal and external oriented search strategy is **Idea Generators**, which can be used in two different ways. Organizations are recognizing the opportunity of using their stakeholders as sources of new ideas, including its customers, software developers, managers and support staff (Florida & Goodnight, 2005). The second possibility is the use of external agencies for the generation of radical different ideas (Iwamura & Jog, 1991). In the first way the orientation of the strategy can as well be internal as external, the second possibility is only external oriented.

What all externally oriented strategies have in common is that they have the purpose to address new sources of information which might lead to discontinuous innovations, which are always outside the physical boundaries of the organization. This is contrary with the sources of innovation that the internally oriented strategies address, they all focus within the boundaries of the organization. This is a major difference and can have great impact on the outcome of the innovation process of an organization. Due to the differences in availability of internal and external resources, different approaches must be used to address these resources. The consequences that are allied to these approaches will be discussed in the next paragraph.

The second variety in search strategies comes from the different gradations of investment for the implementation and operation of the search strategies, because of the specific characteristics of the strategies. The different gradations of investment are summarized in Table 4, for which the differences will subsequently be explained. The gradations are based on the necessity of resources for the implementation of the strategies, classified in time, employees and funds. This means that the investment is determined by the amount of resources that is necessary for the specific strategy [Johnson, Scholes & Whittington, 2008]. Also, the extent of resources that an organization devotes to innovation is a determinant of its innovativeness [Narayanan, 2001].

Search Strategy	Necessary resources			Average investment in resources
	Time	Employees	Funds	
Active Users	Medium	Low	Low	Low
Idea Hunter	Low	Medium	Low	Low
Using The Web	Low	Medium/Low	Low/Medium	Low/Low
Deep Dive	High	Low	Medium	Medium
Brokers	High	Low	Low	Medium
Futures	High	Low	Low	Medium
Intrapreneurs	Medium	Medium	Medium	Medium
Del. Diversity	Medium	High	Low	Medium
Probe And Learn	Medium/High	Medium/Medium	Medium/High	Medium/High
Cor. Venture Units	High	Low	High	High
Mob. Mainstream	High	High	Medium	High
Idea generators	High	Medium	High	High

Table 4: Complexity of search strategies and degree of resources

Active Users have been described as users that are known to be well developed in the knowledge that the organization wants to become (von Hippel, 1999). When organizations want to develop and produce products/services they can be helped with the involvement of these users. Most organizations have the possibility to address the knowledge of their customers (whether business or consumer) in the search for discontinuous innovations, because the organization is already familiar with these customers. This argues that relatively few funds are necessary for the strategy to be implemented and few employees are needed to retrieve knowledge from these Active Users. The time that needs to be made available is more important, because the Active Users need to be convinced what the added value for their participation is. Also, the importance for the Active User to participate will not always be very High,

which determines that the organization needs to be patient in the participation. Organizations that incorporate some form of R&D department already employ **Idea Hunters** (Huston, 2006). This suggests that an organization only needs to become aware of the presence of these employees. Because the **Idea Hunters** are often already employed by the organization the necessity of resources is relatively low. The organization does not have to make much time available, because most **Idea Hunters** already search for discontinuous innovations in their day to day activities. Also, the necessary funds to implement the strategy within the organization are also relatively low, there is no need to facilitate the **Idea Hunters** with large amounts of money. Within **Using the Web** an organization has two choices to use the strategy (von Stamm & Bessant, 2007). When an organization uses the web in its simplest form, it incorporates the use of the web as a passive information source, which is hard to ignore in today's society. The necessary time for employees to search the web for potential discontinuous innovations is relatively low, most employees are well known with the use of the internet. The necessity for funds is relatively low, because of the world-wide availability of the internet as a low-budget resource. Caused by differing interests of employees (an engineer has other interests as a salesman) the necessary employees to make the implementation of the strategy successful is higher when compared to the necessary time and funds. The more sophisticated form, the use of the web as a supportive tool, needs more coordination and has a higher barrier. To create some form of intranet or extranet the organization needs to make more funds available, because the development of these applications calls for specific knowledge, which is often not available within the organization. The time that is necessary to implement the strategy is the same as within the more simple form, for the same reasons. The number of employees that are necessary is lower, just few employees will be known with the development of such a tool. Once the tool is developed it will again be used as the more simple form, which means that than the necessary resources will chance to those that are necessary for the simple form.

The first strategy for which the average investment in resources can be labeled as medium is **Deep Dive**. The purpose of **Deep Dive** is to study what people actually do and what their needs are, rather than what they say they do and want. The necessary time to address these needs is relatively high, because it is a time consuming activity to address consumer behavior (Holt, 1984). The employees that are necessary to implement the strategy is relatively low, because just few employees have the possibility and ability to recognize the needs. To be able to get in contact with these customers an organization needs to make it possible to go to the customer, whether it is physically or indirect, which makes it necessary to make some funds available. Also, when an organization prefers to address the customers indirect, it needs to invest in forms of communication with these customers. **The Brokers** have the purpose to connect sets of knowledge to each other, with the purpose to generate new insights for discontinuous innovations. This implicates that the necessary time to implement the strategy is high. It is relatively time consuming to connect the fields of knowledge to each other, but because the fields are already known there does not have to be a large investment in time to recognize these fields. Within an organization there are just few people who are known to be aware of the existence of the different knowledge fields. Also, the funds that are necessary to implement the strategy are relatively low, because the people that are involved are already accompanied by the organization and no large investments have to be made to recognize the fields of knowledge. **Futures** are used as a method for scenario planning, in which it should be used in on-going strategic conversations (Fahey & Randall, 1998). This implicates that they are applicable on the strategic management of an organization only, so few employees will actually get

involved in the strategy. Also, there are relatively few funds necessary to formulate the Futures in an early stage which the search for discontinuities is. On the other hand, the formulation of Futures is a very time consuming activity, because it is influenced by a lot of different factors (i.e. corporate strategy, market position, etc.). This implicates that the necessary time is relatively high. As is discussed by Fry (1987), the use of **Intrapreneurs** in the search for discontinuous innovations requires a commitment of resources and also a set of mechanisms to take bright ideas forward. The availability of necessary resources is mediocre. It starts with the availability of a specific type or group of employees, which have the characteristic that they are entrepreneurial. This implicates that if this type of people are not already employed they need to be recruited. Second, the necessary time for the use of Intrapreneuring within an organization is also mediocre. A potential to be developed by one or more employees within an organization asks for patience to develop. Also, the development of such a potential may require investments in, for example, assets, which implicates that the necessity of available funds is there to. **Deliberate Diversity** suggests that organizations should think about how they bring together teams that handle discontinuous innovations. These innovations can be very diverse of nature (Bessant & Tidd, 2007), which indicates that for each innovation different knowledge, and thus different members of a team are necessary. This asks for a diverse composition of employees within an organization, in order to be able to successfully cater to each discontinuous innovation. The composition of such a team is very time consuming when it is done the first time, but when it is done ones a certain form of repetition comes in. The necessity for funds to be available is much lower, because the composition does not directly ask for large investments (only when new employees need to be recruited).

The first strategy for which the average investment can be labeled as high is **Probe and Learn**, which can have two purposes. If it is used with the purpose to visualize the future, whether a picture or a model, it seems to come with a low investment in resources, but this is in fact not true. Because of the often radical different nature of a discontinuity, it is hard for organizations to even imagine what the innovation will look like (Thomke, 2003), which has the consequence that there are more resources necessary as one would expect on first sight. If the strategy is used with the second purpose, as a pilot-scale testing, the resources that have to be available are much higher. The testing of a prototype is time consuming, which implicates that relatively much time needs to be available. Also, the creation and testing of a prototype can be very expensive (imagine a prototype car). Not all employees are known to be able to play an active role in the creation and testing of a prototype, so the availability of employees is mediocre. With **Mobilizing Mainstream** the difficulty lies in the use of resources that are often already overloaded with work. In most organizations, especially those that perform well, day-to-day activities already swallow down all available resources in order to be able to satisfy market demands (Tidd, Bessant & Pavitt, 2005). This leaves no room for extra activities, which are necessary to be able to pursue discontinuous innovations. The relocation of resources is a time consuming activity, especially when recreating routines in activities. The strategy is formulated around the availability of employees, which implicates that the necessity for the availability of these employees is relatively high. The only funds that need to be available are those that are connected to employees, whether it be salary or recruitment costs. The use of **Corporate Venture Units** comes with a high investment in resources for organizations as well, because of the demarcation through contracts and engagements (Buckland et al., 2003). The process of creating contracts and building up relations asks for large investments in funds and is very time consuming. The strategy is initiated and formalized from the top management of an organization,

which comprehends that just few employees are able to participate in the strategy. When discussing the necessary investments for the last strategy, the use of **Idea Generators** seems to have a low average investment on first sight as well, but this in fact is not true. Iwamura and Jog (1991) discuss that the difficulty for the use of **Idea Generators** lies in the perception of the organization's specific characteristics. It is hard for external agencies to identify what the specific characteristics are, especially in the complex situations the organizations seem to be. This requires the investment of a lot of funds in order to make it possible for an external agency to become familiar with the way an organization does business. This process is very time consuming, which implicates that the time it takes to be successful is relatively high. Not all employees are suitable to get involved in this strategy. The primary contacts with an external agency will be on a high level within the organization. Subsequently, if more information from within the organization is necessary employees from different levels within the organization can get involved in the strategy.

2.5.2 Contingencies

In this research a distinction is made between two contingencies. These contingencies are based on both the common contingencies from the theory (Burnes, 2004) and the specific insights on the search strategies for discontinuous innovation. Also, some generally accepted understandings on the search for discontinuous innovations have influenced the recognition of contingencies.

2.5.2.1 Contingency 1: Sector

The first contingency is described as sector. Sector refers to the market in which an organization does business. A first distinction is made between manufacturing organizations and service organizations (Daft, 1991), which is characterized in Table 5.

Manufacturing organizations	Service organizations
Produce physical goods	Produce nonphysical goods
Goods inventoried for later consumption	Simultaneous production and consumption
Quality measured directly	Quality perceived and difficult to measure
Standardized output	Customized output
Production process removed from the customer	Customer participates in production process
Facilities site moderately important to business success	Facilities site crucial to success of firm
Capital intensive	Labor intensive

Table 5: Differences between manufacturing and service organizations (Daft, 1991)

The differences between manufacturing and service organizations are very diverse, as comes forward from the table above. Manufacturing organizations are those that produce physical goods. In contrast, service organizations produce nonphysical outputs, such as medical, educational or transportation services provided for customers, which also include the sale of merchandise. Although merchandise is a physical good, the service company does not manufacture it but merely sells it as a service to the customer.

Services differ from manufactured products in two ways (Northcraft & Chase, 1985). First, the service customer is involved in the actual production process. The patient actually visits the doctor to receive the service, it is inescapable. Second, manufactured goods can be placed in inventory, whereas service

outputs, being intangible, cannot be stored. Manufactured products can all be put in warehouses and sold at a later date. However, a service must be created and provided for the customer exactly when he or she wants it.

Next to the difference between manufacturing and service organizations also a distinction between manufacturing organizations can be made. A classification is made by Eurostat (2006), the statistical office of the European Communities, which collects data on a range of different statistical topics, mainly from the 27 Member States of the European Union, but also from the three candidate countries and from the four EFTA countries. The statistical data are often only collected at national level, but very many statistical fields also have statistics at regional level, which gives a more complete picture. The classifications of the different industries are given in Appendix B, in which the numbers in the brackets refer to the original sector defined by Eurostat. The classifications are based on the ratio of R&D expenditure to GDP or R&D intensity. The service organizations are also classified by Eurostat, which is presented in Appendix B to.

The classifications provide a method for classifying the organizations that will be used in this research. The classifications are based on differing R&D expenditures and R&D intensity, which proves that the sector in which an organization operates influences the necessary resources for innovations. It is also a contingency which influences choices that have to be made in the use of search strategies. In this research a distinction will be made in the manufacturing group between High-Tech manufacturers, Medium to High-Tech manufacturers and Low-Tech manufacturers. In the service organizations a difference will be made between Knowledge-Intensive services and Less Knowledge-Intensive services.

The classification in which an organization can be categorized has influences on the use of strategies. When considering the categorization of manufacturers a distinction has been made between High-Tech, Medium to High-Tech and Low-Tech manufacturers. The categorization was based on the R&D expenditure to GDP or R&D intensity, because a High-Tech manufacturer makes much more expenses on R&D than a Low-Tech manufacturer (Eurostat, 2006). The R&D expenses are based on the use of resources, which exist of time, employees and funds. This implicates that an organization that uses many R&D expenses will use many resources in their R&D activities (Eurostat, 2006). One of the important steps in R&D is the search for discontinuous innovations, which means that High-Tech manufacturers will have high expenditures of resources in their search for discontinuous innovations. This implicates that the investment in resources of a strategy has a connection with the classification of an organization.

Organizations will choose to implement the strategies that require relatively few investments in resources first. This implicates that Low-Tech manufacturers will invest in the strategies that require a relatively low investment in resources (green strategies), Medium to High-Tech manufacturers can invest in strategies that require an average as well as a low investment in resources (green and orange strategies) and High-Tech manufacturers can invest in all strategies. These arguments are formulated in the propositions below.

Proposition 1a:

A Low-Tech manufacturer uses search strategies which require a low investment in resources.

Proposition 1b:

A Medium to High-Tech manufacturer uses search strategies which require a low and medium investment in resources.

Proposition 1c:

A High-Tech manufacturer uses search strategies with all levels of investments in resources.

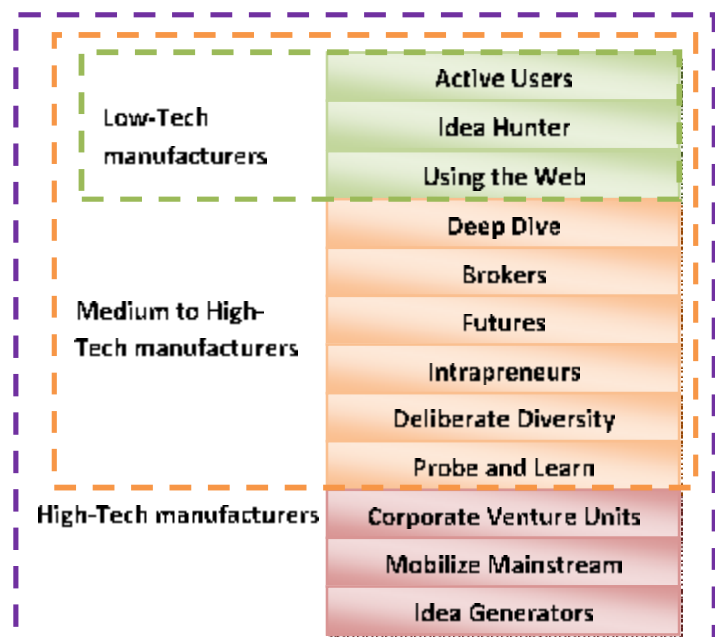


Figure 8: Relation between manufacturing sector and necessary resources

The other category of organizations contains the service organizations. These organizations are not categorized in three sections, as within the categorization of manufacturing organizations, but a distinction is made between Knowledge-Intensive and Less Knowledge-Intensive service organizations. The categorization of these organizations is based upon expenses that are related to the investments in new equipment and personnel and R&D intensity. This relates to the expenses in resources as it is discussed for the manufacturing organizations; organizations will at first invest in strategies that require low investment in resources. If their budget is high enough, they will be able to invest in the strategies that require large investments to. The propositions that come forward from this argument are given next to Figure 9, which visualizes the relation between the service sector and the relative complexity of a strategy.

Proposition 2a:

A Less Knowledge-Intensive service organization uses strategies which require a low investment in resources.

Proposition 2b:

A Knowledge-Intensive service organization uses search strategies with all levels of investments in resources.

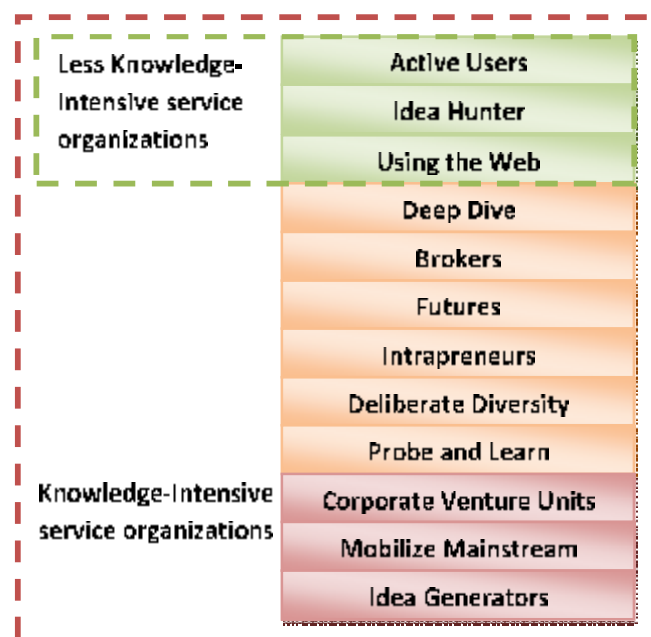


Figure 9: Relation between service sector and necessary resources

2.5.2.2 Contingency 2: Market entrance

The second contingency is referred to as market entrance. With market entrance the role and position the organization takes in the market, and the strategy that is used when entering the market is meant. The market entrance strategy of an organization determines to a large extent how it deals with environmental uncertainty and dependence. It provides an organization handles to deal with uncertainties, in which a difference is made between market pull and market push. As Narayanan (2001) discusses 'market pull is the advancement of technology oriented primarily toward a specific market need, and only secondarily toward increased technical performance'. The idea for an innovation originates with communication about a customer need, followed by a search for technical solutions to meet that need. This is different from a market push strategy, which is defined as 'the advancement of technology oriented primarily toward increased technical performance, and only secondarily toward specific market needs (Narayanan, 2001)'. It are two opposites, which determine in which way an organization behaves in a market. An organization that caters to specific market needs can best be characterized as market pull. An organization that determines the market needs, or in other words which puts technologies, product or services on the market without a distinct market need, can best be characterized as market push.

What these strategies implicate is that an organization chooses to either adapt to market demands or to create market demands. These strategies ask for two different approaches in the search for discontinuous innovations. An organization that chooses to adapt to market demands needs to be aware of these demands, so it has to create strategies that are able to absorb signals on changing demands. On the other hand, an organization that chooses to create market demands needs to obtain strategies that are able to create innovations within the boundaries of the organization. These are two very diverging

approaches, which ask for different use of search strategies for discontinuous innovations. As discussed in paragraph 2.5.1, it is possible to make a distinction between internally and externally oriented strategies. These strategies differ in one important characteristic. The internally oriented search strategies focus within the boundaries of the organization and have the purpose to recognize discontinuous innovations at internal sources. The externally oriented strategies cross the boundaries of the organization and address external sources in the search for discontinuities. The strategies that can be internally as well as externally oriented can use both market entrance strategies. The propositions that can be made from this discussion are given besides the figure that visualizes the relation between market entrance and strategy orientation.

Proposition 3a:

If an organization uses a push strategy in the way it handles market entrance more internally oriented search strategies will be used.

Proposition 3b:

If an organization uses a pull strategy in the way its handles market entrance more externally oriented search strategies will be used.

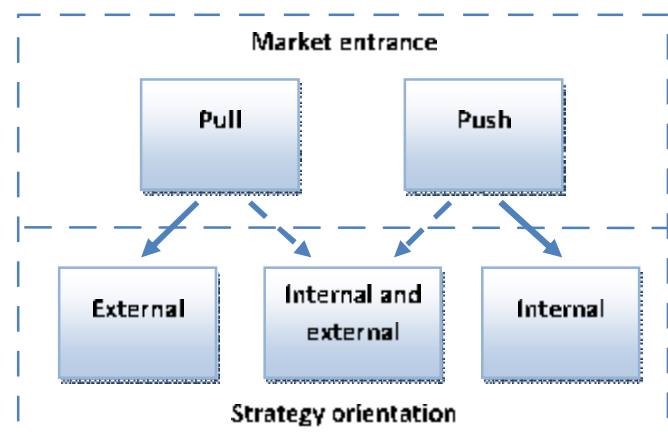


Figure 10: Relation between market entrance and strategy orientation

2.6 Organizational characteristics

Next to the contingencies that influence the applicability of the strategies on a certain organization and the role complexity and orientation play, the organizational characteristics that create a situation in which discontinuous innovations are stimulated are also important. These characteristics will be discussed, with the purpose to give direction to the research, particularly the case studies, which will be discussed further on.

The first important characteristic of organizations when discussing the behavior towards discontinuous innovations is the distinction between a mechanistic and organic form of management system. A mechanistic management system is appropriate to stable conditions, the organic form is appropriate to changing conditions (Burns & Stalker, 1961). These two systems represent a polarity, not a dichotomy. This means that the two forms are at the extremes of a line, and that there are many less radical forms in between. As discussed by Tidd et al. (1999), an organization that is affected by a discontinuous innovation or which searches for such an innovation has to operate in an unstable environment with rapidly changing conditions. This implicates that, in discontinuous conditions, an organization should aim at a more organic form of organization. The characteristics of the mechanistic and organic organization are summarized in Table 6.

