Abstract: Today’s business environment is characterized by the fact that it is changing in a rapidly pace. Firms that want to keep up with competitors have to renew their way of doing business. This can be enabled by either new product introductions or new business models. Radical innovations are defined as those who have a huge impact not only on the firm itself but also on the environment in which it operates; the business ecosystem. This thesis examines the effect of dynamic capabilities on radical innovation.

Keywords: dynamic capabilities, radical innovation, firm competences, path dependency
“Innovation distinguishes between a leader and a follower.”

Steve Jobs – Co-founder Apple Inc.
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Chapter 1

Introduction

Nowadays having the ability to dispose of a wheel is taken for granted. Before it was invented in the fifth century BC in the ancient Mesopotamia they did not know this invention would travel all over the world to make life easier. The example of the invention of the wheel is extreme and could be seen as an innovation. In last decades there have also been radical innovations that made life less complicated. The personal computer, in short PC, is another example of a radical innovation. Bill Gates made it possible for every household to work with a computer and was able to do this because he found a market for it. Just like Bill Gates companies are trying to innovate and trying to make money with their business model.

Many people link a product to the term innovation like the IPod from Apple which is immensely popular among young people. This is because companies use product innovation as a lead activity to renew (Dougherty, 1992). Another example, but with a different link, is the digital camera that replaced the analog camera which could not record sound, film and make photographs digitally. Canon Inc., founded in 1937, today has a worldwide strong market position because it is able to use their new developed technologies to do business. The management of Canon Inc. recognized the need of switching from the analog camera industry to the relative new digital one. This is also a kind of innovation. Like Canon Inc., companies that want to make their business grow, need to search for new opportunities in markets and products. They have to innovate.

With the aid of four research questions this thesis is examining a problem statement. A problem statement that eventually explains how, for example, Canon Inc. can do business like they do and most of all what does it takes to reach certain innovation goals. The innovation discussed in this thesis concerns radical innovation and is chosen because the area of innovation is too comprehensive. The problem statement of this thesis is:

*How is radical innovation influenced by dynamic capabilities?*

First the two variables are defined and addressed in the first and the second research question. This is necessary to state clearly what is mentioned with radical innovation and dynamic capabilities.

- Research question 1: What makes an innovation radical?
For a company to be able to innovate it has to possess some qualities. These competences or capabilities can be used by management to innovate. According to Danneels (2002) companies can use competences that a firm already has or competences they have yet to acquire. In his study he makes a difference between customer competence, technological competence, exploitation, exploration, de-/re-linking, path dependency, marketing competence and R&D competence. These dynamic capabilities were examined at five firms to see how they contribute to the renewal of the firms. The dynamic capabilities indeed contribute to a firm’s renewal over time. The following research question is composed:

- **Research question 2:** Which dynamic capabilities does a company need to be able to innovate?

In order to survive, a firm has to compete with other firms. In order to gain a competitive advantage, grow and develop it has to search for new markets and opportunities; drilling for new sources. Also in this area dynamic capabilities exist. Ellonen et al. (2009) mention market capabilities which they define as a combination of the market-related resources, processes and knowledge needed to serve current but also future markets. Teece (2007) mentions global competition and classifies dynamic capabilities in three groups. Those which can sense and shape opportunities and threats, those how seize opportunities and those how maintain the competitiveness reached. Good examples of companies who found a new market and were labeled innovators are Cirque du Soleil, Canon Inc. and fashion label Ralph Lauren. They used The Blue Ocean Strategy developed by Kim and Mauborgne (2005) and which describes how firms can create uncontested market place to make competition irrelevant. Instead of doing business in the traditional “red” ocean, which is marked by its bloody competition, the “blue” ocean can generate new possibilities in markets that did not exist before.

Two research questions are added to this thesis to enrich the research:

- **Research question 3:** Which factors affect a strategy to either innovate radically inside or outside an existing industry?
- **Research question 4:** What is the relationship between path dependency of dynamic capabilities with radical innovation?
The academic relevance of this thesis is the amplification of the subject dynamic capabilities. Throughout the years this topic has been researched a lot but yet not so much in combination with radical innovation. This thesis is the search to find the degree in which dynamic capabilities of a firm can influence radical innovation. This enriches the topic on both radical innovation and dynamic capabilities.

The managerial relevance of this thesis concerns the simple fact that radical innovation faces a lot of challenges (Leifer et al., 2000). Some of these challenges are listed in Appendix B. Not only are there challenges to overcome but there also exist opportunities. When these opportunities are seen and used properly, the firm that innovates can create a big advantage as to their competitors. Insight in this topic, combined with dynamic capabilities, allows managers to make solid and clear argued decisions.

