Masters Thesis:

Appropriability Mechanisms and Strategies for Innovations

The Case of Rotulus

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Abstract

This thesis investigates appropriability mechanisms, namely; patents, secrecy, complementary assets and lead time. After the investigation of the mechanisms a original framework is introduced that helps to form an appropriability strategy. The framework has been named the Potential of the Appropriability Regime framework or the PAR-framework. A case for analysis is presented that utilizes the framework. The thesis then ends with a recommended strategy based on the findings from using the framework. The thesis further contributes to discussions on whether or not lead time should be considered an independent appropriability mechanism or rather be viewed as a byproduct from the use of the other mechanisms.

Key words:
Appropriability mechanisms, patents, secrecy, complementary assets, lead time, appropriability strategies, Potential of the appropriability regime, the PAR-framework.
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1. Introduction

When launching new product innovations to the market, innovators are faced with challenges of how best to protect the innovation and how to achieve maximum returns from the innovation. Appropriability mechanisms - patents, secrecy, complementary assets and lead time\(^1\) - can help the innovator to secure financial returns but the choice of mechanisms and the combination thereof is not always obvious and is case dependent. This thesis is built around an innovation by the author, an innovative eBook reader, a product that is new to the world and the aim is to build an appropriability strategy with the use of the appropriability mechanisms.

For analysis an original framework is produced. The original framework is derived from investigating what factors affect the choice of appropriability strategy and appropriability mechanisms. Within the framework it is proposed that the choice of strategy is dependent on three factors, which were discovered and structured during the research stages. Firstly, building an appropriability strategy is dependent on innovation attributes which affect which mechanisms are relevant. Secondly, the choice of strategy is affected by innovators abilities that determine if the mechanisms can be utilized. Thirdly, the choice of strategy is affected by characteristics of the external environment. As no two innovators are identical, the framework can help to build a coherent strategy.

Understanding the appropriability mechanisms is important when utilizing the framework. It is important to understand in which situations the mechanisms are relevant and further how they are related. Without knowledge about the appropriability mechanisms it is hard to choose and build an optimal strategy and the original framework will not be as effective. Literature sheds light on the interactions between the mechanisms that can sometimes be seen as complementary or substitutable and even counteracting. The definitions and terminology for appropriability mechanisms varies in the literature but this thesis focuses on the four most noted mechanisms, namely; Patents, secrecy, lead time and complementary sales/assets (Levin

\(^{1}\) Lead time can have different meanings depending on context. Therefore, in this paper whenever referred to lead time it refers to lead time as an appropriation mechanism and should not be confused with lead time definitions of operation managements where lead time used to describe processes.

In this thesis an innovation by the author will be used as a case for analysis. The thesis is therefore built around an innovation with the aim of building appropriability strategy that will provide protection and avoid potentially costly pitfalls in later stages of commercialization of the innovation.

The thesis is theoretical but has a practical application. It contributes to literature by developing an original framework and further provides criticism as the thesis asks the question whether or not the right terminology has been used in the literature before, namely by Levin et al. (1987) and Cohen et al.(2000) in their study and how one of the mechanisms, lead time, is defined. The thesis asks the question if this mechanism should in fact be viewed as an independent mechanism or as byproduct from the use of the other appropriability mechanisms. In terms of practical application of this thesis, it is successful in building an appropriability strategy for Rotulus.

**Structure of the thesis**

The thesis starts by providing the background and motivation of the project. The problem formulation is then introduced along with the research question which serves as a departure point for the thesis. After the research question has been presented, the methodology is explained and delineated. When the methodology has been covered, the theoretical foundations of the individual mechanisms are investigated for use in structuring of the original framework and analysis. The literature review focuses separately on the different mechanisms in order to provide and explain the fundamentals of each mechanism. The review explains how the mechanisms can be viewed as complementary, substitutable or counteractive for the appropriation of a given firm and lists numerous examples and reasons for choices of mechanisms in different situations.

2 In the study they also included a category of mechanisms that were defined as other legal, such as trademarks or copyrights but the definition of what the category included is rather vague. Therefore this category will be left out of the project and other the remaining mechanisms will be in focus.
After a discussion about the relationships of the mechanisms the original framework that has been named the Potential of the Appropriability Regime framework, or the PAR framework, will be presented. When the original framework has been presented it is followed by an analysis using the original framework to provide support the strategy recommendation. After having utilized the framework to analyze product attributes, firm structure and the external environment, a section follows that leads into the recommended strategy

After the strategy has been presented, the thesis begins its closings with a brief summary of what has been covered followed by a discussion about the contributions and criticism to the theoretical world and ends with final words.

**Background and motivation**

The motivation for this thesis is to explore what options are available in commercializing an innovation by the author. In agreement with Copenhagen Business School (CBS), detailed description of the innovation is omitted to protect the proprietary information of the innovation. However, in order to explain the product characteristics for the case analysis some information is included without risking a disclosure that could damage the novelty criteria of patenting the innovation.

**The product**

The innovation is an eBook reader device, an electrical/computer equipment. It is novel to the market and has the potential to deliver value to a variety of users in a growing and evolving market. The market for eBooks and eBook readers has been growing rapidly in recent years and new products are still appearing. For instance, Amazon's kindle, iPad and Android tablets in addition to smart phones have transformed the consumption of literature and even influenced the methods of how people read. As opposed to printed versions of books, readers of eBooks can consume literature in customized format. They can customize font size and color and even read moving or blinking text, an option that are not available for printed media. As the market grows and evolves, opportunities for new products have increased and users have become more willing to choose these alternatives. Therefore it is believed that an opportunity is present for the innovation, which currently works under the project name of
Rotulus. The innovation is in its early development and design stages. Acquiring a patent is believed to be a possible option and patent searches and work alongside this thesis strengthens this belief. The patent application has however not been filed and the thesis will demonstrate why a patent application is not considered timely. Further, possible restraints to patent acquisition will be addressed later in the thesis.

Further I would like to add that I am grateful to CBS for allowing me the opportunity to devote my time to studying in this area and I hope the thesis will contribute to the theory of appropriability mechanisms. It has further helped me personally as it has provided a more in depth understanding of what needs to be considered prior to commercialization of an innovation that could benefit me in the future.

**Problem Formulation**

Rotulus is electronic equipment—an eBook reader—that can be viewed as consisting of off-the-shelf components. The fact that it can be assembled by using off-the-shelf components means that it should be relatively easy to imitate. Despite the fact that the product consists of off-the-shelf components the assembly is novel. Therefore the combination of these components and use are considered to be novel, and open up for the possibility of a patent. Existing patents on the market pose a threat and might block entry if the issue is not addressed. A patent is therefore possibly dire necessity for competition on the market and avoid infringing on other patents along with the need to deter imitation.

The innovation is currently in early development stages and has not been introduced to the market but awaits market testing with a prototype. The innovator is independent, has limited access to capital and other resources and needs assistance to get the innovation to the next stage, which involves building a standalone prototype and commercialization. This means that access to human capital such as software engineers and manufacturing and sales facilities is needed if commercialization of the innovation is to be realized. Possibilities of how to earn revenue without large investments will also need to be explored, namely cooperation with other partners along with the threats that such relationships might encounter.

Competitors on the market are large corporations that offer competing products and have the
potential of entering the market soon after launch through existing sales avenues. Entering
the market without understanding the factors that can keep the competition at bay is likely to
damage the commercial viability of the innovation. Understanding how the use of
appropriability mechanisms can help to deter entry of competitors is therefore important and
creating barriers for competition can result in a larger market share in the long run.