Mechanistic management system	Organic management systems
Specialization of tasks	Much greater flexibility
Closely defined duties, responsibilities and technical methods	Adjustment and continual redefinition of tasks
A clear hierarchical structure with insistence on loyalty to the organization and obedience to superiors	A network structure of control, authority and communication
	Lateral consultation based on information and advice rather than instructions and decisions
	Commitment to the work group and its tasks
	Importance and prestige being determined by an individual's contribution to the tasks of their work group rather than their position in the hierarchy

Table 6: Characteristics of the mechanistic and organic organization (Burnes, 2004)

These characteristics provide the opportunity to analyze whether an organization in this research is closest to being a mechanistic or an organic management system. As already mentioned, for the search for discontinuous innovations the organic management system is most appropriate, it gives the employees the necessary freedom to be innovative. As Moore and Tushman (1982) discuss, organizations that use a management system that is best characterized as organic are much more successful in pursuing discontinuous innovations, they can more easily adapt to environmental turbulence.

Within an organic management system it is important that certain specific factors are created. Lynn and Reilly (2002) have identified the most common factors that contribute to successful product development, focusing on what they call 'blockbuster' products, which are innovations that are more radical and successful than most new products. They identified 5 key practices that contribute to the successful development of 'blockbuster' products:

1. Commitment of senior management
2. Clear and stable vision
3. Improvisation
4. Information exchange
5. Collaboration under pressure

All five practices operate as a system and blockbuster development teams should adopt all practices. These steps are applicable on the innovation process in its entirety, but each step has implications on the search phase as well. The implications of these practices on the search for discontinuous innovations will be discussed.

At first, as Lynn and Reilly (2002) argue, those teams that had full support and cooperation from senior management were able to develop 'blockbusters'. These senior managers functioned as sponsors for the project and took on an active and intimate role. Also, management must create an atmosphere of trust, coordination and control, because key individuals or champions often play a critical role during the

innovation process (Bessant & Tidd, 2007). Second, it is important to have a clear and stable vision, with specific and enduring parameters. These parameters are the key requirements for the innovation. Mission awareness is a strong predictor of the success of R&D projects, the degree to which depends on the stage of the project. For example, in the search phase, mission awareness explains around two-thirds of the subsequent project success (Johnsor et al., 2008). Leadership clarity is also associated with clear team objectives, high levels of participation, commitment to excellence and support for innovation. Leadership clarity, partly mediated by good team processes, is a good predictor of team innovation (Bessant & Tidd, 2007). In the third practice Lynn and Reilly (2002) argue that nobody is so brilliant that they can see the end product from the beginning. This leaves that their needs to be room for improvisation during the search for discontinuities – the steps that are taken in the search need to be flexible and adjustable to unforeseen events. Also, the search for discontinuities is characterized by the unforeseen character of it, these events are hard to recognize, which asks for a flexible approach. Fourth, effective communication and information exchange is another key practice. Exchanging information openly and clearly can be challenging. It is important to provide the right information at the right time at the right place, otherwise the outcome of the process can be negatively influenced. Employees call on each other through a variety of informal and personal ways like casual conversation, phone calls and meeting. In addition more formal knowledge exchange happens through a system for recording, storing, retrieving and reviewing information (Bessant & Tidd, 2007). The fifth practice comes from the external orientation of some strategies, as discussed in paragraph 2.5.1. These strategies are addressing external sources of information in their search for discontinuous innovations. Collaboration in the face of conflicting functions and other sources of internal and external pressure requires a number of facilitating factors (Bessant & Tidd, 2007). Organizations need to be aware of the pressure that can occur when internal and external sources with very diverging interests are combined.

What can be argued is when organizations want to search and pursue the best discontinuous innovations they need to make sure that the five key practices are implemented in the organization. Also, it is argued that a more organic form of management system creates the best circumstances in which an organization can pursue discontinuous innovations. These key factors together form a basis for the analysis of the case studies; they make it possible to perform a cross case analysis on the cases to determine which factors are crucial for the search for discontinuous innovation.

3. Methodology

In this chapter the methodology, as already briefly discussed in chapter 1, will be extensively discussed, with the purpose to provide insights on the approach that has been used and what specific steps have been taken in order to be able to answer the research question. The methods that were used to shape the theoretical framework have already been discussed in paragraph 1.3.1 and will not be elaborated on any more. This chapter will focus on the empirical part of the research, which exists of both the questionnaire, case studies and the analysis.

3.1 Questionnaire

The first empirical step of this research consists of the use of a questionnaire. The goal of the questionnaire is to develop insights on whether the search strategies, as formulated within the theory, are actually used in practice. This calls for a formal study (Cooper & Schindler, 2003), because it begins where the literature search leaves off. The questionnaire is used to give insights on which search strategies are being used, and how well a strategy works for the organization. This means that there is no power to produce effects in the variables (ex post facto), and the study will be communicative. The questionnaire is concerned with finding out *who, what, where, when and how much* (Cooper & Schindler, 2003) and has a descriptive purpose. Because the questionnaire is held at a certain moment in time, the time dimension is cross-sectional.

The original questionnaire has been formulated by the DILab, by dr. Betzina von Stamm. The same questionnaire has been used, except for adaption to the Benelux. The reason why this is done is because this way the results will be representative with research that has already been done by other DILab's and the results will have value for the DILab community.

The questionnaire contains questions about whether one or more search strategies were recognized within the correspondent's organization and the experience of the usefulness of these strategies, whether these strategies really worked for the organization. With the results of the questionnaire an assumption can be drawn on what the most used search strategies for discontinuous innovation are, and whether organizations use one distinct strategy or more strategies combined. These conclusions are used only for an indication, they do not have the function to generalize these findings to a greater population. The results of the questionnaire will be used to shape the case studies that will be done.

The questionnaire has been send to 10 organizations in the Benelux (the questionnaire is recorded in Appendix C). The criteria that has been applied is the following. The selected organizations have to play an active role in the research done by the DILab Benelux. In total seven organizations returned the questionnaire. The reasons why three of them did not respond are because of a lack of available time or declining interest.

The organizations that have returned the questionnaire can be categorized with use of the classification of Eurostat (as discussed in paragraph 2.5.2), as represented in Table 7.

Sector	Organization (Eurostat category)
High-Tech manufacturers	Company E (33) Company D (32)
Medium to High-Tech manufacturers	Company A (29)
Low-Tech manufacturers	Company H (26) Company G (36 to 37)
Knowledge-intensive service organizations	Company C (72)
Less knowledge-intensive service organizations	Company B (60)

Table 7: Respondent organization grouping

3.2 Case studies

The second empirical step in this research is the fulfillment of case studies. The case studies have the goal to investigate the patterns that have been gathered with use of the questionnaire, and to examine how the cases relate to the specific organizational characteristics, as discussed in paragraph 2.6. The case studies that will be used are a type of formal study, in which the data is gathered by interrogation/communication (Cooper & Schindler, 2003). There will be no power to produce effects in the variables under study, because the design is ex post facto. The study has a clear descriptive purpose and is done on a cross-sectional base. The research environment is a clear field setting, in which typical cases are investigated in order to get a broad and in-depth insight on the topic.

A case study is defined by Babbie (1998) as *'the in-depth examination of a single instance of some social phenomenon, such as a village, a family or a juvenile gang'*, or as Cooper and Schindler (2003) put it *'Case studies place more emphasis on a full contextual analysis of fewer events or conditions and their interrelations'*. Case studies are useful because they provide answers to 'how and why' questions about a contemporary set of events over which the investigator has little or no control (Yin, 1987). To give good insights on the management of search strategies within organizations an in-depth examination is required. By using case studies it is very likely that the 'how' questions (research question 2 and the central question) are elaborated and answered and thus give detailed information about the most important search strategies in order to answer these questions.

The case studies will be executed as a qualitative field research. A qualitative field research is useful for several topics such as relationships, roles, practices, organizations and settlements (Babbie, 1998). Looking at the core topic of this research, how organizations organize themselves, all these topics can be recognized. The purpose of the case studies is to gather insights on the way organizations search for discontinuities.

3.3 Description of case studies

In this section a short description of the selected cases will be given. The general characteristics, the division of the organization from which is being participated and the role of discontinuous innovation within the organization will be discussed. A more detailed description of the cases is recorded in Appendix E. In Table 8 the cases are summarized, after which for each case a short description will be given.

	A	B	C	D	E
Core business	R&D of rotor blades and nacelles for wind turbines	Consultancy, advisory and design in the railroad, water and energy market	Consulting, Technology Services and Outsourcing	Applying technologies into first of a kind products	Developing and producing Sensors and Controls
Eurostat category	29	60	72	32	33
Type of organization	Subsidiary	Holding	Subsidiary	Subsidiary	Subsidiary
Location (Headquarters)	Hengelo (Amsterdam)	Utrecht (n.a.)	Utrecht (Paris)	Eindhoven (Eindhoven)	Almelo (Attleboro, Mass. USA)
# Employees (corporate)	45 (45000)	1200 (n.a.)	7500 (80000)	1000 (70000)	300 (8000)
Turnover (corporate)	Not reported separately (\$2.8 billion)	€ 138 million (n.a.)	€ 200 million (€ 1.64 billion)	€ 703 million (€ 25 billion)	Not reported separately (\$1.3 billion)

Table 8: Case study descriptions

The cases can be grouped in both High-Tech and Medium to High-Tech manufacturers and Knowledge-Intensive and Less Knowledge-Intensive service organizations, but unfortunately it lacks organizations that can be categorized as Low-Tech manufacturers. These firms were not willing to get involved as a case study, because of a lack of available time and resources. This has implications for the cross-case analysis, which will be discussed in chapter 6.

3.4 Case study data collection

According to Yin (1987) there are six sources of evidence in case studies; documentation, archival records, interviews, direct observations, participant observation and physical artifacts. In this research interviews are held with employees from within the organizations as described above in the cases. Also the corporate websites and where applicable the divisional websites have been skimmed for information. Due to the limited use of different points of view from within the cases, the level of triangulation is limited. There are two reasons why there is not made use of a higher level of triangulation. First, the case studies are founded on the retrieved questionnaires. Therefore the barrier for a third person to be able to answer the questions within the case studies is relative high, because that person would not be familiar with the train of thought that is necessary to discuss the topic. The persons that have filled in the questionnaire are known to be familiar with the topic of discontinuous innovation, because they attended in the first workshop of the DILab Benelux. Second, the purpose of the research is to retrieve insights on the way companies organize the search phase for discontinuous innovation. This means that the data collection within the case study will be based on a representation of the way a company organizes itself, which is not influenced by a person's interpretation of the situation of the organization, at most by the perception of the specific question.

3.5 Interviews

The main source of evidence will be the interviews that are held with the contact persons within the specific case. Interviews provide a targeted and focused direction for the case study. However, poorly constructed questions can lead to a bias, and there is also the risk of a respondent bias, when for example the interviewee provides answers what the interviewer likes to hear. However, interviews are seen as an essential source of case study information (Yin, 1987).

The interviews have been semi-structured. This way it is prevented that the respondents answer the way they think the interviewer wants them to answer (survey research bias (Babbie, 1998)). During the interviews also some space has been left for any additional information that is not included in the research questions in order to obtain as much relevant and useful information as possible. This way a broad view on the organization of the search phase for discontinuous innovation within the cases is acquired. The sequence of the questions is divided into 4 sections. The first section consists of three general questions, with the purpose to start the conversation and to be able to sketch the context from which the conversation is done. The second sector contains questions founded by the results of the questionnaire. The answers on these questions make it possible to analyze the innovation strategy that an organization uses and which organizational characteristics can be recognized. Also, the relations between the search strategies will become clear from these questions. The third section zooms in on the strategies that were judged as successful by the cases. The goal of these questions is to gather insights on the use of these successful strategies. With these insights a clear understanding is generated on the approach that the specific case study uses in the use of the search strategies. The most important topics in these questions are the availability of resources, the target of each strategy, the organization of the strategy and the specific characteristics of each successful strategy. The final section leaves room for the interviewee to discuss topics that did not come up in the interview. The protocol that belongs to these questions is recorded in appendix D.

The interviews have taken place face-to-face. To make it as comfortable as possible for the interviewee the interviews took place in their natural environment and the outcomes have been remained confidential. This brings in the advantage that the interviewees could speak freely. Before the interview has been executed the protocol was explained, including confidentiality, and it was asked before each interview if the interviewee agreed that the interview would be taped (none refused). In total a number of 5 interviews were held, in which the length varied between 50 minutes and 98 minutes. The interviews were transcribed and send to the interviewee for control. The reason why the interviews were recorded and transcribed is that this provides a more accurate rendition of an interview than any other method (Yin, 1987). For transcribing the interviews the guidelines as described by McLellan et al. (2003) have been used, as summarized below:

- 1.1 Preserve the morphologic naturalness of transcription. Keep word forms, the form of commentaries, and the use of punctuation as close as possible to speech presentation and consistent with what is typically acceptable in written text.
- 2.1 Preserve the naturalness of the transcript structure. Keep text clearly structured by speech markers (i.e. like printed versions of plays or movie scripts).

- 3.1 The transcript should be an exact reproduction. Generate a verbatim account. Do not prematurely reduce text.
- 4.1 The transcription rules should be universal. Make transcripts suitable for both human/researcher and computer use.
- 5.1 The transcription rules should be complete. Transcribers should require only these rules to prepare transcripts. Everyday language competence rather than specific knowledge (e.g. linguistic theories) should be required.
- 6.1 The transcription rules should be independent. Transcription standards should be independent of transcribers as well as understandable and applicable by researchers or third parties.
- 7.1 The transcription rules should be intellectually elegant. Keep rules limited in number, simple and easy to learn.

The transcription of the interviews has been done as literally as possible in order to stay close to the taped interview, which enhances the accuracy of the transcribed interviews. In the transcriptions also the notes that were made during the interview were incorporated. Within the protocol for each question different bullet points were formulated in front, which could be checked off if the interviewee would mention that specific topic. These bullet points were also recorded in the transcription. The interviews have been executed, transcribed and analyzed by the same researcher which enhances the accuracy, because the same person does all the work and no transfer of data occurs between different people. The average size per transcription is 8 pages and contains on average 4000 words.

3.6 Data analysis

To make it possible to analyze the large amounts of extended data a selection of data is necessary. The data is analyzed with the use of a two step approach. At first the within-case data is analyzed in order to be able to understand what is going in that specific case. Subsequently a cross-case analysis is done in order to make it possible to search for cross-case patterns (Eisenhardt, 1989).

Within the first step the cases have been described with use of the theory, in order to be able to analyze the specific situation of that case. In this way it is possible to become intimately familiar with each case as a stand-alone entity (Eisenhardt, 1989). Within the case description the search strategies have been discussed, in order to allow unique patterns to emerge and give the researcher the opportunity to become familiar with each case and so accelerate the cross-case analysis. The second step has been to search for cross-case patterns. The tactic of selecting dimensions and to look for within-group similarities coupled with intergroup differences has been used (Eisenhardt, 1989). This analysis should result in knowledge on how organizations could search for discontinuous innovation. The state of the art literature has described what strategies are available in general, but no specific insights on the actual organization of these search strategies are available. When the practical findings are linked to the current theoretical insights, recommendations can be given to the DILab Benelux and the participating organizations on possibilities for organizing the search phase for discontinuous innovation.

4. Questionnaire

In this chapter the practical insights, based on the results from the questionnaire on the search strategies for discontinuous innovation will be discussed. In the theoretical framework the search strategies have been discussed, which has led to a number of propositions. With the use of a questionnaire a first attempt has been made to investigate the usage and successfulness of the search strategies. These results will be presented in this chapter.

4.1 Strategy use

As discussed in previous chapters, each organization within the DILab Benelux has received a questionnaire. For each strategy the respondents were asked whether they used a strategy within their organization, by giving them a short description of the strategy (see appendix C for the questionnaire). On basis of these descriptions and the shared perception on the topic of discontinuous innovation, as achieved in the first workshop, they were ought to be able to provide insights on their usage of the strategies. The first purpose of the analysis of the data is to provide insights for the propositions, as discussed in chapter 2. Therefore all propositions will be discussed separately.

4.1.1 Sector and investment in resources

It was assumed that there is a relation between the sector in which an organization operates and the investments in search strategies by the organization. This should come forward in the use of the search strategies by organizations. The relations between the sector and the necessary investments for a strategy are visualized in Table 9, which will subsequently be discussed and explained.

		E	D	C	A	H	G	B	Total	
Average need for investment	Low	Active Users	No	Yes	Yes	Yes	Yes	Yes	6	
		Idea Hunter	Yes	Yes	Yes	Yes	No	Yes	Yes	6
		Using The Web	No	Yes	Yes	Yes	Yes	Yes	Yes	6
	Medium	Deep Dive	No	Yes	Yes	No	Yes	Yes	Yes	5
		Brokers	No	Yes	Yes	Yes	No	Yes	Yes	5
		Futures	Yes	No	Yes	No	Yes	Yes	No	4
		Intrapreneurs	No	Yes	Yes	Yes	No	No	Yes	4
		Deliberate Diversity	No	Yes	Yes	Yes	No	No	Yes	4
		Probe And Learn	No	No	No	No	No	Yes	Yes	2
	High	Corporate Venture Units	Yes	Yes	No	Yes	No	No	No	3
		Mobilize Mainstream	Yes	No	Yes	No	No	Yes	No	3
		Idea generators	No	No	No	No	Yes	No	No	1
Total		4	8	9	7	6	7	8		

Table 9: Search strategy use and necessary resources

In Table 9 the propositions from chapter 2 are visualized with use of the dotted lines. The purple dotted line represents the assumed use of search strategies by the High-Tech manufacturers and Knowledge-

Intensive service organizations, the orange line represents the use by the Medium to High-Tech manufacturers and the green line the use by the Low-Tech manufacturers and the Less Knowledge-Intensive service organizations. If the data would have been in line with the propositions, than the answers within the dotted lines would have been 'Yes' and the answers outside the dotted lines would have been 'No'. What can be argued is that for this sample the propositions are correct up to a certain level. The organizations within the green dotted line use the strategies they were expected to (except for Idea Hunter by Company H). They use strategies outside the box as well, which could indicate that the categorization of these organizations is incorrect. Another possible explanation is that these organizations have a R&D budget that exceeds the average R&D budget of their category, which gives them the opportunity to use more strategies than just those that need a low investment in resources.

The organization within the orange line uses 6 out of 9 strategies within the box and 1 out of 3 outside the box. The strategy that the organization was not assumed to use (Corporate Venture Units) will be discussed in paragraph 4.2.3. For this specific organization the proposition seems to be correct, because it uses most of the strategies it was assumed it would use; the proposition does not say all strategies in that specific category have to be used.

For the organizations in the purple box both Company D and Company C use a composition of search strategies that is up to a certain extend in line with the proposition. What is not in line with the proposition is that Company E uses a totally different approach. The reason why the approaches of these organizations differ cannot be given with the results of the questionnaire solely, this should become clear in the case studies.

4.1.2 Market entrance strategy and search strategy orientation

It was proposed that there was a relation between a market entrance strategy of an organization and the orientation of the search strategies. It was assumed that organizations that use a market pull strategy would use externally oriented search strategies and that organizations that use a market push strategy

		Push			Pull					
		D	A	B	E	H	G	C		
Strategy orientation	Externally	Idea Hunter	Yes	Yes	Yes	Yes	No	Yes	Yes	6
		Futures	No	No	No	Yes	Yes	Yes	Yes	4
		Deep Dive	Yes	No	Yes	No	Yes	Yes	Yes	5
		Brokers	Yes	Yes	Yes	No	No	Yes	Yes	5
	Internally	Intrapreneurs	Yes	Yes	Yes	No	No	No	Yes	4
		Deliberate Diversity	Yes	Yes	Yes	No	No	No	Yes	4
		Corp. Venture Units	Yes	Yes	No	Yes	No	No	No	3
		Mobilize Mainstream	No	No	No	Yes	No	Yes	Yes	3
Both	Active Users	Yes	Yes	Yes	No	Yes	Yes	Yes	6	
	Using the Web	Yes	Yes	Yes	No	Yes	Yes	Yes	6	
	Probe and Learn	No	No	Yes	No	No	Yes	No	2	
	Idea Generators	No	No	No	No	Yes	No	No	1	
Total		8	7	8	4	6	7	9		

Table 10: Strategy use and internal or external orientation

use internally oriented search strategies. The relations have been visualized in the Table 10.

The table visualizes the relation as follows. Organizations that use a market pull strategy are characterized by the green dotted lines, the organizations that use a market push strategy are characterized by purple dotted lines. These lines are connected to the distinction between internal (purple) and external (green) oriented search strategies. The strategies that can be both internal and external do not have a color, because they were not recorded in the proposition. According to the proposition, it was assumed that the organizations that used a market pull strategy would use external oriented search strategies and organizations that use a market push strategy would use internally oriented search strategies. This is visualized with use of the dotted boxes. In line with the proposition it was expected that the answers inside the boxes are 'Yes' and the answers outside the boxes 'No'.