In chapter 2 the dependent and the independent variable of the problem statement are theoretically discussed. This is done in research question 1 and 2. In Appendix A, a conceptual framework of the thesis can be found. Furthermore, Chapter 2 contains theory of different studies concerning the four research questions which are the core elements in order to answer the problem statement. After each research question a small conclusion is formulated to structure the thesis. Chapter 3 describes the process of the research. Usually this methodology chapter concerns an explanation of empirical data that is researched but because this thesis is only a literature research this chapter is slightly different. Chapter 4 presents the results and gives answers to the research questions. Chapter 5 is the final chapter in which a conclusion is drawn, a discussion started and recommendations for further research are given.
Chapter 2  
Theory

In this section the four research questions, which ultimately help to answer the problem statement, are addressed. Chapter 2 is divided in six paragraphs to make a clear difference between the research questions. First the dependent and the independent variable are shortly addressed.

Before starting to define the two variables, an important aspect is the environment in which a company is operating. In this thesis it is assumed that the environment is very volatile, the level of competition is high and changes are following each other in a rapid pace. An important principle in the area of strategic management is that performance is heavily influenced by the relationship of environmental conditions and the capabilities and resources of an organization (Bourgeois, 1985). The argument to exclude all other environmental conditions is because of the limited time frame. The time frame is also the reason why environmental factors are not included as a variable in this thesis but an assumption is needed.

§ 2.1  
The independent variable

The starting point of the conceptual framework is the independent variable which is dynamic capabilities. The variable exists of two terms, namely dynamic and capabilities. The dynamic part is related to the environment and an assumption concerning this factor is previously made. Bourgeois (1985) mentions that the environment determines the organization and that, subsequently, the organization determines effectiveness. This being said, the focus is rather on the capability part of the variable. Ethiraj et al. (2005) start defining capabilities by first mentioning Penrose (1959:25): “… resources consist of a bundle of potential services”. The difference between firms is then the ‘capability’ to use the resources available. The differences between resources and capabilities is also made by Amit and Schoemaker (1993) and Grant (1991) (as cited in Ethiraj et al., 2005) which state that capabilities concern the ability to deploy resources and examples of resources are know-how or physical assets.
§ 2.2  The dependent variable

The dependent variable of this thesis is radical innovation. In the Introduction Chapter the example of the iPod as a radical innovation is given but a clear and solid definition is necessary before the research questions are addressed. To make a clear understanding radical innovation is compared with incremental innovation. Benner and Tushman (2003) describe incremental innovation and radical innovation after Dosi (1982), Green, Gavin, & Smith (1995); incremental innovation requires small technological changes that originate from capabilities that a firm currently has.

On the other hand there is radical innovation which changes the technological path on a fundamental way while also the competences of the firm associated with the change. An example of an incremental innovation is the possibility to expand the memory capacity of your computer by installing additional memory slots. An example of a radical innovation in the same area could be a totally new kind of memory slot that has a bigger range.

§ 2.3  What makes an innovation radical?

The Oxford Dictionary defines innovation as follows: “the introduction of new things, ideas or ways of doing something”. Radical is then defined as: “new, different and likely to have a great effect”. So in conformity with the dictionary a radical innovation is a new idea or doing something new that is different and likely has a great effect. Leifer et al. (2000) lists three things that a radical innovation could produce, namely; an entirely new set of performance features; improvements in known performance features of five times or greater; or a significant (≥ 30%) reduction in cost. It is possible that the innovation creates an entirely new market.

To exclude confusion a clear distinction must also be made between innovation and invention. Often an invention is seen the same as a radical innovation. The difference between the two is that an innovation is the attempt to make money on an invention. An invention is the discovery of new knowledge (Freeman & Soete, 1997). Laursen and Salter (2006) mention in their study Marsili and Salter (2005) which state that performance of a firm is greatly affected due to radical innovations. So when a firm wants to change its performance radically, a radical innovation offers the opportunity for it.
Furthermore, Laursen and Salter (2006:136) state the following: “to achieve radical innovation, firms often need to make a considerable investment in R&D and the chances of success are lower as the rewards are great”. Concerning incremental innovation they mention: “… more common and the reward is smaller” (Laursen and Salter, 2006:136).

Again, the distinction between incremental and radical innovation is made to highlight the difference and to gain more understanding concerning radical innovations. The difference between a radical and an incremental innovation is that incremental innovation deals with adding modifications to existing products (Ali, 1994). In the research of Iyer et al. (2006) they mention a study from Christensen (1997), Christensen & Bower (1996), Christensen & Overdorf (2000) and Leifer et al. (2000) and state that companies examine radical innovation more intensively because they disrupt the market on a big scale and established firms in the market are less capable of coming up with radical innovations.

The distinction between radical innovation and incremental innovation originated when March (1991) mentions exploitation and exploration. Exploitation concerns expand the usage range of products that already exist or processes present. Exploration is the act to find something entirely new and it does not matter if it is a product, processes or both. Leifer et al. (2000) see incremental innovation as an improvement to a certain feature and is related to the exploitation competence March (1991) mentions. On the other hand, a radical innovation encompasses “new business” caused by new knowledge or technologies. A radical innovation is dependable of exploration competencies according to Leifer et al. (2000). The two competencies of March (1991) are also addressed in paragraph 2.4 as Danneels (2002) also uses it in his study.