Literature provides insight but a complete framework for innovators to use prior to
commercialization has not been discovered that relates to the use of the appropriability
mechanism. Therefore, understanding the individual mechanisms is important to provide a
logical appropriability strategy for Rotulus. Research studies from within the field need to be
studied to understand the underlying factors that affect appropriation. Comparison of reasons
why different types of innovation require a different approach for appropriating returns can
help to identify whether or not one specific course of action is justified in the case of the
Rotulus. Understanding the traits and benefits of each mechanism is therefore needed as it
can serve as a framework to help building a coherent strategy.

The right use of appropriability mechanisms is believed to be crucial and relevant in
addressing the factors of the research question that guide the thesis. The factors in question
describe the appropriability mechanisms and how they are affected by the position of the
innovator/innovator. The research question that is the departure point for the thesis is
therefore:

What appropriability strategy should the innovator of Rotulus seek to implement and
what factors affect the decision making?

Method

In order to develop an appropriability strategy for Rotulus, a framework was needed.
Literature in the field of appropriability provides insight, but during the research stages of this
thesis no holistic framework was discovered that would help to explain the complex area of
appropriability strategies. Therefore the first step was to understand the appropriability mechanisms through other research studies, in order to learn and identify which factors needed to be considered.

The course for investigation was set and two research studies created the baseline. These were the Yale study conducted by Levin et al. (1987) and the Carnegie Mellon study by Cohen et al. (2000). These studies are believed to be valuable and reliant as they have been viewed as the leading studies in the field. These studies provide valuable insight into the area of appropriability and combined they were based on over 2000 interviews with firms and R&D labs. These interviews included respondents from over 100 lines of business and provide information on what measures firms take to appropriate returns from their innovation, i.e. their appropriability strategies.

In addition to the review of the two aforementioned sources additional sources were then analyzed and sometimes provided alternative views. This was especially important as the CMS and Yale studies both focus on large firms, but in the case of Rotulus the innovator is independent so it was necessary to investigate if small firms behaved differently. To understand how the traits of each mechanism and how it the mechanisms are defined leading studies in the field were studied to grasp the full concept of the mechanisms. This provided understanding of each of the mechanisms individually and further helped understanding the rationale behind why certain choices were relevant of mechanisms of appropriability and even further how the individual mechanisms interact with each other.

Alongside the literature review, other sources of knowledge were explored. This involved independent discussions to further the understanding in practical terms rather than theoretical. This included participation in innovator forums where independent innovators enter discussions about the complex area of way to commercialize their innovations. Additional sources also included participation in events and meetings with Venture Cup, a Danish start up incubator supported by CBS. Lectures and events were attended where soon to be entrepreneurs met and shared their experiences. This part of the research was informal but helped to connect the problem to the real world and further provided motivation.
Delimitations of methodology

The risk involved in using existing studies is that they do not cover all the information that is needed. The risk includes that they are not detailed enough or definitions vary between studies and lack accuracy. Further, different time frame of the studies and population or samples can be different, and won't include the ideal population as if it was an independent study (Blumberg, 2005). An alternative approach would have been to seek interviews with other innovators in similar situations of the author and study their choices. However, lack of resources for such research activities are likely to have resulted in a small sample of interviewees and perhaps only a replication of existing studies. Further limitation is that studies and literature reviewed are not all recent which relates to the different time frame of the studies. More recent studies could have presented different views, if appropriability strategies evolve with time. For instance, Cohen et al. (2000) interpret that that the difference between different responses in their CMS study vs. the Yale study is explained by the fact, that strategies will adapt or change with time. Recent literature however often has a narrower focus for instance on a small sample of firms or companies within a certain industry.

A similar thesis could as well have been written using another product or a company for analysis. If that had been the case, the dilemma would have been to get all the information needed to solve the problem. That could however have avoided a possible bias for interpretation as somewhat the thesis is self-focused so there is the risk of interpreting results in favor of the innovation. However, using the current case for analysis is thought to be both motivating and efficient.
2. Theoretical Framework

The building blocks of the theoretical part are the Yale by Levin et al. (1987) and CMS study by Cohen et al. (2000) which are the leading studies in the field but are supplemented by studies such as Gans et al. (2003), Leipponen and Byma (2009), and other studies that focus on smaller firms and their appropriability strategy. Teece's (1986) study is used to describe the concept of complementary assets and is a leading study in the field which describes the concept well. To understand and explain the factors of lead time, Lieberman and Montgomery's (1988, 1998) articles will be used to provide in depth analysis on where lead time advantages have their origins. Lastly, Davis' (2008) framework for the potential of licensing patents to firms will be utilized to explore licensing options.

The aim of the theoretical framework is to provide understanding and investigate the appropriability mechanism. It starts by introducing the concept of appropriability and its field and is followed by a description of the individual mechanisms in depth and how they can be seen as interacting with each other. The theoretical part further provides the fundamental building blocks for the original framework. It is important to cover the field to demonstrate knowledge and understanding of the mechanisms in order to be able to build the framework and include information to support the development of the strategy.

Appropriability

According to the 17th century English philosopher John Locke, the term appropriation describes the right of having the control over the profits of land and labor. Under that term, farmers have the right to fruits, vegetables and animals cultivated on their lands and the right to control the distribution of profits (McPherson, 1951). Using this description alongside Levin et al. (1987 p. 783) that a patent confers, in theory, perfect appropriability (monopoly of the innovation) it can be said that appropriability refers to a firm's ability to receive the returns of a product and maintaining control of distribution of the profits. Perfect appropriability is however rarely the case in reality and patents rarely confer the monopoly as they do in theory. Innovators must therefore often turn to other means in order appropriate returns from their innovations, namely by using appropriability mechanisms. The
appropriability mechanisms covered in this thesis are patents, secrecy, lead time and complementary sales and/or assets (Levin et al., 1987; Cohen et al., 2000). In the CMS study, the mechanisms are named as being six, where complementary sales and assets are seen as two separate mechanisms in addition to the category other legal. The reason for combining complementary sales and assets in the analysis is to connect it better with the theory of Teece (1986) which studied the relationship of innovators and their complementary assets. The category other legal is however omitted since they are ill defined and vague in their analysis in the CMS study by Cohen et al. (2000), but it is likely that they refer to trademarks or copyrights. Of the remaining mechanisms each has their own set of attributes that can affect the ability to appropriate. These mechanisms can be applied independently but most often they are used in combinations with other mechanisms and can sometimes be used conjointly. Further, the choice of one mechanism can affect the relative effectiveness of another. As each of the mechanisms can affect the appropriability of an innovation it can be said that innovators are faced with a strategic choice of combinations or choice of appropriability strategies. But what affects the choice of appropriability mechanisms for firms?