When comparing the results of the push and pull organizations, there seems to be some relation as it is formulated in the proposition. In the push-group use has been made of 8 out of 12 (=0.66) externally oriented strategies, 8 out of 12 (=0.66) internally oriented strategies and 7 out of 12 (=0.58) strategies that combine both. In the pull-group use has been made of 12 out of 16 (=0.75) externally oriented strategies, 6 out of 16 (=0.38) internally oriented strategies and 8 out of 16 (=0.50) strategies that are internally and externally oriented. In the push-group the fraction varies between 0.58 and 0.66, they are relatively close to each other. This indicates that in this group no major difference is found between the internal and external strategies and those that combine both. In the pull-group the differences in the fractions are much more diverse. The strategies that were assumed to be used have a fraction of 0.75, the strategies they were not assumed to use have a fraction of 0.38. This indicates that these organizations use a different composition of strategy orientation. Therefore the proposition for the push-group seems to be inapplicable, but the proposition for the pull-group seems applicable. The reason why this difference occurs should become clear in the following chapters.

4.2 Patterns

Next to the recognition whether the propositions were found in a positive or negative way in the sample, there are different patterns recognizable in the data. These patterns will be discussed in this section.

4.2.1 Strategy use and need for investment

The first pattern that is recognizable is that the use of a strategy seems to have relation with the need for investment. The strategies are sorted on basis of need for investments, the strategies at the right in Figure 11 need the largest investments to be implemented. What can be seen is that if the need for investment enlarges, the strategy is used less often.

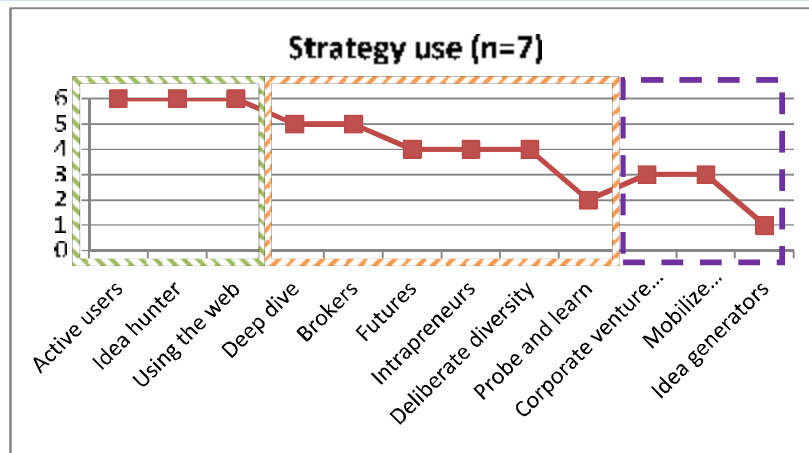


Figure 11: Strategy use

As can be seen in the figure above, 6 out of 7 organizations use the strategies that require a relative low investment in resources (green box). Also, the strategies that require a medium investment in resources to be implemented (orange box) are much more often used than those strategies that require relative large investments in resources to be implemented (purple box). This indicates that organizations choose to use the strategies that need few investments in resources more often than those that require a large investment in resources. Because of the small sample size the external validity of this statement is relatively low. What must be noted is that the use of Probe and Learn does not follow the path of the use of the strategies. In chapter 2 it was discussed that the strategy can serve two different purposes (Lynn et al., 1996; Thomke, 2003). This might lead to the situation that the strategy is used as the more sophisticated form by the organizations, which has a high average investment, while it is visualized as the form which requires a medium investment in resources. Because the question in the questionnaire was not based on this dichotomy it is hard to say whether this is the right explanation, but it should become clear from the case study.

4.2.2 Deep Dive and Active Users

The second pattern that can be recognized is the use of Deep Dive in addition to the use of Active Users. In all cases where Deep Dive is used there is also made use of Active Users, which seems to have some connection. This is summarized in Table 11.

	E	D	A	H	G	C	B	Total
Active Users	No	Yes	Yes	Yes	Yes	Yes	Yes	6
Deep Dive	No	Yes	No	Yes	Yes	Yes	Yes	5

Table 11: Deep Dive and Active Users

Deep Dive is used five times and Active Users is used six times. When looking at the theoretical discussion on both strategies there might be an explanation for the relation between these two strategies.

The first phase in the model describing the customer innovation program (Desouza et al., 2008) contains the idea generation with use of Active Users. For the search for discontinuous innovations this means that an organization uses users that are well developed in the knowledge that an organization wants to become in the creation of possible innovations. A major implication that an organization needs to be aware of is that the way of communication with the customer is very important. As Desouza et al. (2008) put it: *“organizations need to have the right communication tools to get the right kinds of ideas from the right sources, who may reside anywhere.”* This indicates that the added value for organizations to use Deep Dive within the Active Users is present. Also, as Kärkkäinen and Elfvengren (2002) state, the essential objective of the use of Deep Dive is to provide useful information for the early phases of innovation. This means that the use of Deep Dive, connected to the use of Active Users, is most applicable on the first phase of the customer innovation program, the idea generation. These arguments lead to the understanding that Deep Dive is used as a logic addition to the use of Active Users, in which the main purpose is to increase the quality of the generated insights.

4.2.3 Corporate Venture Units

The third pattern that can be recognized within the data is the restricted use of Corporate Venture Units, as is visualized in Table 12.

	E	D	A	H	G	C	B	Total
Corporate Venture Units	Yes	Yes	Yes	No	No	No	No	3

Table 12: Use of Corporate Venture Units

As already discussed, the organizations were categorized in five different sectors. As can be seen in Table 12 Corporate Venture Units is used by the High-Tech and Medium to High-Tech manufacturers only. When looking at how von Stamm and Bessant (2007) describe the strategy, three possible reasons why the strategy is used come up. The first is that the innovation at hand has a too small potential for the firm, and therefore falls outside the strategy of the organization. The second is that the innovation is expected to be so risky that a possible failure would have a tremendous negative effect on the current business. The third possibility is that the innovation falls outside the current portfolio.

Considering the dynamics of the High-Tech and Medium to High-Tech manufacturers, all three organizations operate within a market that is very dynamic and in which they undergo a high degree of competition. Also, the innovations that they place in the market are best described as radical innovations. The market of the Low-Tech manufacturers on the other hand is less dynamic, and the competition is not as much based on radical innovations, but more on disruptive innovations. The risks contained to the introduction of radical new innovations for the High-Tech and Medium to High-Tech organizations are high, because of the market characteristics and the type of technologies that are integrated in the products. Within the Low-Tech manufacturers the innovations are more disruptive of nature, which means that innovations are based on a more accepted principle. A possible failure has less negative side effects on the organization and therefore the necessity to use Corporate Venture Units is much lower in the Low-Tech sector as within the High-Tech and Medium to High-Tech sector.

The service organizations do not create market demands in such a way that they develop and produce new products. The specific characteristic of these service organizations is that they always work together with their customers in order to create new services and applications. This means that the degree of risk for innovations is much lower as for the High-Tech organizations, because the innovations that are done are based on a shared perception between the customer and the consultant. Therefore, the benefit for the service organizations to use some form of Corporate Venture Units in that situation would be much lower when compared to the High-Tech and Medium to High-Tech manufacturers. Also, the main characteristic of a service organization is that it delivers services, which are based on a certain contractual period. This means that if they intend to use Corporate Venture Units within their organization the contractual period of their services needs to be quite long in order to give the Corporate Venture Units the opportunity to be profitable.

4.3 Strategy success

In the paragraph 4.1 the use of the strategies has been discussed. Next to the use of the search strategies the questionnaire contained a question on the perceived success of the search strategies to. The perception of this success will be discussed in this paragraph.

4.3.1 Use and success combined

When the use and the success of the search strategies are combined the following figure can be derived.

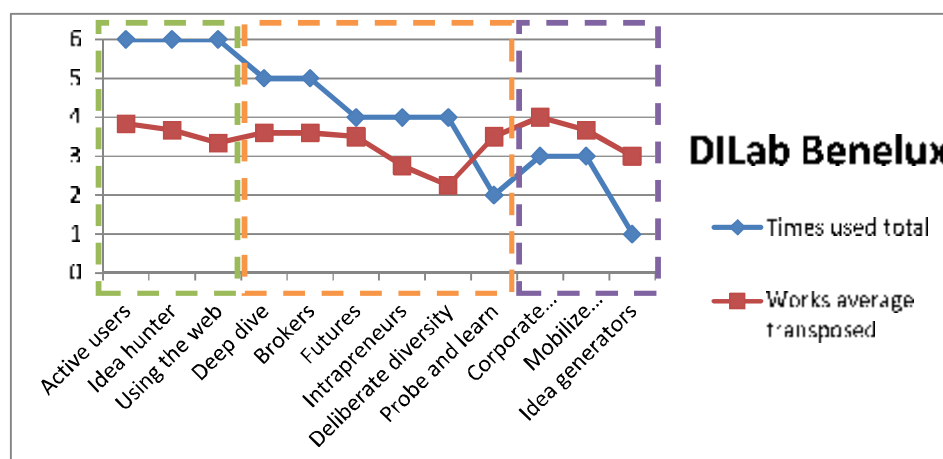


Figure 12: Strategy use and success

The figure is in line with the representation as it is obtained in paragraph 4.2.1, with the difference that the red line in the figure is new, it represents the average success of the strategy, as it was indicated by the participating organizations in the questionnaire.

The strategies that require a high investment in resources will be left out of discussion, because these are used just a few times, which makes them highly dependent on one low judgment. Probe and Learn will also be left out of discussion, for the same argument as in paragraph 4.1, the strategy can be used in two different ways and with the questionnaire it cannot be said which way is assessed by the organization.

The strategies that require few resources to be implemented (green box) have an average success that varies between 3.3 (Using the Web) and 3.8 (Active Users). The strategies that require an medium investment in resources have an average success that varies much more, from 3.6 (Deep Dive and Brokers) to 2.3 (Deliberate Diversity). This indicates that the strategies that require few resources, which are used more often, are more successful than those that require a medium investment in resources.

4.3.2 Success of individual organizations and market entrance group

The second contingency that has been discussed in the previous paragraph was market entrance. In the data a relation was found between this contingency and the orientation of search strategies, organizations that use a market pull strategy use more externally oriented search strategies. This conclusion leaves the success of these strategies out of discussion. Therefore the success of these strategies has been visualized in the following table and will subsequently be discussed.

			Push			Pull				Average
			D	A	B	E	H	G	C	
Strategy orientation	Externally	Idea Hunter	3	4	4	3	N.A.	5	3	3.67
		Futures	N.A.	N.A.	N.A.	4	4	3	3	3.50
		Deep Dive	3	N.A.	4	N.A.	4	3	4	3.60
		Brokers	3	3	3	N.A.	N.A.	5	4	3.60
	Internally	Intrapreneurs	4	2	3	N.A.	N.A.	N.A.	2	2.75
		Deliberate Diversity	3	1	3	N.A.	N.A.	N.A.	2	2.25
		Corp. Venture Units	5	4	N.A.	3	N.A.	N.A.	N.A.	4.00
		Mobilize Mainstream	N.A.	N.A.	N.A.	4	3	N.A.	4	3.67
	Both	Active Users	4	4	4	N.A.	4	3	4	3.83
		Using the Web	4	2	4	N.A.	3	3	4	3.33
		Probe and Learn	N.A.	N.A.	4	N.A.	3	N.A.	N.A.	3.50
		Idea Generators	N.A.	N.A.	N.A.	N.A.	N.A.	3	N.A.	3.00
		Average success	3.63	2.86	3.63	3.50	3.50	3.57	3.33	

Table 13: Strategy use and internal or external orientation

The table is organized in the same manner as is done in paragraph 4.1.2. The difference lies in the numbers, these represent the success of each strategy. The rate of success varies from 1 (very unsuccessful) to 5 (very successful). The strategies that have not been used are represented with N.A. (not available). First the average rates of success of the individual organizations and the groups (push and pull) will be discussed.

When looking at the rate of success of the strategies of the individual organizations the success of the internally oriented search strategies at Company A are relatively low. What the reason is why Company A judges Intrapreneurs and Deliberate Diversity (and also Using the Web) cannot be given with the results from the questionnaire, but this should become clear in the case studies. The average score of the push-group is 3.39, the average score of the pull-group is 3.46. These vary not much, which indicates that the overall score is relatively balanced.

The organizations in the push-group did not make a distinction between internal and external oriented search strategies, as was discussed in the previous paragraph. In the pull-group a distinction is made in the use between internally and externally oriented search strategies. The rate of success of the three groups of strategy orientation in the push-group are as follows. The externally oriented search strategies have an average score of 3.38, the internally oriented search strategies have an average score of 3.13 and the strategies that can be both internally and externally oriented have an average score of 3.71. The rate of success of the three groups of strategy orientation in the pull-group are as follows. The externally oriented search strategies have an average score of 3.75, the internally oriented search strategies have an average score of 3.00 and the strategies that can be both internally and externally oriented have an average score of 3.38. With the results of the use of the strategies in mind, the most interesting average is that of the externally oriented search strategies in the pull-group, which are higher as the overall average score of the pull-group and also higher of the average score of the externally oriented search strategies of the push-group. This indicates that the organizations that can be characterized with a market pull strategy use more externally oriented search strategies, which are also more successful.

4.4 Summary results questionnaire

In this chapter the results from the questionnaire have been discussed. These results have led to a number of understandings and insights on the formulated propositions and to a number of patterns that have been recognized. These insights are summarized as follows:

- ✗ No relation has been found between the contingency sector and the necessary investment in resources for a search strategy (proposition 1 and 2).
- ✗ Organizations that use a pull strategy use more externally oriented search strategies (proposition 3a), organizations that use a push strategy do not discriminate between internally and externally oriented search strategies (proposition 3b).
- ✗ The externally oriented search strategies of organizations with a market pull strategy are more successful when compared with their internally oriented strategies and also when compared with both the externally and internally oriented strategies of organizations with a market push strategy.
- ✗ The strategies that require few investments in resources are more successful than those that require medium investment in resources.
- ✗ Three patterns have been recognized in the data:
 4. Organizations choose to use the strategies that need few investments in resources more often than those that require a larger investment in resources.
 5. Deep Dive is used as a logic addition to the use of Active Users, in which the main purpose is to increase the quality of the generated insights.
 6. Corporate Venture Units is used by High-Tech and Medium to High-Tech manufacturers only, due to the specific characteristics of the strategy (it has the purpose to avoid risks that come with the innovation).

These results will be taken forward into the case studies, which will be discussed in the next chapter. The insights from the case studies and the data and the patterns that have been recognized from the data will be combined in the cross case analysis, which will eventually lead to the answer on the central question, the final chapter of this report.

5. Case studies

In this chapter the case studies on the organization of the search strategies for discontinuous innovation will be discussed. Within these case studies the specific use of the search strategies for each organization have been discussed. As already mentioned, a part of the input for these case studies is based on the results of the questionnaire, as discussed in general in the previous chapter. Therefore for each case the individual results of the questionnaire will at first be discussed. Within the case study insights have been gathered on the organization of the strategies in general, which will be the third part of each case description. Subsequently the specific implementation of the strategies that the organization indicated as successful will be discussed in detail. This will lead to conclusions for each individual case, which will be a part of the input for the Cross case analysis in the next chapter. Each case study will start with a short case description (large case description can be found in Appendix D – Company profiles), which will be followed by a discussion on the specific organizational characteristics.

5.1 Company A

Company A is a young organization where wide experience in the field of composites technology has been united. They specialize in design and development of rotor blades for wind turbines. They intend to deliver a turn-key solution, which entails that in the area of applied composites, such as rotor blades and nacelles, apart from the aerodynamic and structural design, also the selection of materials and process operations is done.

The parent company of Company A, Company F, has the ambition to become within the top 3 of biggest players in the market for wind energy. They intend to do this in such a way that they become technology leaders. This means that discontinuous innovations could play an important role in the path that they intend to follow to become within the top 3. With the innovations that Company A carries through they intend to be the first-to-market. The problem with discontinuous innovation in general, and the search phase in particular, is that Company A lacks the time and resources to pursue them. The market demands for wind energy in India and China, where Company F resides, are growing faster than possible for the organization to grow.

5.1.1 Organizational characteristics

Company A can be characterized with use of the organizational characteristics that have been discussed in paragraph 2.6. These characteristics are summarized in the table below.

Company A	
Management system	Mechanistic – <u>Organic</u>
Commitment of senior management	Low Medium – <u>High</u>
Clear and stable vision	Low – Medium – <u>High</u>
Improvisation	Low Medium – <u>High</u>
Information exchange	<u>Low</u> Medium High
Collaboration under pressure	Low – <u>Medium</u> – High

Table 14: Organizational characteristics of Company A

The management system of Company A can best be characterized as organic. The tasks that employees have to fulfill are for a large amount flexible and continuously readjusted and redefined. There is a network structure of control, authority and communication. Within the organization there are just three primary layers and the organization itself has to pay responsibility to Company F only. Also, the importance and prestige of an individual is determined by its contribution to the tasks of their work group rather than their position in the hierarchy and is highly committed to the work group and its tasks.

The commitment of senior management is high, they are highly involved in the innovation process of the organization. Actually, they make critical decisions on the organization of the innovation process and the path that will be taken. This is partly caused by the flatness of the organization, there are only three main layers within the organization. On top there is the management of the organization, which communicates with use of the R&D manager. The R&D manager gives direction to 7 different departments, which are represented by a departmental manager. These departmental managers run their departments, which can be subdivided in several teams. This makes a decision to have to go at the longest through two layers.

The organization has a clear and stable vision what it wants to become and how it wants to get there. As was mentioned during the case study: *'We are a part of Company F, the fifth biggest player in the market for wind energy, and they have the ambition to become the third biggest player. They intend to do this by being progressive on terms of technology and performance, not by improving what we currently do.'* The organization wants to become a technology leader in all aspects of the organization, which has the consequence that Company A has to make progression on their specific field of knowledge to.

The improvisation of Company A can be characterized as high, which is emphasized with the following statement: *'the organization of our innovation is very adhoc, we adjust to things that come into our path and try to stay open minded. The cause of this approach is that our actions are very diverse, from the acquisition of an organization to the development of a patent, there is no predefined path for the execution of our vision.'* This indicates that the organization is very well able to improvise to changing conditions from outside the organization.

The information exchange within Company A is characterized as low. There is barely any use of any means of communication within the organization. The organization recognizes the need for a form of idea management and is working on the application for such a management tool, but currently it lacks any application of such nature.

The collaboration under pressure of Company A can be characterized as medium, because of two different factors. The first is that the employees of Company A are very entrepreneurial, they have the common aspect that they think out-of-the-box. This indicates that the degree of collaboration under pressure should be high, but this is in fact not true. The employees have to cooperate with other R&D facilities of Company F, which are in different countries. The employees of the R&D facilities in developing countries like India and China are by far not as entrepreneurial, their culture and society does not give them the possibility to think out-of-the-box in a way that Company A is used to. This makes that the collaboration under pressure is characterized as medium.

5.1.2 Questionnaire results

When taking a look at the specific situation concerning the use of search strategies for discontinuous innovation at Company A the following figure is derived. In the figure 0 means that a strategy is not used, and for those strategies that are used, the higher the score means the better the strategy works for the organization with 5 as the maximum score.

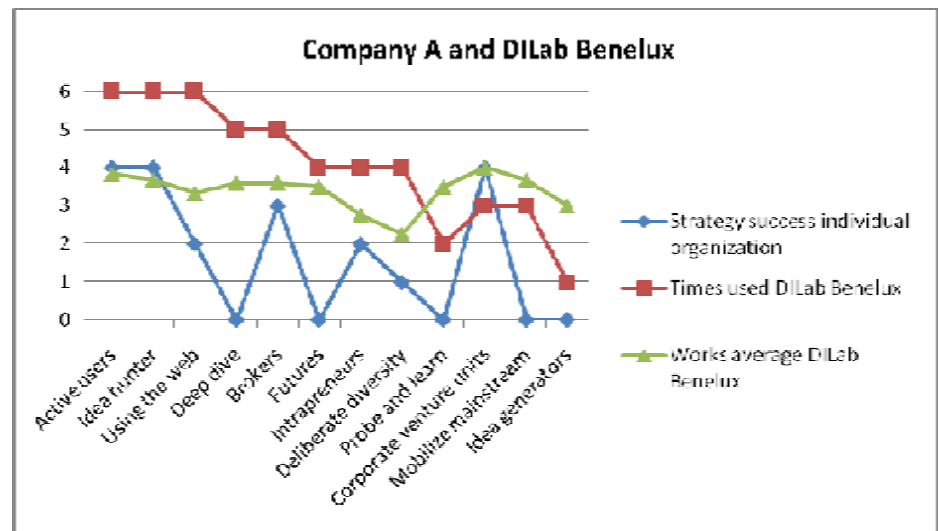


Figure 13: Company A and DILab Benelux

When analyzing Figure 13 different interesting findings come up. The first thing that draws attention is the success of three strategies, Idea Hunter, Active Users and Corporate Venture Units. The second is the bad assessment of Deliberate Diversity. The third is that Company A does not use Futures and Deep dive, where most companies do use does strategies. At first the position these strategies take within the organization and the innovation policy of the organization will be discussed.

When analyzing Figure 13 different interesting findings come up. The first thing that draws attention is the success of three strategies, Idea Hunter, Active Users and Corporate Venture Units. The second is the bad assessment of Deliberate Diversity. The third is that Company A does not use Futures and Deep dive, where most companies do use does strategies. At first the position these strategies take within the organization and the innovation policy of the organization will be discussed.