Because an innovation is something entirely new and likely has a great effect on the firm, the level of uncertainty is very high and plays an important role when a firm plans to innovate. A firm without some knowledge about the new market ensures that the firm cannot make any expectancy. In addition to the fact that the outcomes are not certain, a situation bears less risk when a decision maker has some influence (Sitkin & Pablo, 1992). The firm has to do business in an area where no firm has operated before. In Appendix B a list of challenges in managing radical innovation is present coming from Leifer et al. (2000). The challenge resolving uncertainty in the business model shows the accompanying competencies required. The key lesson is that a firm should create a complete picture of the possibilities and be aware of the importance of learning. The assumption to consider is that the firm already made the decision to introduce a radical innovation.
Collis (1992:125) says the following about the uncertainty topic: “the global political and economic environment will continue to surprise us with its increasing volatility and deepening intrusion into the business world”. A harvesting strategy could be a suitable way to cope with uncertainty. This means that a part of the innovation can be brought to the market to see what the impact is. It is a radical innovation but applied incremental O’Connor et al. (2008). Leifer et al. (2000:3) state the following: “attempts at radical innovation produce more failures than successes, and the magnitude and timing of results are highly unpredictable”, so there is also a risk factor involved. Managers often stick to the things that are known in the firm or else completely buy the knowledge necessary instead of developing it (Leifer et al., 2000). O’Connor and Ayers (2005) define radical innovation as one that has a strong impact on markets and the firms. These impact levels come with high risk and high uncertainty and are important variables in rapidly changing environments. In this definition both risk, uncertainty and the pace in which the environment is changing are present.

**INTERIM CONCLUSION**

The question to answer is; what makes an innovation radical?

A radical innovation could produce; an entirely new set of performance features; improvements in known performance features of five times or greater; or a significant (≥ 30%) reduction in cost.

The difference between an invention and an innovation is that an innovation concerns the attempt to make money on an invention. An invention is the discovery of new knowledge (Freeman & Soete, 1997).

The contrast incremental innovation versus radical innovation is made to better understand radical innovation. Incremental innovation is an improvement to a certain feature. On the other hand, a radical innovation encompasses “new business” caused by new knowledge or technologies. A radical innovation is furthermore dependable on exploration competencies.

Radical innovation also has a strong impact on markets and firms. These impact levels come with high risk and high uncertainty and are important variables in rapidly changing environments.
§ 2.4 **Which dynamic capabilities does a company need to be able to innovate?**

Now that there is some background in paragraph 2.3 on radical innovation the next research question can be discussed. This paragraph concerns the independent variable; dynamic capabilities. The Oxford Dictionary defines the noun capability as “the power or ability to do something”. In the context of this research the term capabilities refers to the power or ability of a firm to act in the industry.

The dynamic part of the variable is related to environmental characteristics which were already mentioned in the introduction of this chapter. Leifer et al. (2000:1) state the following: “the failure to develop and introduce breakthrough innovations puts established firms at risk of being knocked out of the game by the entrepreneurial newcomers”. It is important to develop some capabilities that enable the firm to diminish the probability of the situation mentioned in the quote to occur.

Capabilities concern core capabilities to keep the subject attainable. “Capabilities are considered core if they differentiate a company strategically” (Leonard-Barton, 1992:111). There are many categories concerning capabilities but for now only capabilities are accounted for that affect radical innovation. For example R&D policy, development of competences and choices of the firm on innovation where to innovate. From this point on it is assumed that the management of a company already made the choice to innovate radically. Thompson (1967) addresses the importance of capabilities by stating that they must be able to adapt to the conditions of the market or industry. He states that it is crucial to effective management. In the study of Ethiraj et al. (2005) the study of Nelson and Winter (1982) is mentioned and they state that bundles of knowledge form a firm. The knowledge is gained to the process of “doing by learning” and throughout the years this knowledge accumulates. The next step is to develop routines and develop capabilities; fine-tuning them. Helfat et al. (2007:4) agrees with this by defining dynamic capabilities: “the capacity of an organization to purposefully create, extend, and modify its resources base”.

“Several studies have noted that the ability to innovate is idiosyncratic, even among firms operating under exactly the same environmental conditions” (Ellonen et al., 2009:753). A company has to possess some capabilities to be able to innovate on a radical way and so create new sources of income. Danneels (2002) studies the impact of product innovation on a firm’s renewal and competences. This relationship is a bit comparable with the research question of this thesis except this thesis uses radical innovation.
Danneels (2002) state, that innovation is possible because different competences are developed or mixed. The development of these competences or capabilities does not happen at once. Paragraph 2.6 will discuss the development path competences pass through. Danneels (2002) use different competences in his study which concerned five high-tech firms. These are customer competence, technological competence, exploitation, exploration, de-/re-linking, path dependency, marketing competence and R&D competence. Below the most important competences for this research are addressed. Customer competence and technological competence are the most basic ones.

When, for example, a firm is bringing a new product to the market it has to know the wishes of the customers, how to get the products to them and by which manner they use communication channels. Technological competences concern the design and manufacturing processes. These competences also concern know-how that is necessary for engineering and manufacturing. The two basic competences, technological and customer, have to be well linked in order to create a radical innovation.