Results from studies do differ and for instance the conclusions in the CMS study by Cohen et.al (2000) and the Yale study by Levin et al. (1987) were not identical, but otherwise comprised of similar samples of firms. Secrecy was judged the least effective of the mechanisms in the Yale study but was perceived as being the most effective along with lead time in the CMS study. The differences were not fully explained, but the authors wondered whether time could be a deciding factor, meaning that the choice of appropriability mechanisms has changed over time for given innovations (Cohen et al. 2000). One possible explanation for the change over time could be changes in the legal environment or that some methods have proved to be more effective than others. It is beyond the scope of this paper to explore further the reason for this discrepancy, but this area could be interesting for future research.³

Studies on appropriability strategies of small firms also indicate different behavior compared to larger firms and different effectiveness of appropriability mechanisms. Leiponen and Byma

³Cohen et al. (2002) in Japan showed more tendency to patent compared to similar firms in the U.S.. There can therefore also be differences between countries, whether it can be traced to the legal environment, culture differences or business ethics. This is however not investigated in depth in this thesis.
(2009) conclude that secrecy and speed to market -or lead time- are most important for small firms in Finland. This is similar to the findings of Cohen et al. (2000) concerning large firms. If however this notion is supplemented to the findings of Lanjouw and Shankerman (2004), that due to litigation small firms are at a disadvantage when it comes to patenting compared to large firms, it suggest that the reasons behind choices of appropriability strategies are effected by firm size. Further, Gans et al. (2003) conclude that without intellectual property protection, start ups - which are most often small firms - make weak competitors and Levin et al. (1987) proposed that for small firms, patents were perhaps the most valuable assets.

Differences in studies leave it hard to generalize about the best way, when it comes to deciding on appropriability strategies and choices for firms. The reasons for differences in responses might further be attributed to different approaches by the researches, meaning that questionnaires and methods were not identical. It is plausible as well that the external environment of firms can play a role, for instance in the effectiveness of a patent system depending on countries of operation as Cohen et al. (2002) found a different patenting behavior between Japan and the U.S.

It is interesting that studies show different tendencies in different industries for choices of appropriability mechanisms and examples of this are the Yale and CMS studies. These studies show that certain appropriability strategies prevail within some industries but not others. That suggests that product attributes play a vital role in the choice of mechanisms. Further, a clear distinction in the studies is found in the different choices of strategies depending on whether the innovation is a product or a process. In general, the results of the Yale and the CMS studies were that patents are seen as relatively more effective for product innovations whereas for process innovations patents scored lower (Levin et al. 1987, Cohen et al. 2000).

**Product vs. Processes**

Appropriability literature draws a distinct line between products and processes in terms of appropriability in a cross industry analysis. Tendency to choose patents when the innovation in question is a product is notably higher than for processes (Cohen et al. 2000, Levin et al. 1987). This difference in cross industry analysis further suggests that the differences in characteristics have an impact on the effectiveness of the mechanisms and the provided
One explanation for these differences is what could perhaps be described as ease of infringement and how innovators are positioned to protect their innovation. As Teece (1986; 287) stated a trade secret protection is possible, however, only if the firm can put its product before the public and still keep the underlying technology a secret. Further, Mansfield (1985) found that process technology leaks out more slowly than product technology (cited in Lieberman and Montgomery 1988; 43). As patents are essentially blueprints of the innovation, an assumption becomes logical. Processes more often occur behind closed doors and therefore potential imitators have limited access to the facilities and hence information about the process. In turn, as the production occurs behind closed doors it is difficult for the owner of a patented process to detect if the patent is being infringed by another and therefore it might benefit him to keep the information a secret instead of applying for a patent and disclosing the information.

Another possible source of differences in choice of strategies between products and processes can be due to the product life cycle. Teece (1986) notes that process innovations become more important as the product life cycle is realized. In the early stages, the focus is on the design of the product and product attributes. In later stages, when a dominant design has emerged, established firms are more likely to start looking inwards to the process to lower production costs. The difference between relevance of product and process innovations is important to note and especially to avoid repetition when covering the individual mechanism and later in the thesis. Further, as the innovation in focus in this thesis is a product in early stages of development, using Teece's arguments, the focus is still on the product attributes and bettering the production process is not timely.

**Patents**

The rationale for the patent system is to encourage innovation by granting innovators a monopoly over an innovation. By granting a legal monopoly, innovators are provided with an incentive as it justifies the time and resources spent on bringing that innovation to life. The rationale for governments on the other hand is that the innovator must share detailed descriptions of the innovation which benefits society with knowledge spillovers (Mazzoleni
To be granted a patent, the innovation needs to fulfill three criteria; it needs to be novel, commercially applicable and non-obvious. If the innovation fulfills these criteria, the innovator can be legally protected from imitators, and the innovator has exclusive right and control over the innovation.\(^4\)

There are three types of basic patents granted, namely, design patents, plant patents and utility patents. The different types of patents can have different lifespan and design patents have a shorter lifetime, usually fourteen years, whereas utility patents have a lifetime of twenty years. For the purposes of this paper thesis, a utility patent is the most relevant but the paper will not cover the technicalities in any depth and will rather focus on the strategic motives behind the decisions why or why not to patent.

It is commonly believed that having a patent will guarantee large profits for the innovator. In reality this is different. Patents are often perceived by industries as providing inadequate protection and most often do not provide the monopoly that it does in theory. Patents however can provide the innovator with different set of advantages, but that depends on the type of innovation. When it comes to the issue of whether or not to patent an innovation the matter becomes more complex. For a patent to provide protection, the innovator faces costs, such as application-, maintenance- and legal fees, as well as other implicit costs tied to the patent. These implicit costs are the description of the innovation and the patent claims that can be an asset to imitators and competitors, in addition to unforeseen legal costs. Further, competitors might simply invent around a patent and the costs incurred are simple waste of money.

As there are potential implicit costs there are as well potentially other more non-obvious benefits to being granted a patent. A patent can increase negotiation position for firms and enable them to enter into cross-licensing deals and in addition a patent can as well provide protection from other patent holders that might otherwise see a benefit in filing infringement lawsuits to claim damages. What benefits a patent will provide the patent holder therefore relies on a set of variables that can sometimes be met by the use of the other appropriability

\(^4\) There are exceptions from having control over the innovation if they are for instance socially unacceptable. For further information see – Agreement on Trade-Related Aspects of Intellectual Property Rights, Article 27, para. 2 (1994) – Cited in IPR.
mechanisms. In order to explain and clarify the above mention statements the following section goes into depth on why firms choose to patent or not.

To Patent or not to Patent

Studies on why companies decide to patent or not help to understand the underlying reasoning by firms and identify the various motives that lay behind their decisions. In the CMS study by Cohen et al. (2000) a comprehensive list of reasons can be found. The reasons why firms choose to patent according to this study are the following; to prevent copying, patent blocking, to earn licensing revenue, to enhance bargaining power, to prevent infringement suits, to measure internal performance and to enhance the firm's reputation (p. 17) For reasons why firms choose not to seek a patent were the following; Difficulty to demonstrate novelty, the amount of information disclosed in the patent application, the cost of applying, the cost of defending the patent in court, and the ease of inventing around the patent (p. 14).

These responses indicate that even if a patent for an innovation is an option, it is not necessarily considered to be the best choice. For instance patents alone are not considered the most effective mechanism in any of the industries but are often considered complementary to other strategies (Cohen et al., 2000, Levin et al., 1987). Further, what becomes apparent, are the different strategic motives that lay behind decisions of managers on whether to patent or not, even if the product is patentable. It becomes clear that patents serve a different purpose than the patent system originally intended and there are even cases where innovators that seek patents have no intention of commercializing the innovation. Elaborating on the responses serves the purpose to explain why and in which situations patenting might be considered.