5.1.3 How Company A uses the search strategies

The parent company of Company A, Company F, has the ambition to become within the top 3 of biggest players in the market for wind energy. They intend to do this in such a way that they become technology leaders. This means that discontinuous innovations could play an important role in the path that they intend to follow to become within the top 3. With the innovations that Company A carries through they intend to be the first-to-market. The problem with discontinuous innovation in general, and the search phase in particular, is that Company A lacks the time and resources to pursue them. The market demands for wind energy in India and China, where Company F resides, are growing faster as possible for the organization to grow.

Because of the ambition of Company F the general policy of the organization is being reshaped because it was out of line with the strategic path that needs to be taken. This has the consequence that the innovation policy does not fit with the overall strategy anymore, which leads to low scores on success for the individual strategies. The organization has come to the conclusion that, in order to have a long term right to exist, they need to organize the distinction between continuous and discontinuous innovation better.

5.1.4 Successful strategies

The first successful strategy within Company A is the use of Idea Hunters. At the moment this strategy is organized through the managers of departments, they where ought to have the ambition to be

technology leaders and have to be aware of opportunities and treats. This has led to the common understanding that each individual within the organization with the possibility to add value to the innovation process must have the ambition to be the best in that specific position, especially those within R&D. Currently this is changing, because the organization recognizes the threat of not pursuing any discontinuous innovations anymore. On the demand side of the organization this is changing towards a distinction between a product manager and an innovation manager. This should lead to an appropriate balance between continuous improvement (product manager) and discontinuous innovation (innovation manager). The innovation manager has to stimulate the use of the search strategies throughout all appropriate functions and departments within the existing organization. On the supply side of the organization a specific demand for technological knowledge is growing, caused by the ambition of the organization. The change is done within the existing organization, which has led to the situation that more employees with specific knowledge need to be educated or hired. The organization does not have these employees available within the organization yet, which means that the Idea Hunters are in particular found at the demand side of the organization (in the form of the already employed departmental managers). The change towards the new distinction between a product and an innovation manager does not mean that the departmental managers are not supposed to be Idea Hunters any more. These managers still need to be aware of the changing market demands and opportunities and threats, but the more sophisticated search actions will be organized and done by the innovation manager.

The Active Users are used within long term programs, like for example the technology board within Company F. Within the technology board the managers of business units that can add value to the board are brought together in order to collect information about current business and future expectations. For Company A these Active Users are those that use the blades or nacelles in their operations. This diverges from the actual users of the rotor blades and nacelles, the service organizations and the organizations that maintain the wind turbines. What all these users have in common is that they all operate within Company F. This means all users are internal customers, which is caused by the philosophy that Company F upholds – they intend to deliver energy, not just wind turbines. The customers of Company F are in the first instance organizations that sell energy to private persons. These organizations are not interested in the development of rotor blades and nacelles, they are only interested in price and volume of energy, which results in the existence of only internal Active Users.

Corporate Venture Units is used in two distinct different ways within Company A. The first is the use of a Venture Unit based on a contract with a third party, in which the third party will develop a certain innovation. In this contract the emphasis lays on the intellectual properties that are associated with the innovation. The reason why there is made use of these contracts is the avoidance by the organization of certain already investigated topics. These are in most cases innovations that have been discussed before, but for which the conclusion was that there seemed to be no added value within the innovation. With use of the contracts these innovations can be re-pursued without having the resistance of the organization.

The second way Corporate Venture Units are used is through the participation within promising startups, but this is not used as a strategy. The goal is to identify specific knowledge and knowhow or a certain

topic or within a specific field and absorb it in the organization. On first sight it seems that Company A is a form of Corporate Venturing to, but it actually is not. Company A is taken over by Company F in 2001 and already existed before that. This means that Company A is not founded by Company F, but it is an acquisition. Within the Corporate Venture Units that Company A creates it plays an important role. As soon as they think the Venture Unit has enough potential and it has grown hard enough, they absorb the Venture Unit within the organization, whether it be Company A or Company F.

5.1.5 Case summary

The case study at Company A has identified interesting findings with relation to the search for discontinuous innovation. These include the findings that have been discussed in the previous paragraphs and some general points that relate to the organization of the search for discontinuous innovation.

- ✗ Company A has an organic management system, which is in line with the expectation in literature
- ✗ The contribution to the five key practices differs from low (information exchange) to high (commitment of senior management, clear and stable vision and improvisation)
- ✗ Active Users exist only intern and are used in long term programs
- ✗ Idea Hunters are departmental managers
- ✗ Corporate Venture Units are used on a contractual basis to avoid resistance within the organization on known innovations
- ✗ Strategies are being reshaped towards the disintegration of continuous and discontinuous innovation because of a current lack of discontinuous innovation, which explains the low score for some strategies
- ✗ The driving principles in the search for discontinuous innovation within Company A are freedom, safety, creativity and stakeholder management
- ✗ Discontinuous innovations are present in all layers of the organization
- ✗ The organization reacts adhoc to discontinuous innovations, caused by the diversity in discontinuous innovations (e.g. process, product, acquisitions)
- ✗ There are few means of communication used in the search phase within Company A
- ✗ The success of an innovation is determined by the person that initiates the innovation, the right person with the right entrances
- ✗ Some strategies are successful because they are perceived to be easy implementable and the organizations needs to provide little support

5.2 Company B

Company B is an organization that originally was an engineering agency for the Company L. It helps clients in the Netherlands, but also across the borders, in the railroad, water and energy market. As mentioned, Company B originated as an engineering agency with the Company L as their only major client (90% of turnover). At a certain moment they came to the conclusion that they were very vulnerable with the Company L as their major customer. The Company L is owned by the Dutch government, which generates another major implication for Company B. The income of the Company L is based on two different streams, the sales of railway tickets and the subdivision of taxes by the

government. The Company L has no influence on this last part, and is dependent on what the government decides to do with the division of taxes. This means that when the Company L has less income from taxes, they will have to cut in cost, which will almost immediately lead to cease of activities with Company B. Therefore Company B has started doing business in two new divisions, Infra and Mobility & Safety. The participation for this research is done out of the division Infra.

The restructuring of the organization subscribes the role of discontinuous innovation within Company B as a good example. The restructuring is done to spread risks concerned with the dependence on one organization as your major customer (Company L). Another example is the use of a one of kind Innovator Studio, a place where employees are given the opportunity to explore innovations, often discontinuous.

5.2.1 Organizational characteristics

Company B can be characterized with use of the organizational characteristics that have been discussed in paragraph 2.6. These characteristics are summarized in the table below.

Company B	
Management system	<u>Mechanistic</u> - Organic
Commitment of senior management	Low – <u>Medium</u> - High
Clear and stable vision	Low Medium - <u>High</u>
Improvisation	Low <u>Medium</u> - High
Information exchange	Low <u>Medium</u> - High
Collaboration under pressure	Low – Medium - <u>High</u>

Table 15: Organizational characteristics of Company B

The management system of Company B can best be characterized as mechanistic. The organization has a high specialization of tasks, each employee has his own specific field of knowledge. For a service organization the duties, responsibilities and technical methods are closely defined, they are for a large extend formalized. Also, the hierarchical structure is very clear, but it is not as strict that the employees have to strictly obey their superiors, there is a certain amount of freedom in each task. This concludes that the management system is overall more mechanistic of nature, but it has a minor organic characteristic when it comes to freedom of tasks.

The commitment of senior management is characterized as medium. The size of the organization and the number of layers makes it impossible to be closely connected to each and every part of the organization. Also, as is defined in the corporate code of conduct *'the management of Company B wants to maintain the leading position of the organization and will therefore make it possible for the employees to keep their knowledge and skills at an adequate level.'* This clearly indicates that the senior management of the organization does support the development of their employees, but it does not take an active role in their behavior.

Company B has a clear and stable vision, with a very long term focus (2040) in which it changes the perception of the current approach, being reactive, towards a new approach, being proactive. Their intend is to indicate the demands of the future society, and make it possible to be able to fulfill them

when they occur, rather than adapting to it. This has resulted in a clearly defined plan, which orients towards these new demands and shapes the boundaries in which the organization has to behave and what kind of innovations need to be searched for.

Due to the long term plan that Company B has formulated, the possibility to improvise is under pressure. The long term plan has three driving pillars, for which it is expected that they will become very important in future society. This indicates that the organization focuses primarily on the development of these pillars, and has little room for improvisation. On the opposite, the organization has the possibility to adjust to specific market demands, because of their consulting nature. Company B intends to develop solutions that are based on specific customer demands, which are hard to recognize in advance. This makes that the degree of improvisation is medium.

The information exchange is organized with use of SharePoint (www.microsoft.com), a browser-based collaboration and document-management platform. This application makes it possible to deliver information and knowledge throughout the whole organization, with the possibility to limit reader's access. For example, if an employee has an idea than the idea can be made available for other employees, for whom the employee thinks the idea is useful. This makes that the information exchange is characterized as medium.

The degree of collaboration under pressure is high, because of two reasons. First, the organization has the primary goal to fulfill customer demands, which has the consequence that employees have to be in close contact with the customer to identify the demands and to define the boundaries in which they have to operate. Second, the organization originates from a governmental agency. The common characteristic of such an organization is that it is very hierarchical and bureaucratic organized. To be able to adapt to these two influences the employees have to be able to collaborate under pressure.

5.2.2 Questionnaire results

The specific situation concerning the use of search strategies for discontinuous innovation at Company B is visualized in Figure 14. In the figure 0 means that a strategy is not used, and for those strategies that are used, the higher the score means the better the strategy works for the organization with 5 as the maximum score.

When discussing how Company B searches for discontinuous innovations, 2 distinct different ways have been recognized. The first is their completion on the use of some of the twelve strategies, which will be discussed at first.

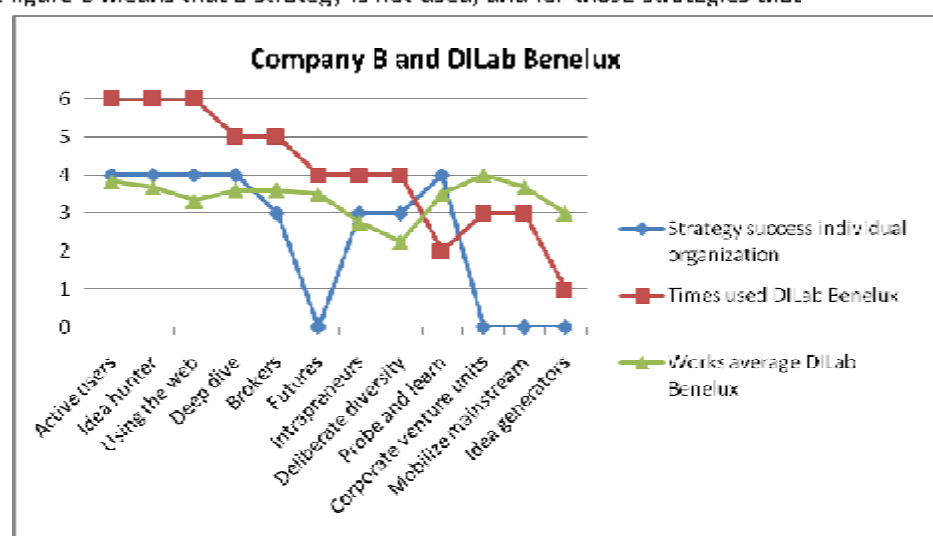


Figure 14: Company B and DILab Benelux

5.2.3 How Company B uses the search strategies

Company B innovates with two separate but interconnected goals. The first is that employees are given the opportunities and possibilities to improve themselves and achieve new competences and skills. The second is that Company B needs to benefit from it. This is done in both continuous and discontinuous innovation. Most innovations that are achieved within Company B are continuous. These encompass for example the improvement of existing processes, technologies and means of production. A good example of a discontinuous innovation for Company B is the use of cold bendec glass within tunnels and also the use of solar cells in these tunnels. These innovations originate outside the organization, the technologies are not invented within Company B. The reason lies within the core business of Company B, it uses technologies and innovations on behalf of a customers demand. As can be seen in Figure 14, Company B uses in total 8 strategies, of which 5 strategies are indicated as successful. These strategies are not chosen intentional, they are recognized afterwards. This does not mean that there has been no thought about the way Company B searches for innovations, but the train of thought does not match with the way the strategies are formulated in theory.

The reason why 4 strategies are not used comes from specific choices. Company B has made the specific choice not to use any third parties outside their customers. The organization incorporates a high number of engineers, which makes it possible to deliver solutions for each request. If this backbone of knowledge does not offer the right solution, the customer needs to question whether Company B would have been the right party to cooperate with and Company B needs to question itself whether the customer's problem fits with the portfolio of the organization. The use of Futures has no large benefits for the organization, because Company B cooperates with the customer on specific demands. These demands may be very divergent, which means that it is hard to predict in which path the Futures need to be developed. The use of Corporate Venture Units has no benefits for the organization, because the risks concerned with the services that Company B delivers are low. The reason why the risks are low is because of the use of Active Users and Deep Dive, the demand of the customer is made very clear before any solutions are developed. The solutions are developed in close cooperation with the customer, which decreases risks to.

Ideas and innovations can be done at three different levels within Company B. The highest level is Company B-level, where most external contacts are maintained. The second level lies at the division level, for example the division Rail and the lowest level is that of the departments. Innovations can be made available at all levels, independent from each other. The principle is that most innovations are made available at the departmental level at first. If it comes out that the innovation goes beyond the boundaries of the department it can be made available at a different level, in most cases at first the divisional level. If the innovation goes even beyond the boundaries of the division it will be made available at the corporate level.

5.2.4 Successful strategies

The first successful strategy is the use of Idea Hunters, which is done through participation in the Battle of Concepts (www.battleofconcepts.nl). The purpose of the Battle of Concepts is that organizations can put a problem online. Subsequently it is possible for students and young professionals to try to come up

with a solution for the problem. The best solutions are rewarded with a sum of money. At the moment Company B has a concept which concerns the reduction of noise pollution by trains and trams.

The second strategy that is successful is Using the Web. The web is used both as an extra dimension in which employees can and should search for discontinuities and as a supportive tool. As the extra dimension it is clearly a passive information source in which information about innovations is being retained. As the supportive tool it is organized through the use of websites like Battle of Concepts.

Not using Active Users is unthinkable for Company B in the way it does business and pursues both continuous and discontinuous innovations. Especially the cooperation with Company I has been successful, which has led to satisfying results for both Company B and the customer Company I. One of the reasons why the use of Active Users is successful lays in the use of Deep Dive together with Active Users. In order to prevent the entrance of the Not Invented Here syndrome Company B operates in close cooperation with the customer, in which the problems and needs of the customer are very specifically laid bare. The use of Deep Dive is done in a very early stage of the process, as soon as the risks are insulated. The innovation process, when using Active Users, is formalized in the following steps. At first the customer makes a need known to Company B. This need is being examined in order to make the actual need known: *'Active Users and Deep Dive are executed at the same moment, they are complementary to each other and are used in order to make the core need of the customer clear'*. Subsequently Company B makes the right resources and knowledge available for that specific customer and delimits the liabilities and the rights of the intellectual property. When these interests are formalized in a contract, the actual process can be started in order to fulfill the need of the customer, which is always done in close cooperation with the customer.

In paragraph 2.4.6 two ways have been discussed on how Probe And Learn can be used. One of them is the use of the strategy as a visualization tool, it does not proceed as a prototype that is being taken into production. The purpose of the use of Probe And Learn is to give a clear and common view on the problem and to be able to direct the process in the right direction.

5.2.5 Innovation Studio

The second way Company B searches for innovators is within the Innovation Studio. The purpose of the Innovation Studio is to make it possible for employees to do things they normally cannot do, because of the accessory restrictions that come with their functions. Employees get the opportunity to step into the Innovation Studio for 3 months so they can investigate topics or innovations for which they normally lack the time and resources. These topics can be very diverse, and may come from the personal interest of the employee or as a possibility suggested by the management. The driving principle of the Studio is that the employees are free to do whatever they want and whatever they find interesting. At the start of the three-month period they are presented a blank sheet with their goals – no goals. As was mentioned during the case study: *'When we have the first explorative conversation with the employee that is going to be in the Studio, we present him a blank sheet with no goals or anything like that – it's up to them how they put their research in practice. Some people get nervous and panic, because they are not used to having no goals or targets, but for the most it works perfect.'* Company B recognizes the danger that lies within this approach. People need to be able to handle this amount of freedom. For the employees that choose to get involved in the Studio and the approach does not seem to work the possibility is open to

get back into their old function at any time. If it works out that an employee is really unable to get used to the radical different way of working within the studio he flows back into the function that he performed before he entered the studio. The contractual function that an employee fulfills is not changed because of the entrance into the studio, it stays the same.

The topics that are investigated in the Innovation Studio are very diverse. Two of the latest topics are Open Innovation, formulated within Company B as a way to innovate in cooperation with another organization and the possibility to count passengers with use of mobile phones. The results of these topics are very diverse. For the Open Innovation topic the result was an advice whether there were opportunities for Company B to innovate in cooperation with other organizations. The result of the calculation with use of mobile phones was that this principle was not applicable. Each employee that enters the Innovation Studio has at first the opportunity to bring up topics to investigate. If these topics seem to be inapplicable the management will come up with topics that are interesting for the concerning employee.

When considering the three levels where innovations can be done and made available, the innovation studio comes at the middle level, the division level. Each division within Company B has his own innovation studio. Within the division Rail the studio is populated by three employees all the time. The other divisions have less resources available, these have together 3 places available.

5.2.6 Case summary

The case study at Company B has identified interesting findings with relation to the search for discontinuous innovation. These include the findings that have been discussed in the previous paragraphs and some general points that relate to the organization of the search for discontinuous innovation.

- ✦ Company B innovates with two separate but interconnected goals, formulated within the strategy
 - The first goal is to provide employees the possibility to develop themselves
 - The second goal is that Company B always needs to benefit
- ✦ The organization has an mechanistic management system
- ✦ The contribution to the five key practices differs from medium (commitment of senior management, improvisation and information exchange) to high (clear and stable vision and collaboration under pressure)
- ✦ One of the ways Company B searches for discontinuities is within the Innovation Studio
 - The studio is placed at the divisional level and has the purpose to investigate specific topics
 - Company B discussed that the Innovation Studio will work for (almost) any organization, it provides the opportunity to explore new ideas en refine the technical skills of employees
 - The studio also enlarges the commitment of employees
- ✦ Idea Hurters are used within the Battle of Concepts
- ✦ Using The Web is both a supportive tool and an extra search dimension

- ✘ The Active Users are external customers and is fundamental for the way Company B does business
- ✘ Deep Dive is a necessity to be able to develop proper solutions
- ✘ Probe and Learn is used as a way to visualize a concept
- ✘ The success of the search strategies is determined by the involvement of the customer in the process, it is perceived as essential to prevent the Not Invented Here-syndrome of occurring
- ✘ Because the customer is actively involved in the innovation process (especially the search phase) the risks attached to the innovations are limited, which explains the absence of Corporate Venture Units
- ✘ There is made use of means of communication in the form of SharePoint

5.3 Company C

Company C is located all around the globe, with its headquarters in Paris. Their mission is to enable its clients to transform and perform through technologies, in which it wants to lead by providing its clients with insights and capabilities that boost their freedom to achieve superior results. It delivers three different but interconnected services to its customers. At first, Company C provides consulting services that contribute to the business transformation and economic performance of organizations, based on in-depth knowledge of client industries and processes. Second, Company C designs and integrates technology solutions, creates innovation, and transforms clients' technical environments. And third, Company C provides both Business Process and IT Outsourcing Services. They manage and improve non-core functions, such as Finance & Accounting, Procurement and IT, enabling its clients to focus on their strategic agenda.

The importance of discontinuous innovation for Company C is very high, of which one of the core businesses of the organization, outsourcing, is a good example. Outsourcing in itself can have huge implications on an organization and a market, depending on the magnitude and scale on which it is done. The principle in which outsourcing is used at Company C, is that activities that lay outside the core-business of the customer are taken over. Subsequently these activities are optimized and standardized, and where possible outsourced towards upcoming economies like India or China. This way it is possible to do these services on a cheaper base as the customer is able to. Company C recognizes the importance of discontinuous innovation, which turns out with existence of the unit Business Innovation.

5.3.1 Organizational characteristics

Company C can be characterized with use of the organizational characteristics that have been discussed in paragraph 2.6. These characteristics are summarized in the table below.

The type of management system that Company C applies is best characterized as organic. The employees experience a high

Company C	
Management system	Mechanistic - Organic
Commitment of senior management	Low – Medium - High
Clear and stable vision	Low – Medium - High
Improvisation	Low – Medium - High
Information exchange	Low – Medium - High
Collaboration under pressure	Low – Medium - High

Table 16: Organizational characteristics of Company C

degree of flexibility in their tasks and there is a continual adjustment and redefinition of tasks. An employee's importance and prestige is determined by his contribution to the tasks of the work group rather than their position in the hierarchy. The organization is characterized by a high degree of flexibility and a low degree of formalization and centralization, employees can plan their own activities up to a certain level.

The commitment of senior management is high. As was mentioned during the case study: *'top management focuses on the navigation of the organization and is open for influences from below. Actually, within Company C the common way is that at a certain moment some individuals come up with a new idea, which originates from the market, and that specific idea is obtained by the top management and resources are made available to pursue that specific idea.'* This clearly indicates that the top management is very involved in the day-to-day activities when it comes to innovations.