Danneels (2002) cites Dougherty (1992) with respect to the linking of technological and customer competences: ‘... a product constitutes the integration of markets and technologies, and cannot be understood as one or the other separately’ (Dougherty, 1992:78). Henderson and Cockburn (1994) describe this capability as the integrative capability. The exploitation and exploration competences come from March (1991) which were explained in paragraph 2.3. The main argument of the study is that when a firm is more exploitative than explorative this causes bad business in the future. The idea behind this is that when a company only extracts resources from the market and does not look for other alternatives, these resources will eventually be used up. New competences should be searched for in order to keep a company viable. This is especially important in environments that rapidly change.

In combination with the technological and customer competence Danneels (2002) makes the following diagram:

New competences for both the customer-area and the technological-area have to be developed.

*Diagram 1: exploitation and exploration strategies (source: Danneels, 2002)*
When a firm follows this strategy it has to cope with many uncertainties but the customer base already accomplished by the firm serves as a driving factor to innovate. The development of the technological competence is mainly a job done by the R&D department.

This is agreed by Leifer et al. (2000:3) which state: “Central R&D labs, traditionally the source of radical innovation ideas, ...”. The development of the customer competence requires a proactive approach in building new relationships throughout a firm.

A firm should keep in mind the seven challenges computed by Leifer et al. (2000). The list of these challenges and the capability that can cope with it is present in Appendix B. Managing radical innovation projects is the challenge related to this research question. Also Bridging resource and competency gaps can apply to this paragraph.

O’Connor and Ayers (2005) come across an emerging model for doing research and developing new ideas; the mirrored model which can be found in Appendix C. The R&D department generates ideas and prepares them for introduction in the market. Besides the activities in the R&D department the business units, which will have to work out the ideas and, in the future, nurture them, have their own complementary capabilities to innovate. This way the projects or ideas made by the central R&D department are accelerated. The knowledge within the separate business units concerning partners, value chain and business infrastructure is richer than of the central R&D department. The research of O’Connor and Ayers (2005) can be combined with the seven challenges of Leifer et al. (2000). The capturing radical ideas in the “fuzzy” front end-challenge requires generation of good ideas, recognition of opportunities and development together with implementation of an effective approach to initial evaluation.
INTERIM CONCLUSION

The question to answer is; which dynamic capabilities does a company need to be able to innovate?

Dynamic capabilities can be defined by: “the capacity of an organization to purposefully create, extend, and modify its resources base”. Capabilities must be able to adapt to the conditions of the market or industry which is crucial to effective management.

Innovation is possible because different competences are developed or mixed. The two basic competences; customer competences are necessary to commercialize the innovation and technological competence concerns the design and manufacturing processes. The two competences have to be well linked in order to create a radical innovation; an integrative capability.

§ 2.5 WHICH FACTORS AFFECT A STRATEGY TO EITHER INNOVATE RADICALLY INSIDE OR OUTSIDE AN EXISTING INDUSTRY?

This research question is designed to elaborate on the radical innovation part with a direct relation to dynamic capabilities. The assumption has previously been made that a firm already made the decision to innovate radically but their capabilities can, besides the ability to innovate or not, also affect the possibility to place the innovation in another industry. Already mentioned shortly in the Introduction chapter Teece (2007) mentions three capacities at enterprise level that are important basics for the micro foundations of dynamic capabilities. Sensing, seizing and reconfiguring are capacities needed to create sustainable advantages over competitors. In this paragraph the sensing and seizing capacities are addressed because these are critical to the choice to innovate inside or outside an existing industry. The reconfiguring capacity is addressed in paragraph 2.6 because it is involved in the development path of dynamic capabilities. First some other studies are mentioned to gain insight in the topic. The assumption within this paragraph is that the industry can be found inside the borders of a country where the firm is already active. No cross border activities are present. Besides that the firm already has the innovation.
Bourgeois (1985:554) state (after Dill, 1958 and Duncan, 1972): “a firm’s task environment includes five external components: customers, competitors, suppliers, regulatory groups, and technological requirements of an industry’. The strategy that a firm compiles regarding where to innovate has to consider these components in order to reduce the level of uncertainty, which already is present due to the radical innovation. In Appendix B the Learning about markets for radical innovations-challenge could be connected to this perspective.

Kim and Mauborgne have written the book *Blue Ocean Strategy* in 2005 and concerns searching sources, not in existing industries but in those areas where no company is fighting for space (Kim and Mauborgne, 2005). The book is a summary of fifteen years of research which studied around 150 strategic moves in 30 industries. A good example of such a strategic move is Cirque du Soleil. This company eliminated the animal-factor out their circus concept. Instead of the animals Cirque du Soleil used ballet and opera to create a completely new show and therefore a unique market space.

Kim and Mauborgne (2005) use the terms *blue ocean* and *red ocean*. The blue ocean refers to an undiscovered market space where there is no competition. In this area of the market huge growth opportunities exist, and when using the right strategy to exploit this opportunity, the profits will be high. In contrast, the red ocean is the market space known today in which competition are in a heavy competition.