Reasons to patent

To prevent copying is the straightest forward of the reasons why firms choose to patent their innovations. This reason is in line with the original intentions, to exclude others from imitating and is the highest ranked reason why firms choose to patent according to the CMS study (Cohen. et al., 2000). For this to be viable reasoning for managers or innovators, there

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6 Difficulty in demonstrating novelty could translate into that a "product is not patentable" as novelty is one of the prerequisites of being granted a patent, but this was not elaborated on in the study by Cohen et al (2000)
are aspects that need to be considered in order for the decision to be justified. Firstly, the innovator needs to be in a position in which he is able to detect infringements and discover competitor infringements with relative ease. If the innovation is for instance a process that occurs behind closed doors it can pose a threat to the effectiveness of protection of the patent. Further, if infringement can be detected, funds will have to be allocated, as the protection is enforced by legal actions which can be costly. If the innovator does not have the funds needed to protect the patent in court, especially larger firms might be inclined to infringe on the patent as they are not as threatened since their legal resources are far greater than that of a small innovator. Small firms have for instance been found to be more vulnerable for infringements and need enforce their patents through litigation (Lanjouw and Shankerman, 2004, cited in Leiponen and Byma, 2009) and therefore they are relatively more exposed to these risks. The underlying argument is therefore that if a firm cannot defend the patent in court the effectiveness of the patent is limited. Although innovators have limited funds, there are options if infringement is suspected. One option that smaller innovators can resort to is attracting investors to fund the legal action when and if infringement on their patent is suspected. These investors fund the legal proceedings and in turn they get a share in the damage payments if the court rule in their favor that the patent has been infringed on.7

The ability to defend a patent in court can be traced to the type of patents, namely a narrow scope patent or a broad scope patent.8 A patent with a narrow scope is detailed and goes into depth on certain aspects of the innovation. The benefit of a narrow patent is that it can provide the innovator with a better chance of being protected in court. The downside is that with a narrow patent scope, competitors have greater ease of developing similar products that are just outside the narrow patent definition and claims. A narrow patent therefore contains highly specific patent claims but stronger protection in court.

Broad scope patents however are of a somewhat different nature. The claims in broad scope patents can be less specific and cover a variety of application for the innovation. The benefits of broad scope patents are that it can create a barrier for other firms on the market to enter

7 This is based on following discussions in the inventors’ forum, where small independent inventors are looking for investors with this intention.
8 “You have to stake the four corners of your invention broadly enough so that they give you maximum protection. . . . Of course, if you write too broadly you may invalidate your claim. . . . But if you write too narrowly you may miss the thing about the technology that turns out to be truly valuable” (quoted by Varchaver 2001, 207) – Cited in Bernard and Yiannaka p. 242
with similar attributes. Firms that have developed a related or a similar product might have seen an opportunity for entering the market if the existing patent was of a narrow scope, but the broader patent increases the field of the patented innovation and therefore increases the threat of the entering firm being exposed to an infringement lawsuit. However, studies have shown that broad patents provide less protection in court and have higher risk of being invalidated or narrowed in courts. This is traced to the broad and perhaps less specific patent claims (Merges and Nelson, 1990, cited in Bernard and Yiannaka).

It is therefore logical to assume that firms with vast legal resources are at an advantage when it comes to standing trial of defending broad patent, and the effectiveness of a broad patent might rely on these legal assets. On the other hand, smaller firms might see more potential filing narrow patent claims that can provide them with a stronger protection in the court of law as it is relatively easier to defend. Therefore, to simplify, narrow scope patents might be more suitable when an innovator has limited legal resources and has a specific application of the innovation in mind whereas broad scope patents can be more effective in deterring entry, for instance for corporations or others that are seeking to deter entry of similar innovations by competing firms. What is further implied in this discussion is that even if a patent is granted by a patent office, it does not mean that patents will be able to stand trial, as it can be invalidated. A granted patent is therefore not a guaranteed protection for an innovation.

A countermeasure to this ineffectiveness of patents and their validity in court can be described as patent blocking. The term patent blocking is defined by Cohen et al. (2000; 17) as the prevention of other firms' attempts to patent a related innovation, which is the second highest ranked reasons for why firms patent their innovations. Firms can use this option to enforce the protection when a single patent does not provide the required protection and the innovator believes that there is ease of inventing around the patent. The innovator can therefore resort to building fences around his patent and keep competitors from imitating the patented innovation. Using the broad scope vs. narrow scope discussion from above the innovator could therefore file multiple narrow scope patents defining aspects of his innovation in separate patents rather than a single broad scope patent. Also he can supplement a broad patent with narrow scope patents to tighten the patent fence around the innovation. Filing new patents around existing ones can therefore strengthen the protection and can deter
competing parties from patenting or entering the market with a related innovation. This strategy can be effective but bears the disadvantage that it is costly. It is further likely that this strategy is available for larger firms with better access to resources. For small firms that have the intent to commercialize their innovation, it can be argued that they should rather use their resources for commercialization of the innovation, rather than spending time and other resources on increasing the patent protection.

The third highest ranked reason why firms patent is to prevent infringement lawsuits (Cohen et al. 2000). When innovators intend to enter the market with their innovations they need to have knowledge of existing patents. Studies have shown that court cases of infringement lawsuits have become more frequent (Ziedonis, 2004) so researching the field and knowing what related patents exist is important. If an innovator is found to have infringed on existing patents it can be costly and he will have to pay damage payments. Small firms have been found to be more vulnerable to preliminary injunctions (Lanjouw and Shankerman, 2001, cited in Leiponen and Byma, 2009). A possible reason is that small firms that have small patent portfolios have limited options to enter into cross-licensing agreements with other larger firms. The larger firms can therefore see the benefit of going to court and not settling the matter through co-operation (Lanjouw and Shankerman, 2001) with the aim to get damage payments.10

To enhance reputation is ranked fourth of the reasons to patent, closely followed by patenting for use in negotiations (Cohen et al., 2000). It is noted that patents can be a signal of productivity or intent and is further more likely to be in the case of smaller firms (Cohen et al., 2000; 18, footnote 41). This strikes as being logical and perhaps links to use in negotiations as well. It can be difficult for smaller firms to approach other and larger companies11, and companies often turn away potential ideas unless the innovator has a patent

9 "Firms spend vast amounts on either defending or enforcing patents. In 1991 US firms spent over $1 billion in these situations which equals one-third of these firms' basic research and development costs" - Ziedonis, 2004. p. 804

10 [a patent troll] "has no significant assets except patents; produces no products; has attorneys as its most important employees; and acquires patents, but does not invent technology itself" - Abril and Plant, 2007. p. 43.

11 This statement is corroborated by talks with companies, knowledgeable persons from the industry as well as information from multinational corporations, namely 3M and Colgate. They invite individuals to share their ideas with the corporations, but unless there is a patent at hand the individual will not get a share in the profit. One interesting aspect of this approach is that corporations get suggestions and ideas for new products from outsiders that will not get a share in the profit, and therefore is an open channel for ideas at low extra cost for the corporation and screens the ideas from the serious inventors and customers that want improvement on
for the innovation. If innovators for instance wish to license their innovation a patent is important and licensing non patented innovation has been noted as being more difficult than for patented ones (Arora and Ceccagnoli, 2006). Views have been expressed that small firms have a tendency to patent their innovations as it signals strategic motives, to enhance position in negotiation and/or attract capital or alliances (Levin et al., 1987; Mazzoleni and Nelson 1998; Gans et al., 2003). Levin et al. (1987) further express that a patent can be a one of the most vital assets for small firms as they often lack access to complementary assets and can avoid the costs of acquiring these assets if they have a patent. Further, Gans et al. (2003) conclude that small firms with patents in strong appropriability regimes are more likely to seek co-operative strategies whereas in weaker regimes the tendency is to enter into competition. Although from the Cohen et al. study large firms have a tendency to patent in stronger regimes as well, the findings of Gans. et al. (2003) could highlight the fact that when a small firm has a strong patent it is able to attract potential partners and gain access to complementary assets, whereas in weaker regimes competitors would pursue developing a similar competitive product and therefore competition is the only option. This further indicates that the strategic uses of patents could be expected to differ between small start-up firms and incumbents. Whereas larger firms often have the complementary assets needed to commercialize their innovations they do not need to enhance their negotiation positions to attract capital and can commercialize the product themselves as is.