Company C has clear and stable vision where it wants to be in the future and how it wants to get there. In this vision a lot of room is left for innovations, both continuous and discontinuous. The organization focuses on these innovations, because they think that the time of optimizing and cutting costs has come to an end, and for organizations to be able to compete it is necessary to innovate.

The degree of improvisation is high to, the organization has the ability to adjust to changing demands very fast. This is made possible by the environment in which Company C operates: *'the Dutch are very loose compelled, they are not as hierarchic as our neighbors. We are learned to think for ourselves, which comes back in all strategies and policies of the organization, a lot of freedom is given to each individual.'* This indicates that the organization recognizes the necessity of a certain amount of freedom to be able to improvise on changing conditions.

For the exchange of information a lot of different applications are available, for example the intranet of Company C, the communities of practices and SharePoint. Employees are given the opportunity to participate in a community, but the participation is not centralized. Also, the use of the intranet is encouraged by the top management, but the employees are not compelled to.

Because of the external orientation of the organization the need to collaborate under pressure is relatively high. The organization does business by fulfilling customer demands. These demands are very diverse, which has the consequence that the organization needs to be flexible to fulfill these demands. Also, the sources that are necessary to fulfill these demands are very diverse, and they all have different interests. Therefore the need to collaborate under pressure is relatively high.

5.3.2 Questionnaire results

The discussion on how Company C has organized the search phase for discontinuous innovation is done from the perspective of the headquarters in Utrecht. The results from the first questionnaire, which is discussed in general in the previous chapter, are visualized below. In the figure 0 means that a strategy is not used, and for those strategies that are used the higher the score means the better the strategy works for the organization. The way these strategies are organized within Company C, with the accent on the more successful strategies, will be discussed in the following paragraphs.

When taking a closer look at the usage of the strategies different interesting findings come up. The first thing that draws attention is the success of five strategies; Using the Web, Active Users, Deep Dive, Mobilize Mainstream and Brokers. The second is the bad assessment of Intrapreneurs and Deliberate Diversity. The third is that Company C does not use Probe and Learn, Corporate Venture Units and Idea Generators, which seems to be in line with most organizations. At first the position these strategies take within the organization and the innovation policy of the organization will be discussed.

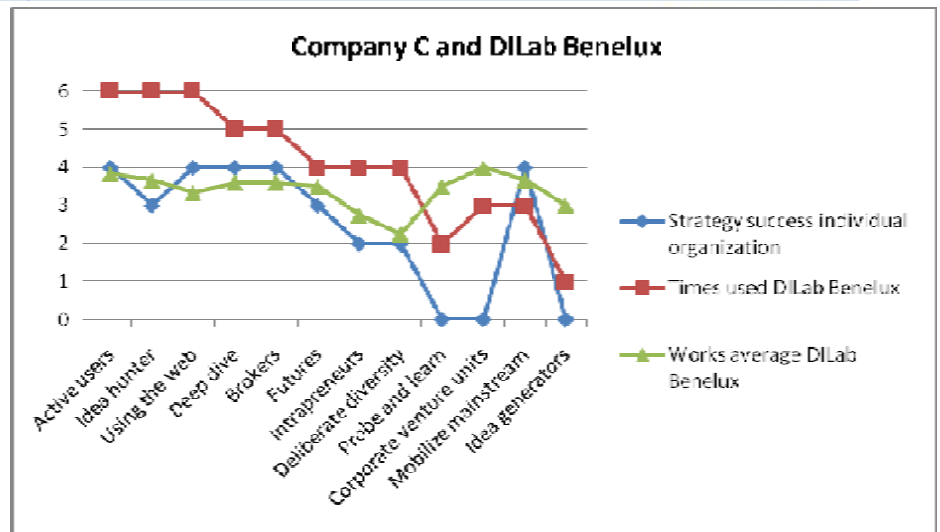


Figure 15: Company C and DILab Benelux

5.3.3 How Company C uses the search strategies

When discussing the importance of discontinuous innovation for Company C, the principle of outsourcing is a good example. Outsourcing in itself can have huge implications on an organization and a market, depending on the magnitude and scale on which it is done. The principle in which outsourcing is used at Company C is that activities that lay outside the core-business of the customer are taken over. Subsequently these activities are optimized and standardized, and where possible outsourced towards upcoming economies like India or China. This way it is possible to do these services on a cheaper base as the customer is able to. Company C recognizes the importance of discontinuous innovation, which turns out with existence of the unit Business Innovation.

The way Company C handles the discontinuous innovation in general, and the search for discontinuities in particular, is a matter of corporate culture. The top-management of Company C is the driving force of the continuing business, in which the emphasis is on profit and growth. Therefore the structure, culture and mechanisms in the organization are designed around these principles. When discussing discontinuous innovation within an organization, the major implication is that an organization needs to create some form of balance between the short term growth and profit goals and the long run strategic right to exist (DeTienne, 2002). The problem is in the discrepancy between these two. The shareholders are for the biggest part interested in short term profit and growth, they make money on that. The stakeholders, especially employees, are more concerned with a long term right to exist. Within Company C the balance between the short term and long term is created through their corporate governance. The driving principle is that the market mechanisms concerning a startup are created inside the organization. This means that for each new concept or innovation new funds have to be addressed in order to create a basis from which it can be developed. This starts with someone who believes in a certain concept and

who is given the opportunity by the governance inside the organization to convince the environment of the potential of the concept. Subsequently the market has to prove whether the concept has the potential that it can generate profits.

The reason why certain strategies are not used is explicable in the typification of Company C. It is a cash-flow organization, which means that no investments are done in assets, the balance sheet is almost empty. This is a distinct choice, Company C wants to have a certain flexibility and scalability, in order to be able to adjust rapidly to changing situations. For Probe and Learn, Corporate Venture Units and Idea Generators large investments have to be made to make them successful, and the business model is not grafted for these investments. The only large investments that can be made are the takeover of proven concepts in the market or organizations that in a certain way add value to the organization. The working principle of Company C is based on projects that are short in duration, the longest projects last for just 4 months. Because of the business model this means that all investments that are made need to have a payback period shorter than the duration of the project.

The reason why both Intrapreneurs and Deliberate Diversity are judged as unsuccessful lays in the business model and the characteristics of the organization. The organization is focused on specific goals and targets, and adjusts the composition of the employees to those goals and targets. When a strategic shift is done, new knowledge is necessary. For some instances this knowledge needs to be adopted from outside the organization. If this is the fact then these new employees are brought inside (Deliberate Diversity) on a slow pace, in order to prevent the organization to shake up too much. Considering the Intrapreneurs the corporate opinion is that each individual that finds itself in a position that gives the freedom to undertake new things needs to have a certain amount of Intrapreneurial characteristics. In the specific market and situation Company C is in these employees are hard to find.

5.3.4 Successful strategies

The most important reason why some strategies do have success within Company C lies within the business model. The services that Company C delivers are based on a short cycle time, the average time is not more than 3 to 4 months. This has the consequence that some strategies are better applicable on the organization.

Each individual employee has adopted a certain topic in which the organization operates, on which the employee is ought to know everything that is known for that specific topic. The strategy Using the Web makes it possible for these employees to search on the internet and intranet for information and knowledge on that specific topic. This means that the internet is not used solely as a searching place, but also as a supportive tool and a place where they deposit their knowledge in order to get into dialogue with others. The use of the web is very important for the organization and also for its customers, it is used as a fundamental tool to make certain things clear to customers and to pursue discontinuous innovations.

Company C uses Active Users both internal and external. The internal Active Users are those that are known to be lead users on specific topics. For questions on their topics these users are addressed to provide directions or answers on a short term, approximately 2 to 3 days. The external Active Users are contacts that are known to be progressive knowledgeable users who are closely connected to the

innovation process of Company C. What these Active Users all have in common is that they are used because of their knowledge on a certain topic, not because of their experience with certain products (as discussed in literature).

Deep Dive is used in areas where business is assumed to be done in the future. This means that knowledge and information about topics in certain areas is retrieved in order to absorb this before business is done within these topics. As formulated this shows similarity with the description of Futures, but there is a difference in perception. It is not about the prediction of pathways to the future, but about the specific awareness of a certain phenomenon. The organization has the ambition and recognizes the necessity that they need to understand the needs that cause a certain signal that is recognized and uses Deep Dive to execute this.

The use of Mobilize Mainstream is done through a small and elite group. The individuals within this group are both internal and external and are all in a certain way Intrapreneurs. Company C recognizes this in the form of a community, in which a certain topic or a certain specific type of knowledge is accommodated. The people within the group are all specialists on that specific topic, but they come from different backgrounds. The community starts as a small and select group and grows towards a certain mainstream, in which it becomes the mentioned strategy.

5.3.5 Case summary

The case study at Company C has identified interesting findings with relation to the search for discontinuous innovation. These include the findings that have been discussed in the previous paragraphs and some general points that relate to the organization of the search for discontinuous innovation.

- ✗ The organization has an organic management system
- ✗ The contribution to the five key practices is high for each practice
- ✗ Active Users are both internal and external and are used as information sources on specific topics
- ✗ The external Active Users are known to be progressive knowledgeable users who are closely connected to the innovation process of Company C
- ✗ Using the Web is both a supportive tool and an extra search dimension
- ✗ Deep Dive is used to understand signals from the market about future business areas
- ✗ Mobilize Mainstream is done with use of both internal and external stakeholders, who act in a community
- ✗ Discontinuous innovation is a matter of corporate culture within Company C
- ✗ The absence of certain strategies is explicable by the typification of Company C
- ✗ The top-management of Company C is focusing on profit and growth, not directly on discontinuous innovations
- ✗ Only form of large investments that can be made is the takeover of proven concepts or organizations
- ✗ Top management support is not essential as a form of searching for discontinuous innovations, it needs to create the necessary freedom

- ✘ The organization is continuous searching for a balance between creative internal entrepreneurship and the recognition of supporting structures
- ✘ The necessary structure to support and manage creativity is absent
- ✘ The success of certain strategies is determined by the persons that execute the strategy in combination with the business model, which is short cyclic
- ✘ Means of communication are used to support and facilitate the search for discontinuous innovations

5.4 Company D

Company D is a contract Research and Development organization that supports the development of products, applications and technical solutions. They intend to bring customers' ideas to life through innovative technologies and consultancy services. Company D can draw on an extensive experience and track record of 40 years of successful releases. This way they are able to make it possible for customers to improve their competitive advantage by developing the cost-effective solutions they need.

Company D is known to be the technology-house of Company J. Company D is part of the division Innovation & Emerging Business within Company J. The core business of Company D is the transformation of new technologies into first-of-a-kind products. This means that they intend to transform new technologies into usable products. Their main customer is Company J, but this is changing. Company D has recognized that their added-value, utilizing new technologies into working products, is not restricted to Company J alone. Therefore they are slowly extending their business outside Company J, and intend to have a 50/50 distribution on the internal (Company J) external turnover in 2010.

Discontinuous innovation plays a very important role within Company D. Because of the characteristics of the products that Company D develops, first-of-a-kind, the extent to which discontinuous innovation occurs within Company D is very high.

5.4.1 Organizational characteristics

Company D can be characterized with use of the organizational characteristics that have been discussed in paragraph 2.6. These characteristics are summarized in the table below.

Company D	
Management system	Mechanistic – <u>Organic</u>
Commitment of senior management	Low – Medium – <u>High</u>
Clear and stable vision	Low Medium – <u>High</u>
Improvisation	Low Medium – <u>High</u>
Information exchange	<u>Low</u> Medium High
Collaboration under pressure	Low – Medium – <u>High</u>

Table 17: Organizational characteristics of Company D

The management system of Company D is best characterized as organic. The employees experience a high degree of flexibility in their tasks and there is a continual adjustment and redefinition of tasks. An employee's importance and prestige is determined by his contribution to the tasks of the work group

rather than their position in the hierarchy. The organization is characterized by a high degree of flexibility and a low degree of formalization and centralization, employees can plan their own activities up to a certain level.

The senior management of Company D is highly committed to the innovations that take place within the organization. Where necessary they get involved in the process, in order to provide a clear direction and make sure the right path is taken. This happens when the potential of an innovation can have major consequences for the whole organization. The senior management creates an environment of trust, coordination and control, in order to make it possible for employees to perform as optimal as possible.

Company D enhances a clear and stable vision. They adapt to the corporate vision, which states that all operations should be stated around simplicity. This has the consequence for Company D that the services it delivers and the innovations it creates have to conduct to the principle of simplicity. *'Technology exists to help make our lives easier and more productive, so why is it so often such a hassle, full of complexity and frustration? At Company D, we believe that technology should be as simple as the box it comes in. It's this very simplicity that transforms a task into an opportunity, a burden into a pleasure'*. Because all operations within all divisions have to conform to this general principle, the organization will stay focused on what goals to attain.

Company D has the purpose to bring customers ideas to life, which has the implication that need for improvisation is relatively high. It is hard to predict what the demands from the customers will actually look like, these demands undergo a lot of changes.

The principle of information exchange is *'a bit old fashioned. There are no resources available to facilitate the innovation process, if someone has an idea he needs to lobby with it. It is all about knowing to find the right doors. In fact this has opportunities for our organization, certainly because we already have many technologies in house which can fulfill these demands.'* This clearly indicates that the information exchange is relatively low, but the organization recognizes the opportunities that lay there.

The degree of collaboration under pressure is high. The organization has the primary goal to fulfill customer demands, which has the consequence that employees have to be in close contact with the customer to identify the demands and to define the boundaries in which they have to operate. This implicates that the need to collaborate outside the organization is high.

5.4.2 Questionnaire results

The specific situation concerning the use of search strategies for discontinuous innovation at Company D is visualized in Figure 16. In the figure 0 means that a strategy is not used, and for those strategies that are used, the higher the score means the better the strategy works for the organization with 5 as the maximum score.

When analyzing the figure above, different interesting findings come up. The first thing that draws attention is the high rate of success of Corporate Venture Units, and also the success of Using the Web, Active Users and Intrapreneurs. The second is that no strategy is judged as unsuccessful. The third is that Company D does not use Futures, where most companies do use does strategies. Also the strategies Probe and Learn, Mobilize Mainstream and Idea Generators are not used.

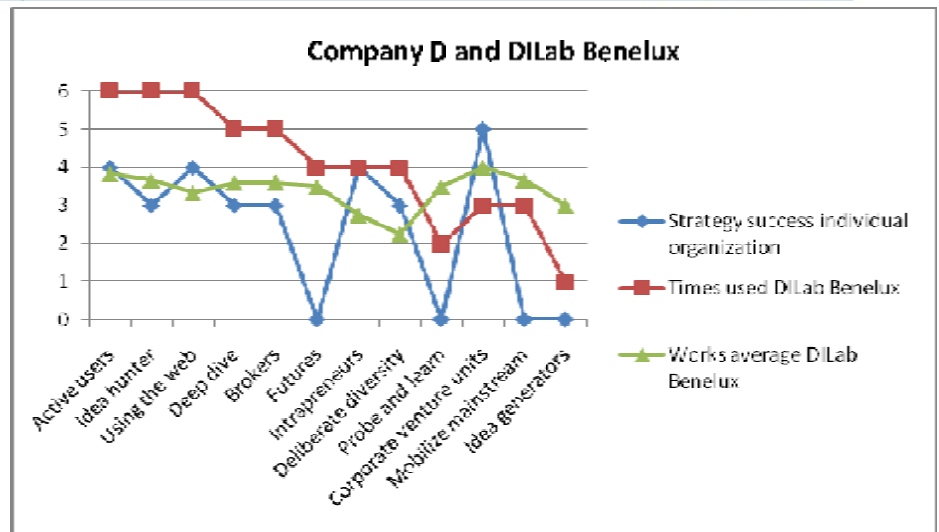


Figure 16: Company D and DILab Benelux

At first the position these strategies take within the organization and the innovation policy of the organization will be discussed.

5.4.3 How Company D uses the search strategies

The core business of Company D is the transformation of technologies into first-of-a-kind products. This means that they intend to be first-to-market, which literally means that they want to be the first to put a product in the market, before competitors do. These characteristics determine the necessity and importance of discontinuous innovation for as well Company J in general and Company D in particular.

When looking at the use of Futures, it seems logical that Company D does not use this strategy. Other parties (both internal and external) deliver technologies to Company D, which are subsequently developed by Company D into first-of-a-kind products. Therefore they do not have to be aware of possible innovation triggers in order to be able to predict the future, the future comes to them. On the other side there is made use of Technology Roadmaps by Company D. These are developments and trends in the technologies that come to them, in which the market perspective is left out. From the perspective of Company D the Technology Roadmaps could become Futures when the market perspective would be taken in, but the reason why this is not done is 'because of a lack of necessity to do it, we get the new technologies anyway because of our name'. Because Company D is efficiency driven some strategies are not implemented, because the added value of those strategies is not recognized.

For Idea Generators the same arguments are in force. There is no need for Company D to use external agencies for the generation of ideas with discontinuous potential, because these ideas are delivered to them. One could argue that the parties (both internal and external) that deliver the technologies to Company D are used as Idea Generators, but this does not apply. The principle of Idea Generators is that external agencies serve as an early warning system for weak signals about changing trends, they do not deliver the outcome of these signals.

Both Probe and Learn and Mobilize Mainstream are also not used within Company D. When searching for an explanation whether this would be an intentional choice no answers are found. This surprises both Company D and undersigned, because the use of other strategies is based on a solid foundation. A possible explanation might lie within the efficiency approach of Company D or the way of doing business of the organization, but there is no reasonable explanation for the absence of these strategies.

The reason why Idea Hunters and Deliberate Diversity are judged as average lays in the lack of steering on recruitment. At the moment Company D employs mostly technically oriented people, but Company D is conscious of the fact that this should be more diverse. There is being adapted towards a more balanced composition of employees, but only in the direction of sales. The average score for Brokers is caused by the type of organization that Company D is, it is a technology-house where technologies are developed into products. There is no need to connect different technologies to each other, the principle is to develop products for one technology at a time. The use of Deep Dive is not formulated as explicit in advance as is done for Active Users, but it is adopted in the use of experts on specific topics and the search for needs in a simulator, as will be discussed further on.

5.4.4 Successful strategies

Company D uses 4 successful strategies, of which Corporate Venture Units is judged as very successful. The Corporate Venture Units within Company D should be seen as a place where people and money are brought together, with the purpose to develop and exploit prospects. These prospects are in most instances based on technologies. The use of these Corporate Venture Units is strictly guided by principles that are formulated by the corporate management of Company D. Within the group, to which Company D belongs, Corporate Venturing is being applied as a part of the core business. The purpose of Corporate Venturing is to expand the scope of Company D and generate new markets in which it does not operate at that moment. The possible reasons for the use of Corporate Venturing are all found (paragraph 2.4.8). Within the principles and guidelines the possibility of a low potential, risk of image damage and the inapplicability with the current portfolio (von Stamm & Bessant, 2007) are all assimilated. Also, the Venture Units have the possibility to easily address the resources of the holding (Buckland et al., 2003). This generates more possibilities for a Venture Unit to develop the prospect.

Within Company D the Web is used as a supportive tool within the search for discontinuities. The consciousness about the possibility to use the Web as an extra dimension where to search for discontinuities is there, but there is no direct adjustment towards this. Company D recognizes the opportunity to use the Web on a much more frequent and in-depth basis, to be able to solve really difficult problems with use of online marketplaces, like for example the Battle of Concepts as used by Company B. At the moment the Web is used as a supportive dimension, not supportive in the way it is done by Company B or Company C with use of an IT application, but in the form of the World Wide Web as a checkup for ideas and their potential. It is very basic, there is no possibility yet to facilitate the search for discontinuities with IT applications or a form of intranet. *'In the facilitation of the search phase we are a bit old fashioned. If someone has an idea he or she needs to shop with that idea in order to find the right person. We have no internal organization that directs this, but there certainly lie chances for Company D, especially because we are a technology house.'*

The use of Active Users is done within Company D with use of a simulator. The simulator is located in Singapore and consists of an apartment with all chambers that are found in a real-life apartment, a shop where the Users can actually buy a product and a hospital. Within these three environments a product is tested on all kinds of characteristics. The simulator is operated by 10 employees and is operative since 2006. Another simulator is being created in Finland and should open its doors in 2009. Only those products of which the concerning business unit thinks the testing would create benefits are tested in the simulator. These products consist of two groups. The first contains products that are already put into the market and which generate problems within the market. These problems can be very diverse, from problems with the installation of the product or defects caused by wrong opening of the packaging. The second group contains products that are ought to have problems likely to those within the first group, but which are not yet put into the market.

The way Intrapreneurs can be found within Company D is caused by the change in business model in recent years. Company D used to be an internal supplier for Company J, and it did not have any outside customers. Due to risks and incompetitiveness the decision was made to change the business model of Company D and also look for outside customers. The goal is to have 50% of turnover generated by outside customers in 2010, the results of the first half year of 2008 were 30%. Because of these goals a different climate was created, which resulted in the recruitment of different types of employees.

5.4.5 Case summary

The case study at Company D has identified interesting findings with relation to the search for discontinuous innovation. These include the findings that have been discussed in the previous paragraphs and some general points that relate to the organization of the search for discontinuous innovation.