Every company in this industry is trying to hold, and preferably expand, their market share. Like Kim and Mauborgne (2005), Laursen and Salter (2006) state that there is more potential to a firm outside the industry. Laursen and Salter (2006) state the following: “those organizations that invest in broader and deeper search may have a greater ability to adapt to change and therefore to innovate” (Laursen and Salter, 2006: 134). The ability to change is thus very important. One way to do this is by way of a good R&D department. The R&D department deals with discovering new knowledge and then uses this knowledge to create new products, processes and/or services. While doing this the R&D department has to keep in mind the wishes in the market but also the resources of the firm. If the resources of a company are not sufficient to bear a new knowledge, the company should first build these in advance of bringing the new knowledge to the industry. It is generally know that a lot of money is invested in R&D to keep a company viable and in order to compete with others in the industry.
First, the sensing capacity is addressed. Teece (2007) stresses two ways of opportunity detection by firms. The first comes from Kirzner (1973) which state that information is only limited available. Companies have deviating access to information and thus some companies have an advantage. The second way to detect opportunities comes from Schumpeter (1934) which state that opportunities can come from new knowledge or information. This information is not only present within a company but also in the business ecosystem which is the total of organizations, individuals and institutions that have an influence on the company and actors directly involved (Teece, 2007). The actors in this system, for example suppliers and customers, need to understand each other.

Both actors mentioned could be drivers for innovation (Teece, 2007). Teece (2007) processed elements of the ecosystem in a model which is shown in figure 1. Searching for opportunities is not easy to achieve; “overcoming a narrow search horizon is extremely difficult and costly for management teams tied to established problem-solving competences” (Teece, 2007: 4).

Secondly, seizing is also an important capacity according to Teece (2007). After the sensing part is done, action is required to begin to commercialize the new concept. “Addressing opportunities involves maintaining and improving technological competences and complementary assets and then, when the opportunity is ripe, investing heavily in the particular technologies and designs likely to achieve marketplace acceptance” (Teece, 2007:8). For a company to be able to do the seizing part it is not only important to know when, where and how many resources should be invested, but also to develop a business model that acts as a backbone throughout the process. This structural tool can be conflicting because an innovation process is mostly accompanied by uncertainty and with radical innovation, where every aspect is new, the lack of structure is greater.

The proof is given by the following quote: “… incumbent enterprises tend to eschew radical competency-destroying innovation in favor of more incremental competency-enhancing improvement” (Teece, 2007:9).
The present actors are called incumbent firms, or shortly incumbents, which operate to gain the most profit from knowledge already known to them (Hill and Rothaermel, 2003). Hill and Rothaermel (2003) state, that incumbents do not seek innovations that have a great disruptive effect. This will cause an imbalance in the market and may go at the expense of market share or market power (after Henderson, 1993 and Reinganum, 1983). On the contrary, for new entrants it is crucial to avoid entry barriers and immediate competition because no market power has been established yet. The incentive to introduce something new is bigger for new entrants especially when it concerns an outside industry. The seizing part also includes making the decision and sometimes requires special skills because of environmental characteristics.

Managers should consider the future competition forces and future demand inside or outside an industry: “entry into a market by an enterprise with a new and superior technology will cause rapid depreciation of the economic value of an incumbent’s plant and equipment” (Teece, 2007:16).

Just like the sensing part the seizing apart is also been graphically shaped. In figure 2 the model is shown and besides the business model three other forces are present that can be seen as dynamic capabilities.

Figure 2: strategic decision skills/execution
(Source: Teece, 2007)
INTERIM CONCLUSION

The question to answer is; which factors affect a strategy to either innovate radically inside or outside an existing industry?

It is important to consider more factors than only competitors, namely: “a firm’s task environment includes five external components: customers, competitors, suppliers, regulatory groups, and technological requirements of an industry”. A firm has to consider the entire business ecosystem in which it operates.

“... Organizations that invest in broader and deeper search may have a greater ability to adapt to change and therefore to innovate”. This can be the reason to develop a good sensing capacity. The Blue Ocean Strategy states that there is more potential outside the industry of the firm.

Next capabilities to seize opportunities are important. After the sensing capabilities did their work the firm has to maintain and improve their innovation to achieve marketplace acceptance.

§ 2.6 WHAT IS THE RELATIONSHIP BETWEEN PATH DEPENDENCY OF DYNAMIC CAPABILITIES WITH RADICAL INNOVATION?

This final paragraph and also final research question deals with development of dynamic capabilities. Do the choices made by the firm in the past affect opportunities to innovate radically in the future?

O’Connor and Ayers (2005:24) define a radical innovation competency as follows: “... the ability of a firm to successfully commercialize radical innovations again and again, and across organizational settings”. So the environment asks the process to repeat and the whole organization to be involved. During this learning process capabilities are formed. Ethiraj et al. (2005) ask the question: “where do capabilities come from?”. They mention the study Nelson and Winter (1982) in which they see a firm as bundles of path-dependent knowledge bases. Then, through learning-by-doing routines are developed. Ethiraj et al. (2005:28) state the following: “Routines, a central concept in evolutionary theory, involve repetitive patterns of activity, require investment in routine-specific human and physical capital, and are easily recognized as belonging to a class (Winter, 1990)”.