Patenting to earn licensing revenue is ranked low in the responses from the CMS study (Cohen et al., 2000). A possible reason for this is that the firms in the study were large manufacturing firms. It is logical to assume that large manufacturing firms focus more on their own R&D activities rather than patenting innovations that are outside their own manufacturing abilities and/or business model and licensing to outside parties in possibly unrelated industries is simply not pursued. However, large firms appear to be more likely to enter into cross licensing agreements with other partners that hold patents that are of value to them (Cohen et al., 2000). It can be argued that with such cross licensing larger firms indirectly earn licensing revenues where the payments are in form of other patents. It is further logical that patenting an innovation with the aim to license is more attractive for products.  

12 It is possible and perhaps likely that larger firms such as 3M and Colgate are also protecting themselves from possible lawsuits from idea contributors, and therefore turn away individuals that share their new product ideas with them.
smaller firms and innovators that have developed a new product, as they lack the full manufacturing and/or marketing capabilities to successfully commercialize the product. Hence, instead of investing in the complementary assets themselves, smaller firms can license the right to their innovations and have the potential to earn revenue from the patent solely.

**Reasons not to patent**

The highest ranked reason, why firms do not patent, is difficulty in demonstrating novelty. Essentially it could mean that the innovations are simply not patentable as they do not fulfill the criteria of novelty. It is however hard to state the reasons behind this response and whether this difficulty is the consequence of a flawed patent system but this issue is not addressed in this thesis. Other responses from the studies are however more interesting and relevant to understand and discuss.

Ease of inventing around a patent is ranked second for reasons why firms decide not to patent their innovations (Cohen et al., 2000). Firms are afraid that the innovation can be imitated without infringing the patent and therefore the patent will not provide enough protection. Mansfield (1981) found that the time required for duplicating innovations was less than 4 years for 60% of the innovations and further the cost of imitation is about 65% of the innovator's cost to originally develop it (Cited in Lieberman and Montgomery, 1988). This is interesting especially when firms believe that ease of inventing around exists. Such situations the patent can be viewed as a waste of time and money. Levin et al. (1987) note, that there is difference between major and typical innovations, where the time and cost to imitate major innovations are higher. Further, they concluded that between products and processes, products are slightly quicker to imitate. As we will see later in this thesis, it is in these situations where firms might be better off in choosing secrecy rather than investing time and other resources in the patent application that would not serve its purpose.

The third highest ranked reason for not to patent, is disclosure of information in the patent application that provides detailed description of the innovation. Even though this reason is ranked third on average, roughly quarter of the respondents ranked it the highest (Cohen et al., 2000). When viewed together with the ease of inventing around, this reason becomes more interesting. As patents are essentially blueprints of the innovation, it is logical to assume that
firms refrain from disclosing information if they believe there is a risk of other companies inventing around their patent. It is as well fair to assume that disclosure of information can speed up the process of imitation and keeping information secret could therefore be more effective in delaying the entry of a competitor.

The fourth and fifth ranked reasons why firms choose not to patent their innovations are application costs and cost of defending patents in court, respectively. The cost of application which includes the time of preparing patents, legal aid, application and maintenance fees can be costly. If the perceived protection or benefits of patenting the innovation are not obvious these costs can further be viewed as unnecessary. Whether the costs of the application are justifiable must therefore lay in the value of the patent for the innovator. For small innovations and products with limited market potential these costs can be considered high but for larger innovations these costs are relatively cheaper, as application costs will be a smaller percentage of the time and total investment that is needed to commercialize the product. The fifth and lowest ranked reason for why firms choose not to patent their innovations is the cost of litigation and protection of the patent in court. This is interesting, especially since Cohen et al. (2000) find that these costs demotivate small firms rather than larger firms from patenting.

After having discussed the reasons why or why not firms decide to patent their innovations it is can be argued that patents by themselves rarely provide the protection that they were originally intended to provide. The type of the innovation can further have effect on how much protection the patent will provide and how well equipped the innovator is to protect the patent, either with patent blocking strategies or protection through the use of legal processes. Patents seem to be only a hurdle for imitators rather than effective protection from market entry. It also becomes apparent that smaller firms stand at a disadvantage when it comes to protecting their patents. Informal discussions have further noted that larger firms have been seen to use their lawyers to intimidate smaller firms and independent innovators that hold patents. One example the author can mention is one conversation on the topic where an innovator accused a larger firm of infringing on his patent. His accusations were simply replied with “Good luck, we have more lawyers.”, possibly discouraging the innovator from filing a lawsuit. Therefore it seems that smaller firms stand at a serious disadvantage of using patents as a protective strategy for their innovations and do not build the same entry barriers
that patents of larger firms do. None the less, patents do provide some advantages as they can also be preventive and protect innovators from lawsuits and increase negotiation positions. For instance Gans et al. (2003) concluded that in order to attract venture capital a patent can be a vital asset to start-up firms. The seemingly weak protection of patents leads to the importance of understanding other appropriability mechanisms and the next mechanism that will be investigated is secrecy.

Secrecy

Secrecy or trade secrets are defined by Torres (2001) as any confidential information with commercial value, reasonably protected from disclosure by its rightful holder. It could be a formula, process, device or compilation of information used in a business, which bestows the owner an advantage over competitors. Secrecy scored considerably higher above patents in the CMS study and in general literature it is agreed that the choice of secrecy over patents -in combination with other mechanisms -or not- is more relevant for processes as described earlier. When it comes to product innovations however, the literature is divided. Cohen et al. (2000) note that the sharpest difference between the studies (p. 13) is the increased role of secrecy in protecting product innovations. In the CMS study, secrecy tended to be ranked first or second for about for 70% of the responding firms (24/33) whereas in the same 33 comparisons, industry secrecy was never ranked first or second in the Yale Study (Cohen et al., 2000). Cohen et al. (2000) noted that use of secrecy has increased compared to the earlier Yale study by Levin et al. in 1987. As stated earlier in the thesis, in the investigation of patents, firms find that patents often disclose too much information and/or are easy to invent around. This disadvantage with the use of patents can somewhat be counteracted by secrecy. Leiponen and Byma (2009) concluded that strategic choice for small firms in Finland is between secrecy and speed to market i.e. lead time. Their findings are similar to other studies of small firms. Arundel (2001) finds that small firms perceive patents as less efficient than trade secrets (cited in Leiponen and Byma, 2009). None the less other studies note that patents can be of more value than secrecy to small firms as it can enhance their negotiating position and thereby attract venture capital or enable them to enter into joint ventures (Levin

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13 He further goes on stating: [...No Registration requirement or any other formality is necessary in order to be protected by trade secret law., are can be used to exclude competition from knowledge that otherwise could benefit the competition and therefore excluding them from potential rents from the innovation. ] - Torres

14 the CMS and Yale studies
et al., 1987; Gans et al., 2003; Mazzoleni and Nelson, 1998). Without understanding the practical use of secrecy, it is hard to generalize about the usefulness and therefore it is important to elaborate on secrecy in practice.