- ✗ The organization has an organic management system
- ✗ The contribution to the five key practices is high for each practice, except for information exchange, which is low
- ✗ The absence of Futures and Idea Generators is explicable, the absence of Probe and Learn and Mobilize Mainstream is not
- ✗ Corporate Venture Units are used because of the risks involved and are structured by strict guidelines
- ✗ Corporate Venturing is strictly guided by principles that are formulated by the corporate management of Company J
- ✗ Using the Web is a supportive tool and has potential to become an extra dimension
- ✗ Active Users are used within a simulator with use of external customers
- ✗ The use of Deep Dive is not formulated as explicit in advance as is done for Active Users, but it is adopted in the use of experts on specific topics and the search for needs in a simulator
- ✗ Caused by the change in business model Intrapreneurs were recruited
- ✗ The success of the search strategies depends on the person that executes the strategy and the core business of the organization; searching for new applications of technologies
- ✗ The discontinuous innovation process is bottom-up; ideas need to be 'sold' within the organization to the right people

- ✘ Employees are intentional placed on places in the organization to execute the strategies
- ✘ The success of the search strategies is not determined by the top-management, they can only give direction and support the innovations and provide the necessary freedom to make the search for discontinuous innovations possible
- ✘ There are no means of communication(e.g. SharePoint) available for the discontinuous innovation process

5.5 Company E

Company E is formally known as Company K, a developer and producer of Sensors and Controls. Company E was originally founded in 1916 under the name General Plate Company. After a number of mergers it became in 2006 property of an external investor, and from then on it became an independent company under the name Company E. In 2000 Company E (then known as Company K) reshaped its strategy to the current product range. This range consists of two major groups; Sensors and Electrical Protection. When talking about Sensors, Suspension Pressure Sensors and Fuel Level Sensors are examples in the automotive industry. Electric Cooler Thermostats and Window Lift Motor Protection are examples of Electrical Protection in the automotive industry. The automotive industry is for 50% responsible for the revenues, and thereby the most important sector for Company E.

5.5.1 Organizational characteristics

Company E can be characterized with use of the organizational characteristics that have been discussed in paragraph 2.6. These characteristics are summarized in the table below.

Company E	
Management system	<u>Mechanistic - Organic</u>
Commitment of senior management	Low Medium - <u>High</u>
Clear and stable vision	Low – Medium - <u>High</u>
Improvisation	Low Medium - <u>High</u>
Information exchange	Low Medium - <u>High</u>
Collaboration under pressure	Low Medium - <u>High</u>

Table 18: Organizational characteristics of Company E

The management system of Company E is somewhere in between a mechanistic and an organic form. The employees are restricted to clear defined boundaries, in which they can operate with freedom. This indicates that their tasks are both specialized (mechanistic), but also flexible (organic). Their tasks are closely defined by use of duties, responsibilities and technical methods to fulfill specific needs (mechanistic) but they are also frequently reshaped to adjust to changing needs (organic).

The commitment of senior management is characterized as high. *'The management is strongly connected to all R&D activities that happen within our organization. These activities combine actions from as well our commercial side as our development side and also a specific task force which has the purpose to indicate new growth engines for the organization.'* The importance of commitment of senior management is very high, because Company E operates in highly instable market, and needs to continuously adapt to the changing environment. If the senior management is not aware of changing

demands in time, the organization is not able to adjust to these demands and subsequently loses ground on competition.

Company E enhances a clear and stable vision, which is 'to improve safety, efficiency, and environment protection for millions of people every day'. This shapes clear boundaries for the organization in which it should operate. Also, to be able to shift innovations it generates a handle to discriminate between innovations that fit with the corporate strategy and innovations that do not.

The market in which Company E operates is continuously changing. This calls for a high degree of improvisation, one never knows where the market will evolve to. 'To be able to invest in specific demands, one needs to know what the actual demand is. The problem is that ones you think that you have a clear understanding of what the market wants, these demand slightly change, which has the consequence that you have to adjust again. And this happens all the time, over and over again.' This clearly illustrates that the need to be flexible and to improvise is high.

Company E makes use of SharePoint: to, as in line with Company B and Company C. For the exchange of information they also use what they call biweekly highlights. This is a communication medium in which employees are ought to report their activities, the history and the approach that will be taken in the next few weeks to solve any problems. It is perceived as a good tool to keep the organization focused on what it does and where it wants to be.

The need for collaboration under pressure is relatively high. Company E has to develop technological solutions for specific customer demands, which has the consequence that employees have to be in close contact with the customer to identify the demands and to define the boundaries in which they have to operate. This implicates that need to collaborated outside the organization is high.

5.5.2 Questionnaire results

The discussion on how Company E has organized the search phase for discontinuous innovation is done from the perspective of the division in Almelo. The results from the first questionnaire, which have been discussed in general in the previous chapter, are visualized below. In the figure 0 means that a strategy is not used, and for those strategies that are used the higher the score means the better the strategy

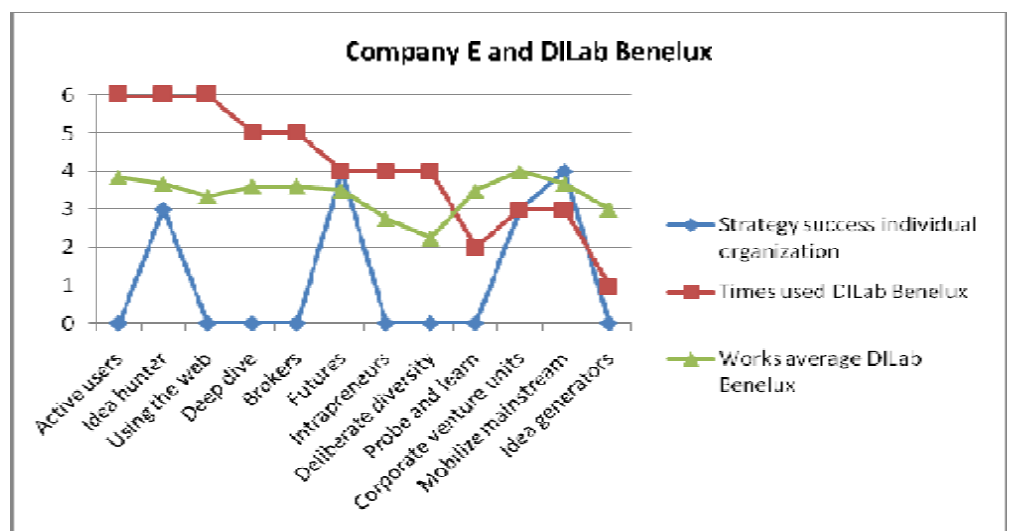


Figure 17: Company E and DILab Benelux

works for the organization. The way these strategies are organized within Company E, with the accent on the more successful strategies, will be discussed in the following paragraphs.

When taking a closer look at the figure that visualizes the search strategies that are used by Company E, the first and most obvious finding is that just a few strategies are used. This is contradictory with the other case studies, they all use at least 7 strategies. The reason why Company E uses just 4 strategies will be discussed in the next paragraph.

5.5.3 How Company E uses the search strategies

Company E innovates with use of three different approaches, but which all have one collective goal – enlarge growth and profit. The first approach is the use of the already existing technologies within the organization, which are used to create as many products as possible to serve market needs. This first form of innovating is best characterized as continuous innovation. The second approach that is used within Company E comes forward through a distinct group of employees which focuses on new aspects which are not associated with day-to-day activities. The focus of this group is on innovations which are market driven and internally oriented. This means that the innovations that this group creates need to fit to the current portfolio of the organization. The people within this group make use of congresses, current and potential customers and innovations from within the organization. This approach is best characterized as discontinuous innovation, the purpose is to create innovations that are different from current business. The third approach that is used within Company E is the use of Mergers and Acquisitions to fulfill a recognized market need. When a certain market need is recognized by Company E and the perception of the potential of that market need meets the demands for successful application by Company E, then the possibilities are there to acquire the technologies that can fulfill the market need. The technologies that are acquired through these Mergers and Acquisitions are best characterized as discontinuous innovations, providing that market need is relatively new.

As can be seen in Figure 17 Company E uses 4 strategies, of which Idea Hunter and Corporate Venture Units are judged as average. These strategies are combined in the use of the Mergers and Acquisitions. The Idea Hunters are the employees that look at global level at the Mergers and Acquisitions. These employees focus on the long term, in which they keep products and markets with potential in mind. The results of these Idea Hunters can have three different results. The first is that they might point the subsidiaries on the existence of a certain potential, with the note that the potential needs to be investigated further. It can also be the other way around, it might be that a subsidiary comes up with a certain potential and questions whether it might be possible to investigate in it, or perhaps even acquire the organization or innovation. The third possibility is that the market approaches Company E with the question whether they are interested in the acquisitions of them.

The focus within Company E is on the recognition of a certain trend and to develop a product which fulfills the need of that trend. Therefore also Corporate Venture Units can be used, which is closely connected to the use of Idea Hunters. Within the organization funds are available to invest in potentials. It needs to be noted that these Venture Units are always used internal, not external as described by Smith (2006). Recently the acquisition of an organization has been finalized. All resources have been adopted in the organization except for the R&D activities of the organization, which have been left independent in order to develop the already existing innovations. This a form of Corporate Venturing

with use of an external Venture Unit, but for Company E this is a ones in a lifetime experience due to a lack of success. This explains why these strategies are judged as average.

5.5.4 Successful strategies

Company E also uses Futures and Mobilize Mainstream, which are judged as successful. The Futures are used at different levels within the organization. The lowest level is the use of scenarios for different products or market segments, which are used to identify different pathways for the fulfillment of certain market needs. The highest level of the use of scenarios is at the corporate level. This is where a perception is made of the foreseeable future. There are always at least three scenarios developed in order to make it possible to cater to future needs and demands. These scenarios are quantified in order to make it possible to adjust to fluctuation during the development of the scenarios. The quantification is done with use of a cash flow analysis. Within that analysis a forecast is made of what investments have to be made and what these investments will return. All costs within the period, both direct and indirect, are accounted for in order to be able to give a precise judgment of both the profit that will be made and how long it takes before the breakeven point is reached. The basic principle in the judgment of the cash flow analysis is the rule of two. *'At the end of a scenario it has cost twice as much, it has taken us twice as long to get there and the profits are twice as low as expected'*. The scope of the scenarios is 10 years and each year adjustments are made, which creates the possibility for a very optimistic scenario with an even more optimistic outcome to be revalued each year and step out if it has not the perspective it was ought to have.

The use of Mobilize Mainstream is done through project teams, in which employees from marketing, finance and engineering, including project management and process preparation, are brought together. These employees are always the best available at that moment and are made full available for that specific project. Such a project team has the purpose to develop a recognition of a specific need or innovation into a concept which is workable for the organization. The people who work within such a team are always others than those that recognize the need for innovation. The reason why different people are used lies within the characteristics of those people and their specific needs: *'the people that are able to develop a successful concept are good at creative thinking, those that recognize a need are able to ask the right questions to the right people'*.

5.5.5 Case summary

The case study at Company E has identified interesting findings with relation to the search for discontinuous innovation. These include the findings that have been discussed in the previous paragraphs and some general points that relate to the organization of the search for discontinuous innovation.

- ✗ Company E has an organic management system
- ✗ The contribution to the five key practices is high for each practice
- ✗ Company E innovates with use of three different approaches:
 - ✗ Use already existing technologies to enlarge market share (continuous innovation)
 - ✗ New aspects which are not associated with day-to-day activities (discontinuous innovation)
 - ✗ Mergers and Acquisitions to fulfill new recognized market needs

- ✗ Idea Hunters are employees at corporate level who focus on Mergers and Acquisitions
- ✗ Corporate Venture Units is used especially internal through Acquisitions of proven concepts or high potentials
- ✗ Futures are used at two levels:
 - ✗ Identify different pathways for the fulfillment of certain market needs
 - ✗ Create different perceptions of the foreseeable (10 years) futures
- ✗ Futures are quantified with use of cash flow analysis and evaluation moments each year
- ✗ Mobilize Mainstream is done through project teams, consisting of employees from marketing, finance and engineering, with the purpose to develop an innovation or identify a need
- ✗ The organization uses strategies that are applicable on their specific situation
- ✗ The success of the strategies is dependent on the strategy itself and the goals it has and the fields of knowledge it addresses (for Idea Hunters failure is a necessity to become successful)
- ✗ The search for discontinuous innovation has one common goal; accelerated growth with emphasis on exploiting organizational strengths
- ✗ A difference is made between searching on corporate level and searching on a lower level:
 - ✗ Corporate level: Idea Hunters and Corporate Venture Units
 - ✗ Lower level: Futures and Mobilize Mainstream
- ✗ The search for discontinuous innovation is supported by highly developed means of communication; SharePoint and biweekly highlights
- ✗ Top-management of Company E is as well actively involved in the search for discontinuous innovations as supportive for the employees; it regulates and controls employee actions

6. Cross case analysis

In this chapter a cross case analysis will be done. This analysis will include both an analysis on the case studies and an analysis on the results of the questionnaire, compared to the retrieved insights in the case studies. The analysis contains 3 different areas. At first: the organizational characteristics of the case studies will be compared, after which the usage of strategies, which are judged as successful by the organizations, will be compared to each other. Subsequently the insights that are gathered in the case studies will be applied on the assumptions that have been done in chapter 3. Finally the different groups of organizations will be compared and analyzed with each other.

6.1 Organizational characteristics

Each organization has been discussed with use of the organizational characteristics that have been outlined in paragraph 2.6. These characteristics will be compared and discussed with each other. The characteristics are at first summarized in the table below.

	A	B	C	D	E
Management system	Organic	Mechanistic	Organic	Organic	Mechanistic / organic
Commitment of senior management	High	Medium	High	High	High
Clear and stable vision	High	High	High	High	High
Improvisation	High	Medium	High	High	High
Information exchange	Low	Medium	High	Low	High
Collaboration under pressure	Medium	High	High	High	High

Table 19: Organizational characteristics

As is discussed in paragraph 2.6, an organization that operates in discontinuous conditions, either in the searching or another phase, should aim at a more organic form of management system. Such a system creates benefits for the organization, it makes it possible to adapt more rapidly to changing conditions. As can be seen in Table 19, not all organizations in the sample have implemented such a management system. Company B is the only organization which has adopted a more mechanistic management system, due to the specific situation in which they operate. Their market is guided by strict rules and procedures, which has had its influence on the organization. Also, Company B originated as a part of the Company L, which used to be owned by the government with the consequence that a high degree of formalization and centralization is standard. The other organizations are more entrepreneurial of nature, the tasks of their employees are much more flexible and the operations are less formalized and decisions are more decentralized. Company E is in between, it has characteristics that are familiar with a mechanistic management system, e.g. highly specialized tasks, as well as characteristics that are familiar with an organic management system, e.g. continual redefinition of these tasks.

Amongst the practices for successful development the commitment of senior management is one of the most important. As Bessant & Tidd (2007) discussed, the support and cooperation of senior management is very important for an innovation to be successful. None of the organizations is characterized with a low commitment of senior management, which indicates that the organizations recognize the

importance of the practice. Actually, only Company B is characterized as medium, which is caused by the bureaucratic organization through many different layers. The other organizations apply short communication lines when it comes to discontinuous innovations, which creates the benefit that actions can be taken swiftly when conditions are changing or possibilities open up.

The practice of a clear and stable vision is the only practice which is indicated as high for all organizations in the sample. What all organizations have in common is that they shaped their overall strategy around one generally accepted goal. All actions and behaviors have to adapt to be aimed at the fulfillment of this goal. The main characteristic of the goal is that it is formulated at corporate level and is applicable on the whole organization. This implicates that the type of organization, either a subsidiary or a holding, may have no influence on the emulation of the general goal. All organizations in the sample have conformed to the general goal of the holding. This indicates that the awareness of the importance of one overall, generally accepted goal in the pursued of a discontinuous innovation is high, the organizations underpin the importance of a clear and stable vision in the search for discontinuities.

The degree of improvisation is very important when an organization faces discontinuous conditions. All organizations recognize the importance of flexibility, they intend to create mechanisms that make them able to adjust to a changing environment, because they are aware of the fact that it is impossible to predict the future. The market in which Company B operates is less changeable as those of the other organizations. Company B operates in a market which is partly owned by the government. These markets have the common characteristics that changes can be more easily predicted and that these changes are less frequent. This explains why Company B is the only organization that does not have a high degree of improvisation present. The overall picture that comes from the sample is that the degree of improvisation is highly dependent on the market dynamics; the only organization that does not operate in a highly dynamic market has a lower level of improvisation.

The information exchange is the only key practice that is characterized twice as low. It is essential for a successful innovation development that the right information is available at the right time and at the right place. The organizations that are characterized as high all use SharePoint, as discussed a browser-based collaboration and document-management platform. This platform gives the opportunity to make information available at any time at any place, which is key for a successful search and development of an innovation. Also, Company C extends the use of SharePoint with communities of practice and the intranet of the organization. These platforms combined give the organization the opportunity to monitor information flows and adjust to changing conditions even more rapidly. Both organizations that do not use any digital means of communication work in a more traditional way – a good idea needs to be ‘sold’ within the organization to key players in that organization. The benefits that a platform like SharePoint gives for an organization are recognized, actually both organizations are working on the implementation of such a platform. This indicates that the organizations underpin the importance of information exchange in the search for discontinuous innovations. Company E makes, additional to SharePoint, use of their biweekly highlights, a tool which helps the organization to observe and control the progress of their innovation process on a frequent base in an easy manner.

The need for collaboration under pressure is especially important when an organization addresses external resources in their search for discontinuous innovations. As discussed in chapter 4, all

organizations use at least 2 externally oriented search strategies. Within the cases only the need for collaboration under pressure of Company A is characterized as medium, the others are all high. The difference is caused by the general focus of the organization, for which it develops products or services. Company A innovates on behalf of internal connected customers, the holding (Company F) is in control of the entire chain. The other organizations all innovate on behalf of external customers, which has the complication that the communication always crosses the boundaries of the organization. Also, the possibility that the interests of external customers and internal interests collide is relatively high. This implicates that the need for collaboration under pressure is much higher.

6.2 Successful strategies

Within the case studies several strategies have been examined, which were evaluated as successful or very successful by the participating organizations in the questionnaire. The organization of these successful strategies will be compared between the companies.

6.2.1 Active Users

The strategy Active Users is evaluated as successful by Company A, Company B, Company C and Company D. The use of Active Users has been summarized for each case. These summaries are combined in Table 20. Also the rate of successful (successful or very successful) is given for each case.

Summaries of the use of Active Users		
A	The Active Users exist only intern and are used in long term programs	Successful
B	The Active Users are external customers and is fundamental for the way Company B does business	Successful
C	Active Users are both internal and external and are used as information sources on specific topics	Successful
D	Active Users are used within a simulator with use of external customers	Successful

Table 20: Summaries of the use of Active Users

The Active Users are used in diverse settings within the cases, the users have different purposes and outcomes. Both Company A and Company C use Users that are situated within the organization. The purpose of the Users within Company A is to develop long term programs in close cooperation with internal stakeholders, in which the interests of all parties is accounted for. The goal of the Active Users within Company C is to make it possible for employees to deploy difficult questions at internal Lead Users, in order to retrieve information and knowhow that they normally would not be able to address that easy. The difference is that Company A makes use of the internal Active Users for strategic decision making and Company C uses both internal and external Active Users to provide knowhow to employees in order to get to a higher level of services. What these Active Users have in common is that they are both Lead Users in their own particular field of knowledge. The internal stakeholders of Company A are supposed to be leaders in their own particular area, the Users of Company C are Lead Users on their field of knowledge.

The use of Active Users within Company B is explained in the way they do business. All services that are delivered to customers are based on close cooperation with that customer. The process is shaped

around the involvement of the customer. The use of external Active Users within Company D is done through a simulation. These users are not typical Lead Users, they can be anybody.

This discussion indicates that the characteristics of the Active Users do not correspond one on one with the description that has been done in chapter 2 for all cases. The Active Users were indicated as Lead Users, people who are known to be well developed in the knowledge that an organization wants to become, typically because of their superior knowledge on a specific topic. Within Company A and Company C the Active Users do are Lead Users, they are known to be progressive knowledgeable users which are closely connected to the innovation process of Company C or the decision making process within Company A. The Active Users of Company B are actually their customers, which is a different perception on the use of Lead Users, caused by their business model. Therefore these users are too a form of Lead Users, with the comment that they are used in a different approach. Only the Active Users that are used within Company D are not referred to as Lead Users, they can be anyone that uses their products.

6.2.2 Idea Hunters

The strategy Idea Hunters is found as successful within Company A and Company B, for which the summaries of the use of the strategy are given below. The rate of successfulness (successful or very successful) is also given for each case.

Summaries of the use of Idea Hunters		
A	Idea Hunters operationalized with use of departmental managers	Successful
B	Idea Hunters is done through the Battle of Concepts	Successful

Table 21: Summaries of the use of Idea Hunters

The use of Idea Hunters is done in two very different ways within the organizations. Company A used to organize this strategy with use of departmental managers, but this is being reshaped towards a distinction between demand and supply side. On the demand side a distinction is made between a product manager, who's involved with continuous improvement, and an innovation manager, who's responsible for discontinuous innovation. On the supply side of the organization a change is made towards a demand for specific knowledge, which leads to need for employees with specific knowledge. Not all knowledge is available within the organization at the moment, which means that the knowledge needs to be trained or hired.