S928333: W.J. Sikkema
This thesis considers the class of routines, build upon dynamic capabilities, which is necessary in dynamic situations. Additionally, Tzeng (2009) makes a distribution within the innovation topic after work of Schumpeter. The three innovation schools are shown in figure 3 and at the corporate capability school path dependency is present. This means that, within this corporate capability school, path dependency is a factor to consider.

Danneels (2002) also take into account the “history” of capabilities. When developing a competence, a firm can learn from good decisions that have been made in the past. Also mistakes can be an attribute to the learning curve of a firm and so enable the firm to do not make the same mistake again. Danneels (2002) mentions Penrose (1959) which state that the nature of the existing capabilities to some extent determine the direction of innovation. Additionally, Danneels (2002) state that the customer and technological competences, mentioned in paragraph 2.4, are stepping stones to develop additional competences. In a changing environment it is important to add new competences to continue prosperity (McGrath, 2001). At some point in time a firm needs to outline a path of development concerning the capabilities. When the goal is set to introduce a new radical innovation the capabilities have to be built in a sequence and every step have to be conducted in precision to be able to back up the innovation.

An addition, to what is stated in paragraph 2.5 concerning the sensing and seizing opportunities, is the reconfiguration opportunity mentioned in Teece (2007). This is a final step in the process to earn some resources coming from a radical innovation. “A key to sustained profitable growth is the ability to recombine and to reconfigure assets and organizational structures as the enterprise grows, and as markets and technologies change, as they surely will” (Teece, 2007:17).
The reconfiguration part of dynamic capabilities is to enable management to deviate from an undesirable development path made by certain choices in the past. Teece (2000) state that when a company decides to innovate in a radical way it has to renew operations entirely. The already established routines that were present to contain continuity are useless. The more an organization is coped with shifts in the way business is executed, the more they learn from it. Figure 3 shows the framework Teece (2007) uses. The framework consists of four aspects that a firm should account for when innovating. The framework clearly shows that the development path can be broken down into these four aspects.

Throughout the process the company is learning and so falls under Knowledge Management. The process has to be guided and this is the task of the Governance aspect. After bringing an innovation to the market the work is not done but has to be positioned repeatedly. The aspect Cospecialization takes care of that part. In Appendix D an overall framework can be found of the three opportunities Teece (2007) mentions.

Bers et al. (2009) recognize that the process of radical innovations is one that lasts for several decades and happen in cycles. In their study they describe the Accelerated Radical innovation or ARI project. The organization of this project was searching for a way to accelerate the process of innovation.

As an example they mention the World Wide Web which was originally a defense-related network but is nowadays used by more than 1.8 billion people and counts for 26.6% of the world population. The growth rate between 2000 and 2008 was 399.3%! Retrieved from http://www.internetworldstats.com/stats.htm. Bers et al. (2009) serve three main lessons from past radical innovation based on the literature.
The first one is that a radical innovation starts with a crisis or opportunity. The Internet is a good example. Second, all innovation proceeds along a technology life cycle and this cannot be rushed or else important steps will be skipped. The third lesson state that every major innovation builds on prior achievement. This is because information has to evolve. The challenge Accelerating the transition from radical innovation projects to operating status connects the ARI project to a challenge in managing radical innovation.

**INTERIM CONCLUSION**

The question to answer is; what is the relationship between path dependency of dynamic capabilities with radical innovation?

A firm can be seen as bundles of path-dependent knowledge bases. Then, through learning-by-doing routines are developed.

The nature of the existing capabilities can, to some extent, determine the direction of innovation. The customer and technological competences are stepping stones to develop additional competences. In a changing environment it is important to add new competences to continue prosperity (McGrath, 2001).
Chapter 3  
Method

This chapter of the thesis usually contains procedures that are executed by the researcher. By doing this the researcher can increase his credibility; readers are able to understand the things that are written more easily. Most researchers use a dataset to test their hypotheses and then answer research questions to solve their problem statement. This thesis is slightly different because of the fact that there is no quantitative data but only theory. The research is done through a literary review which falls under the subject of secondary data. Sekaran (2003:222) defines secondary data as: “… information gathered by someone other than the researcher conducting the current study”. The most important advantage of using this kind of data is the time that can be saved. The sources used when collected the data consist of high quality Management Journals that are contemporary. Beside these journals some books are used that target the topics in this thesis very well. Subsequently, theories and thoughts found are applied to the different research questions that are formulated in the Introduction chapter. The purpose of the thesis can be described as exploration (Sekaran, 2003).