**Secrecy as an alternative to patents**

Secrecy has been viewed as being an alternative to patents (Teece, 1986; Levin. et al. 1987; Cohen et al. 2000). The benefits that trade secrets provide for innovators, beyond patents, are a potentially longer lifespan relative to patents, no application and maintenance fee and no disclosure of information. Whereas patents have limited time of protection, trade secrets can in theory be kept proprietary indefinitely. A commonly known example is that of the Coca-Cola recipe. This example is most likely partly myth or an urban legend, but the tale tells that only a select few people know the exact recipe. Further, where patents disclose information about the innovation, secrecy does not. The innovator can therefore hold imitators at bay and potentially create a higher barrier for imitators if the product cannot be easily reverse engineered, especially if information in the patent description could benefit the imitator for inventing around the patent. Further, trade secrets are not formally applied for, and the innovator avoids paying application fee, maintenance fee and legal fee tied with patents, and saves time by not going through the application process of the patents (Cohen et.al, 2000).

Strategies that involve secrecy are none the less exposed to risks and Teece's words come to mind where he states that secrecy should only be used if a firm can put its product before the public and still keep the underlying technology secret (Teece, 1986 p.287). As was noted by Mansfield (1985) imitators can successfully duplicate an innovation within 4 years for 60% of innovations and therefore promise of extended time of protection should be viewed carefully. Further, as opposed to patents, trade secrets do not a grant a legal monopoly to the holder. This means that if an imitator can successfully imitate or reverse engineer the product, he does so legally and cannot be penalized for copying the product or innovation (Bernard and Yiannaka, 2010; Torres, 2011). innovators that use secrecy however can counteract the threat

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15 As Coca-Cola was a cough syrup and new innovation it most likely could have been patented. If it had been patented, other manufacturers could have marketed the product as being identical, when the patent expired. Although the trademarks would have had some strength, it is worth to question whether their market share would be as large as they still can say that no one else has exactly the same recipe.

16 Footnote 61. page 28
of imitation to some degree and take the measures of using legal documents such as non-disclosure agreements, non-competition agreements and other forms of confidentiality agreements, with their employees or other partners. The use of legal documents are important as in order for trade secrets to be protected in the court of law, innovators must be able to demonstrate that it –the innovator- has taken all reasonable measures can to keep information private. Trade secret law is designed to inhibit the movement of sensitive information from one company to another but in reality there are threats of competitor illegally obtaining protected information. In situations where there is suspicion of illegal acquisition of trade secrets or other confidential information it is important to know where the burden of proof lies if it comes to pursuing the matter in court. The burden of proof lies with the plaintiff that means that the plaintiff needs to prove that his rights have been violated and the information about his innovation was obtained illegally. Therefore, there is the chance of costly legal expenses to protect the innovation if there is a suspicion of a trade secret breach. These costs could therefore be seen as being similar to the costs of defending patents in courts as was covered in the earlier chapter. These costs seem to be overlooked in literature and seem to be mostly associated with patents. In addition to costs of defending the trade secrets in court the innovator risks being subject to infringement lawsuits. Without a patent, it is likely that innovators stand at a disadvantage in the court themselves if subject to an infringement lawsuit. Otherwise the innovator could rely on the patent and have a chance of having the existing patent revoked.

**Secrecy in combination of patents**

As secrecy can be viewed as an alternative to patents, there are situations where they

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17 http://definitions.uslegal.com/p/proprietary-information/

18 (a) Whoever, with the intent to convert a trade secret, that is related to or included in a product that is produced for or placed in interstate or foreign commerce, to the economic benefit of anyone other than the owner thereof, and intending or knowing that the offense will, unjust any owner of that trade secret, knowingly – (1) steals, or without authorization appropriates, takes, carries away, or conceals, or by fraud, artifice, or deception obtains such information; (2) without authorization copies, duplicates, sketches, draws, photographs, downloads, uploads, alters, destroys, photocopies, replicates, transmits, delivers, sends, mails, communicates, or conveys such information; (3) receives, buys, or possesses such information, knowing the same to have been stolen or appropriated, obtained, or converted without authorization; (4) attempts to commit any offense described in the paragraphs (1) through (3); or (5) conspires with one or more other persons to commit any offense described in paragraphs (1) through (3), and one or more of such persons do any act to effect the object of the conspiracy,(...) shall, except as provided in subsection (b), be fined under this title or imprisoned not more than 10 years or both. (b) Any organization that commits any offense described in subsection (a) shall be fined not more than $5,000,000 – 18 USC Sec. 1832 -Chapter 90 – Protection of Trade secrets.
complement each other and using a combination of secrecy and patents can be effective. For instance, secrecy and patents are somewhat inescapably intertwined in the early stages of patent applications, especially in the stages prior to patenting an innovation. If an innovator discovers a patentable innovation, disclosure about proprietary information can destroy the novelty criteria and thereby the chance of being granted a patent, i.e. by public disclosure. Further, as stated by Cohen et al. (2000), most firms typically want to keep most innovations secret at some point in their development (p. 6 footnote 10) and firms may rely on secrecy in early stages of development.

However, a more complex combination of secrecy and patents exists and can be used for strategic purposes. In some situations secrecy can be used in a combination with patents for parts of a patented innovation and elements of the innovation can be kept out of the patent application and its claims. Examples of this can be found in the chemical industry where firms apply for one or more patents for different elements of a chemical, while keeping other elements of the innovation a secret (Arora, 1997, cited in Cohen et al. 2000). This strategy therefore partly compartmentalizes the knowledge and creates a puzzle with a few individual pieces missing that masks the larger picture. Similarly to the effect of patent blocking this requires filing multiple patents and therefore increases patent costs. In addition, filing multiple patents can also increase R&D costs of competitors and imitators by making it more difficult to imitate and therefore this action might deter entry. When combining these mechanisms is plausible, it can bear advantages as it increases the protection from imitation. In theory it can as well prolong the lifespan of the protection beyond the granted patent period if the innovator is successful of keeping the information undiscovered by competition.

Using secrecy in combination with patents is none the less exposed to risks. By choosing to not disclose information in the patent and keep it secret there is the risk of the patent falling into the category of being too broad or too narrow, depending on the type of combination. This means that if a firm withholds information from the patent application and a competing firm discovers the secret there is the potential that the competing firm can enter with its own related innovation without the risk of infringement and the original patent is further at risk of invalidation in court. An example of this is the case of Scripps Clinic & Research foundation where its patent was found invalid on the grounds that the innovator had failed to disclose the
best mode of operation for carrying out the innovation\textsuperscript{19} (Merges and Nelson, 1990). Therefore, combining secrecy with patents has the potential to be the cause of invalidation in courts, along with higher maintenance and application costs.

Secrecy can have the advantages of providing the innovator with similar protection of patents or be used in combinations of patents with the aim of strengthening the protection. Secrecy can as well have other advantages and innovators can gain time while developing and designing their products. Dechenaux et al. (2008) concluded that when lead time advantages are important, innovators should delay commercialization until the product has been developed. Filing a patent before the product is fully designed and developed can be hazardous for the reason that the patent can have claims that are insufficient or immature. The protection of secrecy is further dependent on the characteristics of the product and how easily it can be reverse engineered. If many innovators are working in the same area developing related products, there will be risks associated with a competitor launching a product before the innovator files for his patent and therefore he is at risk of being blocked from entering the market.