Company B uses the Battle of Concepts as their approach towards Idea Hunters. This is a whole different approach as that of Company A. The Battle of Concepts creates possibilities for organizations to address knowledge in a fast and easy way. Subsequently that specific knowledge can be applied and spread within the organization.

The two approaches used for the strategy are completely different, but both organizations seem to benefit from it. The approach of Company B with the Battle of Concepts is applicable for almost any organization within any market, which comes forward through the battles that are being held at the moment. It is also a seemingly easy strategy to implement, because it requires almost no resources and time of employees, and provides contacts that the organization normally cannot address that easily. The

approach of Company A is more sophisticated and needs more resources and time from employees to become successful. A major advantage is the distinction between continuous and discontinuous innovation which generates a better balance in the attribution of resources to both activities. This way it is more easily for an organization to adjust the balance between both activities, in order to be able to adjust faster to market developments.

6.2.3 Corporate Venture Units

Corporate Venture Units is used and evaluated as successful by both Company A and Company D. The summary of the use of the strategies is given in Table 22.

Summaries of the use of Corporate Venture Units		
A	Corporate Venture Units is used on a contractual basis to avoid resistance within the organization on known innovations	Successful
D	Corporate Venture Units are used because of the risks involved and are structured by strict guidelines	Very successful

Table 22: Summaries of the use of Corporate Venture Units

There is a difference between the organization of both strategies. Company A uses Corporate Venture Units in a more easy way to implement. Some innovations have already been examined within the organization, but they have been judged as unsuccessful or impracticable. For these innovations the possibility is there to be re-examined through the cooperation with a third party, which is referred to by Company A as Corporate Venturing.

Within Company D Corporate Venturing is formulated within the strategy. It is seen as a necessity for the organization to be able to avoid risks that are associated with discontinuous innovations. Within Company D the use of Venture Units is done as described in literature; a big organization uses small organizations to examine the possibilities of an innovation. If the innovation seems to have high potential, than the organization can easily retrieve the innovation for itself. If the innovation has few potential, the organization can easily step out. This is in fact the purpose of Corporate Venturing within Company D, to be able to avoid risks, but to have the opportunity to still examine high risk innovations.

6.2.4 Using the Web

The strategy Using the Web is evaluated as successful by Company C, Company B and Company D, for which the summaries are given below.

Summaries of the use of Using the Web		
C	Using the Web is both a supportive tool and an extra search dimension	Successful
B	Using The Web is both a supportive tool and an extra search dimension	Successful
D	Using the Web is a supportive tool and has potential to become an extra dimension	Successful

Table 23: Summaries of the use of Using the Web

All organizations use the strategy at least as a supportive tool. As discussed in paragraph 2.4.3 this can be done through both intranets and extranets. The difference is where the boundary of the supportive tool is set, intranets stop at the boundary of the organization, extranets go beyond that boundary. Within Company C the Web is used as a supportive tool both within and across the boundaries of the

organization. The purpose is to gather information and make information available for others, in which the Web facilitates these actions. Company B uses the supportive part of the Web within the application SharePoint. With use of this application it is made possible to make ideas and innovation available at different levels within the organization. It is a form of information sharing which exists within the boundaries of the organization. Company D uses the Web as a supportive tool only, but in a very limited way. The only possibility that the tool gives is to record ideas and innovation in the form of a project management tool, it cannot be used as within Company B, who use it as a sort of network tool.

Both Company C and Company B use the Web also as an extra dimension where they could and should search for discontinuities. Both organizations recognize it as a fundamental way and place for the recognition and search for discontinuities. The difference between both organizations is the use of the Web as a searching place. Company B uses it as a passive information source, it is clearly one-way traffic. They absorb the information that is available and do not intend to provide information on the Web (with a few exceptions like the Battle of Concepts). Company C uses the Web as a dynamic information source, they both absorb information and make information available on the Web. Actually, they recognize the Web as a necessity for the way they do business. They get in dialogue with users on specific topics, users of whom they normally would not know they existed. Company D recognizes the possibilities of the Web as an active searching place, especially in the form of active market places like the Battle of Concepts.

6.2.5 Deep Dive

Both Company B and Company C have evaluated Deep Dive as successful, as summarized below.

Summaries of the use of Deep Dive		
B	Deep Dive is a necessity to be able to develop proper solutions	Successful
C	Deep Dive is used to understand signals from the market about future business areas	Successful

Table 24: Summaries of the use of Deep Dive

As discussed by Kärkkäinen and Elfvengren (2002) one of the most essential objectives of Deep Diving is to produce useful information for the early phases of product innovation, which can be utilized in the planning, evaluation and prioritization of new product development projects. Both organizations use the strategy with this objective as the main importance, but with different interpretations. Company B uses Deep Dive actually through their Active Users, in line with pattern 2. It is a necessity for Company B to use Deep Dive in cooperation with Active Users to be able to structure their innovation process. The cooperation with the customer is essential for the outcome of the process, for Company B it is unimaginable to innovate without using the customer as an Active User. The use of Deep Dive is done in the initial phase of the innovation process, it is dedicated to the recognition of the actual need of the customer.

Within Company C the use of Deep Dive has a very different purpose. Where Company B uses the strategy to recognize the actual need of a customer, Company C uses the strategy to retrieve knowledge and information about topics in which future business is expected to be done. With the strategy they intend to clarify the needs that cause a certain signal to come to the organization.

6.2.6 Mobilize Mainstream

Both Company E and Company C have evaluated Mobilize Mainstream as successful, as summarized below.

Summaries of the use of Mobilize Mainstream		
E	Mobilize Mainstream is done through project teams, consisting of employees from marketing, finance and engineering, with the purpose to develop an innovation or identify a need	Successful
C	Mobilize Mainstream is done with use of both internal and external stakeholders, who act in a community	Successful

Table 25: Summaries of the use of Mobilize Mainstream

The way organizations look at their resources and relocate them in order to be able to generate discontinuous innovations is referred to as Mobilize Mainstream by von Stamm and Bessant (2007). Both organizations that judged this strategy as successful, Company E and Company C, use the strategy in a similar way but with a different perception. Company E uses the strategy within multi-disciplinary teams with the purpose to actually develop an innovation or identify a need. These teams have a specific goal and task, the right of existence is defined. This is in contrast with the way Company C uses the strategy. The goal of the strategy within Company C is to involve people which are all specialists on a specific topic but who come from different backgrounds, in order to solve difficult problems. These are brought together in so called communities. These communities show similarities with the multi-disciplinary teams within Company E. One of the major differences is that not all people within the communities are 'owned' by Company C, most of them are working for external parties. This is in contrast with Company E, which uses only employees from within the organization in their multi-disciplinary teams. Another difference lies in the goal and purpose of the teams and communities. The purpose of the teams within Company E is twofold, always focusing on the development of actual innovations or perceptions of needs. The goal of the communities within Company C is to be able to address knowledge and information on specific topics which is not available within the organization.

6.3 Patterns

In chapter 4 three patterns have been recognized, based on the results of the questionnaire. Each pattern will be re-discussed, in which use will be made of the insights that have been gathered in the case studies.

6.3.1 Strategy use and need for investment

In chapter 4 the assumption has been made that the use of a strategy is determined by the average investment in resources that comes with the implementation of the strategy. This means that the more resources a strategy requires for implementation in an organization, the less it will be used in the search for discontinuous innovations.

The difference between the frequent used and the less used strategies is in the necessity of available resources. For the most frequent used strategies, Active Users, Idea Hunter and Using the Web, just a few resources need to be available in order to use the strategy. The use of Active Users is done with use of different types of contacts within the case studies, but what all these contacts have in common is that they are already connected to the organization. This makes it more easy to use these Active Users within

the idea generation of the innovation process (Desouza et al., 2008). Huston (2006) discusses that organizations often already incorporate potential Idea Hunters in their R&D departments, they are just not aware of their potential which has the consequence that the use of Idea Hunters does not have to lead to the use of more resources. As von Stamm and Bessant (2007) discuss the simple form for Using the Web, as an additional space where organizations can search for discontinuities, is a passive information source which the organization can easily address. The overall picture that comes from the case studies in respect to these strategies is that they are used in the simple forms.

When comparing the insights on the strategies that need large investments, for example Idea Generators and Corporate Venture Units, it comes forward that the organizations that do not use these strategies have made a specific choice to do so. The specific needs of those strategies is that they will repay themselves on the long run, which has the consequence that an organization needs to be able to invest on the long run. The products or services of the organizations that do not use the strategies can be characterized as short term, which has the consequence that the strategies do not fit to these products or services.

For Corporate Venture Units and Probe and Learn much more resources are needed. The use of a Corporate Venture Unit entails the investment of a large amount of financial resources into a smaller entity (Smith, 2006) by a larger organization. This means that if an organization chooses to establish a Venture Unit it has to invest financial resources in order to make it possible for that Venture Unit to start doing business and develop the innovation for which it is being created into a fruitful product or service. The basic principle of Probe and Learn is that an organization puts a prototype or a concept into the market in order to investigate the reactions and perceptions of actual users (von Stamm & Bessant, 2007). This entails most of the time large investments in as well financial and non financial resources.

6.3.2 Deep Dive and Active Users

In chapter 4 the pattern was discussed that Deep Dive is used as a logic addition to the use of Active Users, in which the main purpose is to increase the quality of the generated insights from the Active Users. This has been investigated with use of the organizations that participated in the case studies. Company D, Company B and Company C use both strategies, of which the summaries are given in Table 26.

Summaries of the use of Deep Dive and Active Users	
B	<ul style="list-style-type: none"> * The Active Users are external customers and is fundamental for the way Company B does business * Deep Dive is a necessity to be able to develop proper solutions
C	<ul style="list-style-type: none"> * Active Users are both internal and external and are used as information sources on specific topics * The external Active Users are known to be progressive knowledgeable users who are closely connected to the innovation process of Company C * Deep Dive is used to understand signals from the market about future business areas
D	<ul style="list-style-type: none"> * Active Users are used within a simulator with use of external customers * The use of Deep Dive is adopted in the use of experts on specific topics and the search for needs in a simulator

Table 26: Summaries of the use of Deep Dive and Active Users

As von Stamm and Bessant (2007), Holt (1984) and Kärkkäinen et al. (2001) discuss Deep Dive (or customer need assessment) has the goal to indicate what the cause is of an expression of customers. This has the consequence that, from the perception of von Stamm and Bessant, an organization that uses Deep Dive needs to be in contact with its customers. The way Company B uses Deep Dive is in line with the approach described by von Stamm and Bessant. Company B develops solutions for customers which are based on the specific needs of those customers, which are adopted through a close and intensive contact with that specific customer. The approach Company D uses with respect to Deep Dive is with the use of a simulator to address the perception and needs of their Active Users. The organization of the strategies in both organizations is different, but the purpose and outcome is almost the same – they both intend to identify specific customer needs. The difference is in the possibility to generalize the outcome to other customers, which is present for Company D but absent for Company B.

The approach used by Company C is different when glanced from the organization of the strategies. Within Company C Deep Dive is used in areas where business is assumed to be done in the future. This means that knowledge and information about topics in certain areas is retrieved in order to absorb this before business is done within these topics. This is not strictly done with use of customers as within Company B and Company D, the sources can also be non customers or even competitors. The purpose and outcome on the other hand is the same, the intention is to identify future business areas based on retrieved signals. The use of Deep Dive is a necessity for the organization to identify future business areas, but it does not necessarily have to be done with use of customers.

This leads to the understanding that the use of Deep Dive is complementary to the use of Active Users, but it is not a necessity to use it through customers (Active Users). It can also be done, as seen within Company C, with use of non customers or competitors.

6.3.3 Corporate Venture Units

The pattern is based on the observation that the use of Corporate Venture Units depends on the type of organization (High-Tech or Medium to High-Tech manufacturer). Subsequently, when looking at how these organizations judge the success of the strategy, it shows that the strategy is judged as mediocre (Company E), successful (Company A) and very successful (Company D). Especially the difference between Company E and Company D is interesting. As already discussed in paragraph 2.4.9, the success of a Corporate Venture Units is influenced by both the size of the organization and the role the organization plays in the venture. The specific case conclusions per case were as follows:

Summaries of the use of Corporate Venture Units	
D	Corporate Venture Units are used because of the risks involved and are structured by strict guidelines
A	Corporate Venture Units is used on a contractual basis to avoid resistance within the organization on known innovations
E	Corporate Venture Units is used especially internal through Acquisitions of proven concepts or high potentials

Table 27: Summaries of the use of Corporate Venture Units

What comes from the case studies, is that the difference between being the large and small party within the venture does not always correspond to the propositions within the literature. The benefit for the large party is that it can exorcize risks and/or low potential contained to the innovation, the small party

can benefit from the resources of the large party in order to develop and utilize the innovation. Within Company D the reason why an innovation is being developed by them is the risks contained to the innovation for the other party. The only comment that needs to be made is that there is no distinction between the large and small party as is done within literature. The parties that place a technology inside Company D, in order to develop it into a first-of-a-kind product, are not typically larger. The reason why they outsource the development of the innovation is that Company D has the specific knowhow that is necessary to develop the technology into an actual product, while the party that outsources often lacks this knowhow.

The situation with respect to Company A is different. They use Corporate Venture Units in the form of contracts. The reason why this is done is to avoid the resistance of already excluded innovations. The parties with whom Company A uses these contracts can be both bigger and smaller as Company A. The purpose is always to make use of knowledge that Company A does not have but needs to develop the innovation. Also, on first sight Company A can be indicated as a Corporate Venture Unit of Company F, whether it is that the reasons for the use of a Venture Unit like Company A are not in line with the reasons found in literature. Company F makes use of Company A because of the specific knowledge that is available within Company A, just like Company A makes use of contracts in order to obtain knowledge from third parties. This does not stroke with the purpose for the foundation of Corporate Venture Units as formulated in literature, the avoidance of risks.

The use of Corporate Venturing by Company E is more internally focused, and comes hand in hand with the use of Mergers and Acquisitions recognized by the Idea Hunters. This makes the strategy different from those at Company A and Company D, the purpose is to invest in potentials that are recognized by the Idea Hunters at corporate level and then absorb them within the organization.

Another point of interest is that the use of Corporate Venture Units comes with large investments for the long run (Buckland et al., 2003). The consultancy firms are organized around projects that typically have a lifetime of no longer than 6 months. This has the consequence that every investment that is made needs to have a payback period no longer than the lifetime of the project for which the investment is made. For the High-Tech manufacturers this problem does not occur, the products that they develop are typically applicable for a longer time.

6.4 Case comparison

The final part of the cross-case analysis will exist of an overall case comparison. In this case comparison the most important findings of this research will be outlined, in order to provide a solid ground for the conclusion. In chapter 4 the results of the questionnaire have been discussed, in which a difference has been noticed in the use of the search strategies by the participating organizations. These results will be discussed, in which Company H and Company G are left out of discussion, because these organizations have not taken part in the research in the form of a case study. In this discussion the findings on what determines the success in the search for discontinuities will also be taken along.

The observation was made that the composition of search strategies at Company E is very different when compared with the other organizations. No possible explanation could be given on the results of the questionnaire solely, but with the insights of the case studies the observation can be explained. The

difference in composition of search strategies occurs because Company E has an explicit strategy towards discontinuous innovations. The organization knows what type of discontinuities it searches for and where it can find these. To be able to address these sources of information it uses a combination of an easily implementable search strategy (Idea Hunter) and more sophisticated search strategies (Futures, Corporate Venture Units and Mobilize Mainstream). The strategy Idea Hunter is used at corporate level and has the goal to identify Mergers and Acquisitions, a very specific focus. The Futures are developed at different levels within the organization and have the purpose to give direction to the strategy of the organization and to provide the organization the necessary flexibility to adjust to changing demands. The Corporate Venture Units are additional to the Idea Hunters, it gives the organization the opportunity to explore a specific potential. Mobilize Mainstream is done with the specific composition of teams, these are composed based on the characteristics of the employees. What all strategies have in common is that they have a very specific focus and are supported by the organizational characteristics as discussed in paragraph 6.1. Senior management is committed in two different ways; they give the employees the necessary freedom to make the search for discontinuities successful and they search for discontinuities themselves. The specific focus of the strategies comes from the vision of the organization, in which a core element is what the organization wants to search for. This is continuously adjusted to changing demands, but has one common goal; accelerated growth. All steps in the innovation process are supported by very advanced means of communication, which appeared to be essential in a more sophisticated search.

When arguing that Company E has a more sophisticated and further developed composition of search strategies, it must be argued why the perception of success of the strategies is not higher. The organization indicated that both Futures and Mobilize Mainstream are successful, but Corporate Venture Units and Idea Hunter are not (medium). This is caused by the perception of the organization on what success actually is, which the organization explained to be twofold. The perception of success is based on the outcome of the strategies, these generated both very successful and unsuccessful innovations. During the case study it became clear that it is a necessity for the strategies Idea Hunter and Corporate Venture Units to be allowed to generate unsuccessful outcomes. It was argued that if the strategy was allowed to only generate successful outcomes, it would exclude risks as much as possible, but often the innovations that are most risky on first sight have the highest potential. Therefore these two strategies should actually be judged as very successful.

Company C can be characterized as more developed too. The organization has a balanced composition of search strategies and support mechanisms. Senior management uses a bottom-up approach, they support new ideas but do not search for these ideas themselves. The organization has characterized two strategies as unsuccessful (Intrapreneurs and Deliberate Diversity) which is caused by the market entrance strategy of the organization and the orientation of these two strategies. The means of communication that the organization has implemented are very developed, from the basic tool SharePoint to more complicated communities of practice. Also, the organization has a very specific vision of where it wants to become, how it wants to get there and which sources of information are necessary to take these steps forward. In this vision a lot of room is left for innovations, both continuous and discontinuous. The organization focuses on these innovations, because they think that the time of

optimizing and cutting costs has come to an end, and for organizations to be able to compete it is necessary to innovate.

Company B searches for discontinuities in a very different setting when compared to the other cases. Use is made of the Innovation Studio, as discussed in paragraph 5.2.5, which is a perception of searching in which different strategies are combined in one searching place. In the Innovation Studio the employees have a lot of freedom to investigate certain specific topics – these can be brought up by the employee or the top management. One of the characteristics of the Innovation Studio is that failure is not condemned, the organization recognizes that failure comes with the search for discontinuities with high potential. This creates the opportunity for employees in the Innovation Studio to investigate topics that would normally have had no change, they would have been judged as inappropriate in an early stage. The Innovation Studio is not the only way Company B searches for discontinuities, also use is made of different strategies, but it is the most important strategy for the organization.

Company D has a high overall score on success for the search strategies, which indicates that the current composition of the search strategies works for the organization. During the case study it became clear that the strategies are working for the organization, but they are not supported in a way that is appropriate for the organization. No supportive tool is implemented in the organization, which could cause the loss of retrieved knowledge and information. The organization recognizes this danger and is currently investigating which tool is most appropriate to their setting. Also, the strategies are used in a way that seems to work for the organization, but if the organization wants to advance to a more sophisticated search for discontinuities changes have to be made. Supportive tools and means of communication need to be implemented in order to make information and knowledge available at the right time and the right place, for example as done by Company E.

Company A has the lowest average score for success when comparing the average success of the case studies. The reason that the organization identified to cause the low scores for some strategies is in the reshaping of the organization towards a better focus on discontinuous innovation. But when taking the argument forward that an organization can develop itself through time from a more general composition of search strategies to a more sophisticated, specific composition a different explanation can be derived. The organization identified that the composition of search strategies that are present did not satisfy their need, they did not generate the necessary discontinuities. This indicates that the organization has been using a composition of search strategies that were on first sight thought of generating the necessary discontinuities and has come to the recognition that some of these strategies do not perform the way they were ought to. This implicates that the organization is investing resources in search strategies that do not pay themselves back, which explains the low score for some strategies. This relates to the organizational characteristics as follows. The commitment of senior management and the clear and stable vision are characterized as high, but when comparing it with the completion of Company E it is different. The commitment of senior management is high, they support the search activities of employees and give them the necessary freedom, but they not perform any searches themselves. The vision has recently been changed, because it lacked the focus that is necessary to make the search for discontinuities successful. The necessity of a good working idea management tool is recognized, but Company A has not implicated any mean of communication.

7. Conclusions

The conclusions based on the case studies and the cross-case analysis will be presented in this chapter, which have the purpose to provide answers for the main research question. The research questions have already been answered in the previous chapters, therefore these will not be elaborated on anymore. Next to the conclusions on the main research question also the limitations of the research and the suggestions for further research will be discussed.

7.1 Answering the central question

The aim of this research was to investigate in which way organizations can search for discontinuous innovations. Actually, the central question embraces what organizations have to do in order to make the search for discontinuous innovations successful. This research has indicated several guidelines for the search for discontinuous innovations, which will be discussed.

At first a difference must be made in the maturity and experience of the organization in relation to the search for discontinuous innovation. Organizations that are relatively inexperienced with the topic or which have not developed their search for discontinuous innovation thoroughly will not be able to implement search strategies that require more resources and guiding. This research has shown that organizations that are relatively new with the topic can best choose search strategies that are easy to use, those that require few resources. The advantage of these search strategies is that they are often already used in the organization, be it in a different type of innovation (e.g. continuous). Also, the search strategies that require few resources are judged successful more often than those that require more resources. This is caused by the discontinuities that are recognized with these search strategies; they address very diverse sources of information and knowledge, which makes it possible to recognize more diverse discontinuities for different parts of the organization. Also, because very diverse sources of information and knowledge are addressed a possible lack of direction in the search for discontinuities is reduced, the chance of recognizing potential discontinuous innovation in advance is enlarged.