The subject of innovation inquired a specific theme to keep the thesis manageable for the time available. Radical innovation is a topic within the innovation theme and allows the search to be targeted. In the beginning of the thesis the independent variable was set on management capabilities but is changed in dynamic capabilities of a firm to keep the search feasible. This is because there is only a small amount of literature on management capabilities so the decision to switch to dynamic capabilities made the research a lot more comfortable. Besides these specific topics specific assumptions are made to exclude factors which only could confuse the reader. The assumptions are that firms already choose to innovate on a radical way and that the firm also has the innovation. Furthermore, the innovation takes place within the boundaries of a country where a firm is active but the firm is able to innovate in another industry. The environments in which a firm operates are those which have rapidly changing characteristics. These characteristics connect the radical innovation subject to dynamic capabilities.

The search for literature starts with the two variables from the conceptual framework (Appendix A). The problem statement of this thesis; *How is radical innovation influenced by dynamic capabilities;* makes it necessary to first find literature on the *dynamic capability* topic. Using ABI/Inform database, through the webpage of the University of Tilburg, and search terms like *capabilities, dynamic capabilities* and *competencies*, articles could be retrieved from JSTOR, Science Direct and Wiley Interscience.
The search is then narrowed down to high quality papers like Academy of Management Journal, Academy of Management Review, Journal of Management and Strategic Management Journal. Again, using ABI/Inform on the website of the University of Tilburg articles concerning radical innovation are retrieved. Search terms like *innovation and radical innovation*, filtered by high quality papers, result in academic sources of good quality. The sources of this thesis are listed in the Literature chapter. Not only articles can be found by using a search engine but also by using articles within articles. By reading the articles thoroughly and scanning for useful theories, new articles are found. When a researcher is using a definition or statement from another researcher this is clearly mentioned and so the available information can be extended. The selecting process of articles is also filtered on a time base. The criterion is that the articles must be a 21st century publishing which assures theory used to be present-day. Of course other studies are used to strengthen the other articles.

During the process of writing this thesis several feedback meetings are attended. In these meetings fellow thesis writers, together with the supervisor, commented on the progress of the research.
Chapter 4 Conclusion, Discussion and Recommendations

In this chapter the problem statement is the central aspect. After the previous three chapters, Chapter 4 is now able to conclude the thesis and start a discussion. Recommendations for further research are also given. A pure literature study is performed to ultimately answer this problem statement and the four research questions, present to structure the thesis, are the building blocks for the answer to:

*How is radical innovation influenced by dynamic capabilities?*

§ 4.1 Conclusion

First the variable radical innovation is explicated. A radical innovation, according to Leifer et al. (2000), is one that have at least one of the following results; an entirely new set of performance features; improvements in known performance features of five times or greater; or a significant (≥ 30%) reduction in cost. It is possible that the innovation creates an entirely new market. The distinction between incremental and radical innovation is given to create a good understanding. Furthermore, the environment to commercialize an innovation is set at a level with high volatility. Risk and uncertainty play a big role so dynamic capabilities of a firm should consider these characteristics.

Secondly, dynamic capabilities as a variable is explicated. Helfat et al. (2007:4) define this variable as follows: “the capacity of an organization to purposefully create, extend, and modify its resources base.” There are many capabilities in order to innovate but the most necessary for a successful innovation are the customer competence and the technology competence from Danneels (2002). These two capabilities can be combined with *exploitation* and *exploration* and subsequently show which capability needs more attention. An integrative capability can arise to link the customer and technology competence.
Next, the possibility for a firm to innovate in another industry than in which it operates currently in is examined. This is to examine the effect of the dynamic capabilities to accomplish this. The entire business ecosystem should be taken into account. The sensing and seizing capacities from Teece (2007) enable a firm to find new innovating ideas outside its own industry and to be able to commercialize a concept. Incumbents do not seek innovations that have a great disruptive effect but will try to maximize their return with current operations. A golden rule is a higher risk, enables a higher return. If new entrants have a good concept and they can avoid entry barriers, for example by making a new market, a competitive advantage exists.

Finally, the path dependency topic is raised to consider possible building blocks. A radical innovation competency definition by O’Connor and Ayers (2005) pointed out that it should be able to commercialize an innovation over and over again. So there is a time aspect present. Routines are also present within the firm, which enable the firm to accumulate things learned in the past. The routines can give the firm a direction. The customer competence and the technology competence from Danneels (2002) can serve as stepping stones to develop other competences. During the time the competences or capabilities that support the radical innovation should be managed. Teece (2007) mentions the reconfiguration capacity. Another thing mentioned is the acceleration factor to be able to beat competitors with introducing an innovation.