\textbf{Complementary Assets}

Complementary assets is a term attributed to D.J. Teece (1986). These are assets that are complementary to the innovation, and in the literature they are often referred to as complementary manufacturing and/or sales. These assets can include manufacturing, sales, services or knowledge or simply any other assets that can benefit the innovator and assist him in developing and/or commercializing the innovation as a product. Teece (1986) studied the relationship of how these assets affect the ability of the original innovator to capture the profits from the innovation. These assets can determine if the innovator or a follower will ultimately stand as the winner. One of the main points to be taken from Teece's article is that owners of complementary assets might benefit more from the innovation than the innovator himself, for instance in joint ventures, co-production agreements and other contractual modes or even customers. Teece's framework consisted of appropriability regime, dependency on complementary assets and the dominant design paradigm (1986; p. 286). These concepts will be briefly explained to clarify the concept of Teece's contribution, but these factors, and

especially the appropriability regime, serves as great inspiration for the conceptual framework of the author of this thesis, The Potential of the Appropriability Regime or PAR framework.

**Appropriability Regimes**

 Appropriability regime, defined and described by Teece (1986; 287) refers to the environmental factors, excluding firm and market structure, that govern an innovators ability to capture the profits generated by an innovation. Further, in tight appropriability regimes technology is relatively easy to protect but when the regime is weak the technology is almost impossible to protect (Teece, 1986; 287). Teece's appropriability regime therefore implies that depending on type of innovation, the choice of appropriability strategy can affect potential profits of an innovation. The nature of the knowledge involved is relevant as well. Explicit knowledge is often more easily replicable while tacit knowledge is harder to articulate and transfer as it is embedded in firms’ routines and capabilities.

**The Dominant design paradigm**

Teece used Abernathy and Utterback (1975) dominant paradigm theory for his analysis. The dominant design paradigm consists of the preparadigmatic paradigm and a paradigmatic paradigm.

The preparadigmatic paradigm describes the earlier stages of an innovation where for instance technology has recently emerged in a new field and is still in developing stages. At this stage firms are striving to establish the new technology and the focus is on the design and firms often keep the design afloat, with loosely defined concepts and processes (Teece, 1986). At this stage firms go through trial and error to develop technology to fit the needs of its customers and essentially the aim is to come up with the best design.

In the paradigmatic stage, some designs have prevailed and gained the acceptance of customers and firms with the best designs move from competing on design to price (Teece, 1986). Once the dominant design has emerged, incumbents seek to gain competitive advantage through economies of scale and learning curve advantages and lowering unit costs (Teece, 1986).
Dependency of Complementary Assets

Teece further describes the different relationships between assets in terms of dependency which essentially describes the relationship between the innovators and owners of the complementary assets. The complementary assets can be generic, specialized or co-specialized.

Generic complementary assets are those that do not need to be tailored to the innovation and therefore neither party needs specialized capital investments in order to bring the innovation to life (Teece, 1986).

Specialized assets can be divided into two sub groups; unilateral dependency of asset on an innovation, and unilateral dependency of innovation on an asset. In a unilateral dependent relationship one party is dependent on the other but not the other way around. For instance, if an innovator is dependent on complementary assets, it is likely that the complementary asset owner holds more bargaining power in negotiations of price and therefore he can appropriate more of the profits to himself (Teece, 1986).

In a co-specialized relationship both parties are dependent on each other in terms of making profits from the innovation and the relationship is not likely to succeed without participation of the other (Teece, 1986). Bargaining power in a co-specialized relationship is therefore likely to be balanced between the two parties. The importance of these dependencies becomes clear for instance when an innovator needs to acquire these complementary assets in order to commercialize his innovation.

If the innovator lacks complementary assets he can either invest in these assets himself or seek to establish a contractual relationship with an owner of these complementary assets. If an innovator seeks to acquire the assets he will need to succumb to the relevant costs that are in some cases irreversible and depending on the assets needed. If he is inexperienced it can potentially affect his ability to make the innovation a success. For instance, an innovator with a product that is new on the market is at risk of being unsuccessful if he is inexperienced with the necessary technology. It was for example stated by Berends et al. (2007; 316) that endeavors, where innovators enter new markets without knowledge about the relevant
technology, these endeavors can collectively be described as being *suicidal* from a commercial standpoint and doomed to fail. In such cases, the innovator might be well advised to rather seek cooperation with owners of the complementary assets through a contractual relationship.

Contractual relationships can include licensing the technology, joint ventures or other contracts that provide access to the complementary assets or in other way facilitate the commercialization of the product. When innovators go into contractual relationship, they can avoid the risks of capital expenditure and make use of accumulated knowledge of the asset owner. Entering contractual relationship with a respected party can for instance add to credibility of the inexperienced innovator. This could be in the area of branding and if the partner has a reputation that is considered to be reliable or of quality, the innovator might expect spillover effects from that reputation. If the innovator enters into a contractual relationship he can benefit from the knowledge that is already in possession of the complementary asset owner which can potentially lower costs when developing the product.

None the less, there are risks involved and implicit costs when seeking contractual relationships. For instance, learning advantages of the innovator, that might take place alongside the development, can be lost to the contracting assets owner. On the other hand the assets owner faces the risk that the innovator will disappear with the technology. In other words both parties face the risk of being excluded from the venture. Further, owners of complementary assets might be discouraged if capital investments are high.

In cases where the bargaining power of the innovator is relatively low, for instance in weak appropriability regimes, the risk that the complementary assets owner disappears with the innovation is increased, meaning that the asset owner could commercialize the innovation without paying a share of the profits to the innovator.

**Lead time**

Lead time can have different meanings depending on context. Lead time as an appropriability mechanism is defined as *being first to enter the market with a new product and/or being ahead of their rivals*. (Davis, 2001; López and Roberts, 2002; Carow et al., 2004; Cited in
Laukkanen and Puumalainen, 2007). First movers gain advantages by acting early relative to peers, pioneer may establish a competitive advantage that enables it to garner positive economic profits (Lieberman and Montgomery, 1988: 41, cited in Carow et al., 2004). As stated by Carow et al. (2004:563) first-mover advantages can be viewed as resource that is rare, valuable, non-imitable and non-substitutable, and have been described arising from three primary sources: (1) technological leadership, (2) preemption of scarce assets, and (3) switching costs and buyer choice under uncertainty (Lieberman and Montgomery, 1998; 42-43).

Technological Leadership

Technological leadership is derived from learning curve advantages and success in patent and R&D races. Learning curve advantages stem from increased learning by doing and can lower costs of production, thereby strengthening the competitive position of firms in the market place. Success in patent and R&D races includes preemptive patenting as well as patent fencing (Lieberman and Montgomery, 1988). Technological leadership is therefore obtained through technological superiority, lower production cost or successful blocking of entry with the use of patents. What is interesting in these cases is that the lead time advantages that can be gained are directly connected to complementary assets.

Preemption of Scarce Assets

Preemption of assets, is described as being preemption of input factors and preemption of locations in geographic or product space. If the investments in facilities are needed to commercialize the innovation, competitors might be deterred from entering to the market (Lieberman and Montgomery, 1988). Carow et al. (2004) concluded that first-mover advantages rising from the preemption of scarce assets were present when the pioneer acted strategically and with asymmetric information.