During the use of these strategies it is important that top-management gives the employee the necessary freedom to actively search for discontinuous innovation. This means that it is not necessary for the top-management itself to search actively, but it must create the necessary space and freedom to make it possible for discontinuous innovations to be recognized by employees. The role that top-management plays is best described as supportive, in which they need to create an atmosphere in which the exchange of knowledge and information on all levels is encouraged. The research indicated that in most instances the search for discontinuous innovations is still bottom-up, the employee needs to 'sell' an idea to the right person in the organization, a process of trial and error. That is why an employee needs to enjoy a high degree of freedom to make the process work, it asks a lot of patience from the organization.

If organizations are more experienced with the search for discontinuous innovations they can proceed to the use of search strategies that require more resources. The previously discussed strategies are often already present in the organization, and if not they can be implemented without many intentional concerns, the more sophisticated strategies ask for a different approach. To be implemented these

strategies are compelled with a clear corporate strategy, they address very specific resources (whether internal or external) and are different in nature and outcome. Also, the actors that execute the strategy can be different, even top-management itself can use these strategies. For example, Futures on strategic level and Corporate Venture Units are best executed by top-management.

The benefits of the more sophisticated search strategies, compared to the strategies that require less resources, lie in the sources of information they address and the information they gather. The more sophisticated search strategies address sources with very specific information and knowledge, they can be successfully used only if the organization provides a direction about the information and knowledge it wants to become. Therefore these strategies are better applicable on organizations that are more developed in the search for discontinuous innovation.

The search strategies need to be supported by means of communication. The complexity and advancement of these means of communication can be very different, it follows the path of complexity of search strategies. The more easily to adopt search strategies can be supported with a general tool, e.g. SharePoint. When the organization is more advanced in the search for discontinuities the necessity for more sophisticated supportive tools comes in. Because the organization searches for very specific knowledge and information it needs to make it possible to store this knowledge and information and make it available at the right places in the organization. Also, these tools should make it possible to address very specific fields of knowledge and information.

Another guideline that comes from this research is that some strategies are successful in specific situations. First, the use of Corporate Venture Units is applicable for High-Tech and Medium to High-Tech manufacturers in particular and can be very successful for these types of organizations (Buckland et al., 2003; Smith, 2006). The research indicated that the use of this strategy is perceived as a necessity by organizations in these sectors, it provides them the opportunity to avoid risks that are connected to the development of certain innovations in their organizations. The operationalization of the strategy can be very different, but the main purpose stayed the same for all cases – to avoid risks that are concerned with some innovations and to prevent them of being eliminated from the organization due to these risks.

The second specific situation considers the use of Deep Dive in combination with Active Users. When these two strategies are combined, if the context and characteristics of the organization allow this to happen, then Deep Dive creates major benefits for the use of Active Users (Desouza et al., 2008; Kärkkäinen & Elfvengren, 2002). The purpose of both strategies is to identify certain needs, in which Deep Dive can create a more sophisticated level of doing so. Also, the requirement of resources for these strategies to be used in organizations when they are combined is relatively low, they address the same resources, the major point that must be noted is that the use of Deep Dive is very time consuming.

Another important aspect that comes forward from this research is that all organizations underpin the importance of discontinuous innovation for their organization, but when they have to choose they prefer short term profit and growth instead of long term investments on discontinuities. This has negative influences on the development of discontinuous innovations in general and the search for discontinuities in particular, because these activities ask for different actions of an organization (Tidd et al., 1999). To prevent this of occurring the search for discontinuous innovations needs to be defined, in which the

resources that have to be made available need to be described. This creates a situation that when the organization encounters difficult decisions on the investment for the short or long term, it has resources available for long term investment, which discontinuities often are.

Within the case studies very different interpretations on the operationalization of the search strategies have been found. The difference lies within the interpretation of the strategies and small adaptations to the context and specific characteristics of the organization. What almost all organizations had in common is that they used the strategies that were formulated, with exception of one. This specific organization uses an Innovation Studio next to the search strategies, in which employees have the opportunity to spend three months on research on 2 or 3 specific topics. This form of searching for discontinuous innovations was a unique practice which has not been seen within any other case. It creates major benefits for the organization, it makes it possible to investigate certain topics and innovations that would normally be left out due to a lack of available time and connectedness of the topic with the organization. Because the Innovation Studio was found in one organization only, it is not said that it is applicable on the specific situation of that organization. Actually, it creates opportunities for other organizations as well, as long as the resources, both financial and non-financial, are available it can create major benefits for almost any organization.

7.2 Limitations

There are several limitations with respect to this research. This is not something unusual, all research studies are likely to have limitations. In this section the main limitations and the influence on accuracy, reliability and validity will be discussed.

The first limitation lies in the selection of cases. In the categorization a distinction was made between High-Tech, Medium to High-Tech and Low-Tech manufacturers on one side and Knowledge-Intensive and Less Knowledge-Intensive service organizations on the other side. Due to a lack of participation no organization from the Low-Tech manufacturers was found willing to attend in the case studies. This represents a limitation for the research, because the choices for the use of search strategies by these organizations have not been investigated. This limits the cross case analysis, because it is imaginable that these types of organizations have different motives for their choices.

A second limitation is the use of the interviews. First, it is questionable to what extent the results from the field research are reliable because interviews are only held with top or senior management of the organizations that are involved in the case studies. This means that there is only one level of analysis, not a multi-level analysis on the different layers of the strategies (for example strategy making and strategy execution). Second, because this research has been a qualitative research the interviewer is ought to be neutral and objective in order to prevent a respondent or interviewer bias of occurring. During the reflection it has become clear that the level of neutrality and objectivity has not been equal in all cases. This has the consequence that the results have not been completely reliable, but large differences have not been recognized in the perceptions of core elements. However, more research seems to be necessary as will be discussed in the next session.

During the case studies the different perceptions of core elements of the first questionnaire became clear. Especially the perception of the description of the search strategies has not always been in line

with what the research expected it to be. The questionnaire originated from the DILab and in order to be able to create a high degree of comparability the same questionnaire has been used. With the insights that were gathered in the case studies one should consider whether this has been the right choice and question if a sharpened description of each strategy would have been more appropriate, which can be seen as a limitation of this research.

This research has been based on the work of von Stamm and Bessant (2007), in which they discussed the existence of 12 search strategies for discontinuous innovations. One needs to question whether these strategies are really strategies. The use of another concept might be more appropriate, perhaps the concept of mechanisms as is used by Gertser et al. (2007) is a better 'label' for the strategies. The problem with the use of strategies is, as came forward in the case studies, some organizations find it difficult to discuss the existence of so many strategies for a small part of the whole innovation process. If it would have been labeled otherwise, perhaps mechanisms or maybe approaches, this discussion would have been avoided and the perception would have been even better, especially within the first questionnaire.

7.3 Suggestions for further research

This research has used a qualitative approach in order to provide insight on the organization of search strategies for discontinuous innovations within organizations, because a good developed theory on this topic is not present. This research has provided insights on the use of search strategies for discontinuous innovations by organizations with use of both a questionnaire and case studies.

To be able to extent the possibilities of generalization of the use of search strategies a quantitative research is desirable. The questionnaire which has been used in this research had the purpose to identify which strategies are used by organizations that participated in the DILab Benelux, and what the success of these strategies is. Different assumptions have been made on the use of the strategies, but these assumptions cannot be generalized due to a lack of external validity. If a quantitative research would be done with a much bigger sample, based on a design which is similar to the questionnaire as used in step 3 of this research, the external validity would be much higher and the possibility to generalize would be present. This way one could argue what search strategies are used in general, and whether some strategies are applicable in particular sectors (e.g. Corporate Venture Units in High-Tech manufacturers) or a relation between two or more strategies is present (e.g. Deep Dive and Active Users).

The second suggestion for further research that can be made is based on the necessity for an unambiguous understanding of what is and what is not gathered in the topic of discontinuous innovation. This should lead to a clear understanding of different streams within literature on discontinuous innovation, and if possible should have the outcome of a uniform definition of discontinuous innovation. This should take the research done on the topic in general and the progression made by the DILab in particular to the next level. Also, the next phases in the innovation model should be investigated in order to provide insights on how organizations should select and implement discontinuous innovations.

Another suggestion for further research considers an international comparison between the results of this research and other research. This can include a comparison between research that is already done in

foreign countries with these results as well as a research on how these results should be taken forward outside the Benelux.

The final suggestion for further research is based on the current economic crisis. One could argue that the cause of the crisis lies in the short term focus of many organizations which are listed at the stock exchange. These organizations suffer from the absence of a balance between short and long term strategic goals, which is in line with the discussion on the distinction between continuous and discontinuous innovations. The society is changing rapidly, and possibly a new era is going to begin which could shake up the current way of thinking about doing business. This can have many consequences for each organization, for which research should be done in order to keep on existing in the near and far future.

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Appendix A – Overview of used databases and keywords

The databases that have been used in this research are:

- ✗ ISI Web of Knowledge (selection on Social Sciences Citation Index (SSCI))
- ✗ Scopus (selection on Social Sciences)
- ✗ Jstor
- ✗ GoogleScholar

The key-words that have been used on the topic in general are:

- ✗ Discontinuous innovation
- ✗ Dealing with discontinuity
- ✗ Radical innovation
- ✗ Disruptive innovation
- ✗ Innovation management
- ✗ Organizing innovation

The key-words that have been used for the search strategies are summarized in Table 28.

Overview of used key-words per strategy			
Active Users	Active users	Lead users	New product development
Idea Hunter	Idea Hunter New innovation triggers	Search for new ideas	Scout
Using The Web	Web Intranet	Internet	Online communities
Deep Dive	Customer behavior	Deep dive	Actual need
Brokers	Brokers		
Futures	Futures Scenario learning	Scenarios	Scenario planning
Intrapreneurs	Intrapreneuring	Intrapreneurs	Intrapreneurship
Deliberate Diversity	Deliberate diversity	Diverse teams	Multitask teams
Corporate Venture Units	Corporate Venture Units	Corporate Venturing	
Mobilize Mainstream	Mobilize mainstream	Mainstream actors	Market push and market pull
Probe and Learn	Probe and Learn Concept testing	Prototyping	Prototype
Idea generators	Idea generators	Creativity tools	

Table 28: Overview of key-words per strategy

Appendix B – Categorization of organizations

Classification	Description of industries
High technology manufacturing	Manufacture of office machinery and computers (30) Manufacture of radio, television and communication equipment and apparatus (32) Manufacture of medical, precision and optical instruments, watches and clocks (33)
Medium to high technology manufacturing	Manufacture of chemicals and chemical products (24) Manufacture of machinery and equipment n.e.c. (29) Manufacture of electrical machinery and apparatus n.e.c. (31) Manufacture of transport and equipment (34 and 35)
Low technology manufacturing	Manufacture of food products, beverages, and tobacco; textiles and textile products; leather and leather products; wood and wood products; pulp, paper and paper products; publishing and printing (15 to 22) Manufacture of coke, refined petroleum products and nuclear fuel (23) Manufacture of rubber and plastic products; basic metals and fabricated metal products; other non-metallic products (25 to 28) Manufacturing n.e.c. (36 to 37)

Table 29: Classification of manufacturing industries (source: Eurostat)

Classification	Description of markets
Knowledge-intensive services	Water transport (61) Air transport (62) Post and telecommunications (64) Financial intermediation (65 to 67) Real estate, renting and business activities (70 to 74) Education (80) Health and social work (85) Recreational, cultural and sporting activities (92)
Less knowledge-intensive services	Motor trade (50 to 52) Hotels and restaurants (55) Land transport; transport via pipelines (60) Supporting and auxiliary transport activities; activities of travel agencies (63) Public administration and defence; compulsory social security (75) Sewage and refuse disposal, sanitation and similar activities (90) Activities of membership organization n.e.c. (91) Other service activities (93) Activities of households as employers of domestic staff (95) Extra-territorial organizations and bodies (99)

Table 30: Classification of service organizations (source: Eurostat)

Appendix C – Questionnaire search strategies DI Lab Benelux

Survey by the DI Lab Benelux, coordinated by Ir. Rick Middel; please send all responses to:

h.g.a.middel@utwente.nl

Your name:

Your position:

Your organization:

All data will be treated confidentially

Introduction

In a fast moving world, one of the biggest challenges facing organizations is dealing with discontinuous innovation. Most organizations understand that innovation is an organizational imperative. They learn to listen to customers and constantly evolve their existing products and services, continuously improve their processes, so that they are not left behind by competitors.

The ability to deal with this continuous type of innovation - the constant storms of change within an industry - is essential. Every so often, however, a whirlwind blows through an industry - a technology, or a product, so radically different that it changes the shape of an industry completely and in doing so puts many existing, successful companies out of business.

Being ready for discontinuous innovation requires a specific set of organizational skills, not least the ability to search for signs of the potential whirlwind that may sweep through an industry, or, as with the internet, across entire business sectors right around the world.

The Wheel of Search Strategies

In our research we have come across 12 search strategies, some of which are overlapping but were still sufficiently different to warrant separate mentioning. Below the wheel you will find a brief summary of each of the 12 strategies.

It is important to acknowledge that it is not a question of 'either or' but very much about:

Which are most relevant and appropriate to your context, and

With the limited resources available, which mix of strategies will offer the most extensive cover and insights.



What we would like to know is not only whether these strategies are used in your organization, but also whether you feel that they are being used well, i.e. whether your organization's innovation performance benefits from them. In addition we are asking whether you think the way a particular strategy is used in your organization and how this is operationalized within your organization might serve as a case study from which others might be able to learn; in that case please provide us with a contact e-mail for follow-up:

Many thanks.

Search Strategy				
Idea hunter Someone who is proactively looking outside their organization for interesting and/or potentially threatening developments.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Futures Develop ways of looking at the world which do not necessarily follow the current trajectory. Can be trend extrapolation or 'standard' forecasting techniques but can also be more advanced scenario-based approaches.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Using the web Use the power of the web to access and explore different developments – connecting to multiple sources of information and operating various forms of web-enabled marketplace.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Active users Seek out and work with those users who actively want to change and improve existing offerings.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Deep dive Term coined by design and innovation consultancy IDEO (www.ideo.com) to really understand how users operate, what they want and need, building heavily on an ethnographic approach.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Probe and learn Deliberately think up alternative hypotheses and then explore them – for example, look for opportunities in the segments of the market you are not active or strong in. Look for the opportunities at the 'low and' low price/good enough product/service offerings.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Mobilize mainstream Refocus the core tasks of groups like procurement, sales or finance staff to pick up peripheral information about trends in the wider world.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Corporate venture units A fund set up by a company to be invested in internal or external ventures.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree

	agree			disagree
Intrapreneurs Various ways of mobilizing high involvement innovation across the organization around not only continuous improvement but radically new ideas. Very simply put, intrapreneurship is Entrepreneurship practiced by people within established organizations.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Brokers Brokers are people who are making connections, internal as well as external.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Deliberate diversity Bringing-in and nurturing people with a mindset that is different from the organization's cultural norm.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree
Idea generators The use of third party agencies to do the scanning and searching for you.	Used		Not used	
This strategy works really well for us.	Totally agree			Totally disagree

What are the barriers that discontinuous innovation is experiencing in your organization?

Barrier	Not at all		Significant	
Lack of transfer within the organization				
Lack of buy-in				
Lack of connectedness inside the organization				
Lack of incentive to participate				
Information is available but there is no impetus for acting on it				

If there are any general comments or questions, please enclose them in the box below.

Appendix D – Questionnaire search strategies 2 – case studies

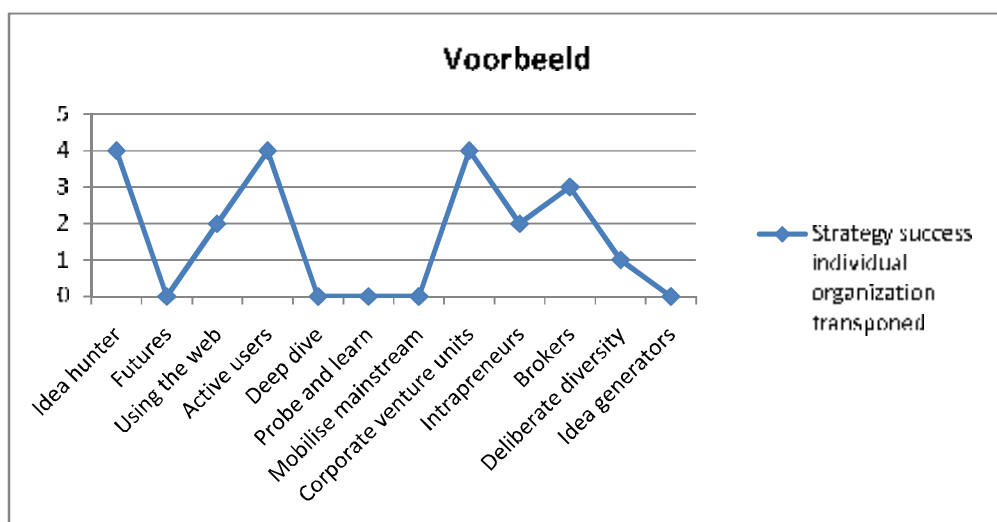
Organisatie:
Contactpersoon:
Functie:

Inleiding

De hedendaagse maatschappij is continue in beweging. Verwachtingspatronen van consumenten veranderen, grondstoffen worden vervangen door geavanceerdere varianten, nieuwe technologieën treden toe tot de markt, te veel om op te noemen. Daarom is het noodzaak om inzicht te verkrijgen in hoe organisaties omgaan met deze veranderingen, hetgeen ondermeer heeft geleid tot deze vragenlijst.

1. Wat is het belang van Discontinue Innovatie voor uw organisatie?
2. Wat is uw rol als het gaat om Discontinue Innovatie?
3. Kunt u een voorbeeld geven van een Discontinue Innovatie binnen uw organisatie?

U heeft reeds medewerking verleend aan de eerste questionnaire vanuit het DILab Benelux, waarvan de bevindingen hieronder kort zijn samengevat.



In de figuur staat 0 voor geen gebruik. Voor de strategieën die wel zijn gebruikt geldt hoe hoger de score, hoe succesvoller de strategie binnen uw organisatie (Question: Does this strategy work for your organization? Answer: Totally agree = 5) met als maximumscore 5. U geeft aan een aantal strategieën te gebruiken binnen uw organisatie. Hierover volgen een aantal vragen.

4. Hoe passen deze strategieën binnen het innovatiebeleid van uw organisatie? En hoe belangrijk zijn deze strategieën voor uw organisatie?
5. Is het gebruik van de strategieën een bewuste keuze, of is dit een vorm van herkenning raderhand?
6. Heeft u een verklaring voor het verschil in succes tussen de afzonderlijke strategieën?
7. U geeft aan een aantal strategieën niet te gebruiken, is hier een verklaring voor?
8. Worden de strategieën separaat gebruikt, of zijn deze op een bepaalde manier met elkaar verbonden?

De resultaten van het eerste deel van het onderzoek (de questionnaire) hebben geleid tot een aantal bevindingen. Een hiervan is dat een tweetal strategieën door de meeste organisaties worden gebruikt en ook als succesvol worden beschouwd. Gezien de doelstelling van het onderzoek – een antwoord vinden op de vraag hoe bedrijven kunnen omgaan met organiseren van de zoekstrategieën – zal daarom dieper worden ingegaan op deze twee strategieën om inzicht te krijgen in de werking van deze strategieën. Het betreft de strategieën Idea Hunters en Active Users. Over deze strategieën zullen een aantal specifieke vragen gesteld worden.

DILab's definitie

Idea hunter

Someone who is proactively looking outside their organization for interesting and/or potentially threatening developments.

9. Wat is het doel van elke strategie?
10. Hoeveel mensen/middelen/tijd is beschikbaar voor elke strategie?
11. Hoe zijn de afzonderlijke strategieën binnen uw organisatie georganiseerd?
12. Welke communicatiemiddelen worden gebruikt om de strategieën te ondersteunen en waar wordt de verkregen informatie opgeslagen en beschikbaar gemaakt?
13. Waarom zijn juist deze strategieën succesvol binnen uw organisatie?
14. In hoeverre geniet(en) de Idea Hunter(s) vrijheid in hun zoektaken?
15. Kunt u een omschrijving geven van de Active Users?

DILab's definitie

Active users

Seek out and work with those users who actively want to change and improve existing offerings.

Een tweede conclusie over het eerste deel van het onderzoek is het niet functioneren van een aantal strategieën. Dit betreft voornamelijk de strategieën Intrapreneurs en Idea Hunters. Hierover zullen een aantal vragen worden gesteld, met als slot een tweetal afsluitende vragen.

16. Heeft u een verklaring voor het 'falen' van deze strategieën?
17. Wat is er nodig om deze strategieën wel succesvol te laten zijn?
18. Zijn er nog strategieën die niet besproken zijn, maar volgens u wel in uw organisatie worden gehanteerd?
19. Heeft u zelf nog vragen / opmerkingen?

Appendix E – Company profiles

Left out do to confidentiality

Appendix F – Case study reports

Left out do to confidentiality