Taking all these separate interim conclusions the problem statement can be answered. Dynamic capabilities should be tailored to the environment and to the mission of the firm in order to bear a radical innovation. This is because the impact of a radical innovation is often very big and the level of uncertainty very high. The history of a firm determines largely the routines, developed by the dynamic capabilities, which are present in the firm. The development of the capabilities is often done by an R&D department but with a radical innovation the whole firm should be tailored to commercialize the innovation. It is not only possible to innovate inside an existing industry but also in another one. Firms should actively search for new opportunities and trends in the market and beyond in order to find concepts that enable competitive advantages. Dynamic capabilities have to be tuned for this search. The presence of capabilities like exploration, exploitation, sense, seize, reconfiguration all affect radical innovation. A firm also has to pay attention to their customer competence and the technology competence which serve as basics for a radical innovation.
§ 4.2 Discussion and Recommendations for Further Research

Because of the limited time frame available to write this thesis some factors are left out in the conceptual framework and some assumptions had to be made. This study excluded mediating factors that could have a significant influence on the results. For example, the environment is standardized in one that is volatile and is changing rapidly. Further research could study different types of environmental conditions to see what the effect of the environment is on the relationship radical innovations versus dynamic capabilities. Another assumption made is the fact that the decision to innovate already has been made by the firm and that the innovation will be placed within the country. This assumption excludes the process of developing a radical innovation and different business ecosystems in which the innovation could be placed. Dynamic capabilities could, and probably will, have a great impact on the development stage and the ability to implement an innovation outside the country where a firm is operating. An interesting research could be to find the perfect portfolio of dynamic capabilities to innovate radically. When there is one, a manager of a firm that wants to innovate can slowly expand their capabilities to ultimately be able to execute the innovation.

Additionally, the studies of Bers et al. (2009) and O’Connor and Ayers (2005) both deal with an acceleration aspect. Bers et al. (2009) mention the Accelerated Radical Innovation (ARI) model which goes a step further than normal radical innovations. Step 1 of this model is of greatest importance namely recognize 10x force crisis. By means of this step a company is able to answer the question whether there is an opportunity in the market or a crisis. When this can be positively answered, a company needs to act fast to gain as much as advantage as possible. When the question can be answered negatively then the time is not yet right to commercialize. O’Connor and Ayers (2005) found the Mirror Model in their study which was addressed in paragraph 2.4. The complementary capability of separate business units enable innovation to be accelerated. The expertise of the business units is greater than the central R&D department when it, for example, comes to value chain and partners. The acceleration aspect could be crucial in the innovating process and is an option for further research in the relationship with dynamic capabilities.
§ 4.4 Acknowledgements

I want to thank my supervisor, Dr. W.E.J. Sofka, for guiding the process of writing this thesis. The comments he made were constructive and clear so that I could make improvements and come to the result as it is now. At the start of the process he focused on narrowing down the topic so that it would not consider all the themes present in the area of innovation. In addition I followed his advice to adjust my independent variable into the current one, dynamic capabilities, in order to eliminate the risk of having a “fluffy” base in the research. I also want to thank my fellow thesis writers for the feedback they provided.
Literature


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S928333: W.J. Sikkema


Appendix A

Dynamic capabilities
- Competences
- Focus
- Development

Radical innovation
- Incremental vs. radical
- Outside/inside existing industry
## Appendix B

### Seven Challenges in Managing Radical Innovation

<table>
<thead>
<tr>
<th>Managerial Challenge</th>
<th>Competencies Required to Address the Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capturing radical ideas in the “fuzzy front end”</td>
<td>Generation of good ideas</td>
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<tr>
<td></td>
<td>Recognition of opportunities enabled by breakthroughs</td>
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<tr>
<td></td>
<td>Development and implementation of an effective approach to initial evaluation</td>
</tr>
<tr>
<td>Managing radical innovation projects</td>
<td>Articulation of a vision</td>
</tr>
<tr>
<td></td>
<td>Uncertainty-mapping capability</td>
</tr>
<tr>
<td></td>
<td>Development of and ability to follow a learning plan</td>
</tr>
<tr>
<td></td>
<td>Recruitment of champions</td>
</tr>
<tr>
<td></td>
<td>Effective management of organizational interfaces</td>
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<tr>
<td>Learning about markets for radical innovations</td>
<td>Commitment to asking different market research questions</td>
</tr>
<tr>
<td></td>
<td>Willingness to conduct market research in new ways</td>
</tr>
<tr>
<td>Resolving uncertainty in the business model</td>
<td>Understanding of what the firm should outsource and what new competencies it should develop</td>
</tr>
<tr>
<td></td>
<td>Adaptation of the business model in response to learning</td>
</tr>
<tr>
<td>Bridging resource and competency gaps</td>
<td>Resource acquisition</td>
</tr>
<tr>
<td></td>
<td>Establishment and management of internal and external partnerships</td>
</tr>
<tr>
<td>Accelerating the transition from radical innovation projects to operating status</td>
<td>Accurate assessment of the transition readiness of the project and the receiving unit</td>
</tr>
<tr>
<td></td>
<td>Development of people, practices, and structures for successful transitions</td>
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<tr>
<td></td>
<td>Ability to build bridges between organizational units</td>
</tr>
<tr>
<td>Engaging individual initiative</td>
<td>Ability to effectively define the roles of senior management, key individuals, and the project team</td>
</tr>
<tr>
<td></td>
<td>Building of appropriate reward systems and career paths</td>
</tr>
<tr>
<td></td>
<td>Promotion of informal networks</td>
</tr>
</tbody>
</table>

*Source: Leifer et al., 2000*
Appendix C

Mirrored Model

Source: O’Connor and Ayers, 2005
Appendix D