Switching costs and buyer choice under uncertainty

Switching costs are defined as initial transaction costs, supplier specific learning and contractual switching costs. If initial transaction costs are relatively high customers can be deterred from switching to another product if they need to incur these costs again during
switching. Supplier specific learning stems from the learning behavior of the buyer that adapts to characteristics of the products and the user can find it costly to switch to a new product that does not operate in the same way. For instance when a customer needs to learn how to use specialized equipment it can deter him switching to another product. Contractual switching costs incur when the seller creates a contractual lock in, through a contract with the buyer (Lieberman and Montgomery, 1988). Further, buyer choice under uncertainty relates to asymmetry of information in favor of the supplier (Shamalensee, 1982, cited in Lieberman and Montgomery, 1988) for instance brand loyalty, where the perceived benefits of a homogenous product are interpreted in favor of one brand over another. This means that all things equal, the customer will rather choose a brand he recognizes and trusts even though products are identical.

Disadvantages of moving first

As moving first can bear advantages there are disadvantages as well. As described by Lieberman and Montgomery (1988;47) these are; (1) the ability to “free-ride” on first mover investments, (2) resolution of technical and market uncertainty (3) technological discontinuities and (4) incumbent inertia.

Costs of colonization of new market are born by the first movers, for instance to build awareness for a new product or innovation in the market when attracting new customers. Later entrants can free-ride on first entrant efforts. Also costs of imitating can be lower than original cost of the innovator (Mansfield, 1985). Therefore, the first-mover can bear the cost of developing and creating the new market.

In terms of resolution of technical and market uncertainties it is pointed out in the literature that when there is rivalry between two or more designs i.e. competition for a dominant design, later entrants can benefit by waiting while the dominant design is emerging, avoiding the risks of entering with a losing design (Lieberman and Montgomery, 1988). Further, when firms enter the market with a new product, especially in a new market, there is the chance that customers develop new needs for the technology which the later entrant is able to capitalize on by entering with slightly modified versions and fill market gaps that the first mover is perhaps unable to respond to quickly enough.
Technological discontinuities refer to the process of creative destruction where a technology essentially becomes outdated as new technology enters the scene. Therefore, if the first mover enters a market with a design that will not be the ultimately be the dominant design, the first mover can fall victim to the new technology that takes over the market.

Incumbent inertia is the fourth reason listed as disadvantage of moving first and describes a situation where the incumbent firm may be locked in with its capital investments and be reluctant to shift the focus from the existing product lines or even be reluctant to cannibalize them. Further, after having moved first into a market and experienced growth, incumbents may become organizationally inflexible as processes and procedures become standardized. The inflexibility prevents organizations from adapting to changes in their environment and therefore they lose their first-mover advantage (Lieberman and Montgomery, 1988).

**Lead time in practice**

Cohen et al. (2000) concluded that in manufacturing industries lead time is *emphasized most heavily* along with secrecy and was further the overall highest ranking appropriability mechanism and scored patents, lead time and complementary/sales and assets. Of all the industries, lead time received the lowest ranking in electronic equipment, but it is noted that it might represent an overall low effectiveness of any of the appropriability mechanisms within the industry (Cohen et al., 2000; 6). Levin et al. (1987) found that lead time along with learning curve and complementary sales and service efforts were most effective for protecting product innovations and more effective than patents. This is similar to the findings of Leiponen and Byma (2009) that concluded that secrecy and lead time were most important for small firms.

What is interesting about these findings, does not relate to the effectiveness of lead time itself but rather how is defined. Under the definition of lead time as presented, lead time or first-mover advantages and technological leadership is achieved by moving down the learning curve, by preemption of scarce assets or by switching costs and buyer choice under uncertainty. However, in Levin et al. (1987) lead time and learning curve appear to be

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20 “Lead time appears to play the most important role of all the mechanisms in steel, metal product, general purpose machines, special purpose machines, computers, communications equipment, TV/radio, medical equipment, precision instruments, auto parts, cars and trucks and aerospace.” - Cohen et Al, 2000, p. 10 footnote 21
separate mechanisms rather than relating to the technological leadership as defined under first-mover definitions. This leads to the question if lead time is an individual mechanism.

**Is lead time an individual mechanism?**

Cohen et al. (2000) acknowledge that appropriability mechanisms *may be linked causally*, for instance, that a patent can provide the holder with lead time advantage and factor analysis shows that lead time *partially loads on patents*, meaning that lead time appropriation is a result from the use of patents. Further they find that complementary assets and lead time are *so closely linked to one another . . . that they may be collectively viewed as a distinct appropriability “strategy”* (p.8). Cohen et al. (2000) further suggest that the appropriability mechanisms should be narrowed into three categories, placing lead time with complementary assets and the other groups should be categorized as legal documents (patents) and secrecy. This is somewhat logical and if one views the three sources of first mover advantages, especially technological leadership and preemption of scarce assets, it can be argued that lead time can be gained by acquiring complementary assets. If one looks at patents and Cohen et al. (2000) words that lead time loads on patents one could as well argue that patents can be a source of asymmetry in information. Carow et al. (2004) further found that first-mover advantages were present when the pioneers acted strategically and with asymmetric information. As the secret holder has more information that other parties, secrecy can be a source of asymmetry of information, and one could argue that secrecy can act as a source for lead time advantages for instance by preemption of assets. Further, in practice a patent can act similarly as secrecy, since the owner of a patent has created a barrier for entry. In theory the patent can therefore provide some lead time advantages. A patent can even directly affect buyer choice under uncertainty as can easily be argued for with examples from the drug industry. Manufacturers of patented drugs can build their brand names over a period of years, when the patent is valid and after the patent is expired competitors are allowed to enter the market with generic drugs. However, the brand has been established and the customers have built trust towards the brand. Lead time can therefore be directly linked to the use of patents, or rather gained through patents.

Dechenaux et al. (2008) conclude that where lead time advantages are important, innovators should wait until the product is fully developed. Then as a result of moving first, innovators
can establish relationships with market parties and establish a brand name and hold the market when competitors arrive. This is in line with Cohen et al. (2000) remarks on whether lead time should be viewed as an independent mechanism or if it should be grouped with complementary sales and assets. This assumption is logical as to noting the factors where first mover advantages—technological leadership, preemption of scarce assets and buyer switching costs— are originated from according to Lieberman and Montgomery (1988). The question about lead time opens up the door for a more intimate look into the relationship between the different appropriability mechanisms, to understand how they are related and how they can be seen as linked to each other.

**Relationships of mechanisms**

Previous sections have focused primarily on the appropriability mechanisms independently to provide the depth and insight needed to explain in what situations and what benefits each mechanism can provide an innovator with. This has been important both to establish knowledge about the mechanism and also to build the foundation for the practical use of the mechanisms. This section however, provides a view of the relationships between the mechanisms and builds on the theoretical part to further understand the effectiveness of the relationship.

Figure 2.1 presents a schematic view of the appropriability mechanisms to help to conceptualize the relationship between them. The figure describes the relationship of the different mechanisms as they are portrayed in theory except that a combination of secrecy and patents is added to the picture. The reason for such an approach is that patents and secrecy can sometimes be alternatives but sometimes are complementary as well. This will be elaborated on in this section. Further, complementary assets and sales are combined in one category to simplify the view and avoid repetition.
Figure 2.1 Relationship of the appropriability mechanisms

A1: Patents ↔ Complementary Assets

The effect of patents on complementary assets is seen as that patents can have a positive effect on the acquisition of complementary assets. Literature states that patents can increase bargaining power for small firms and thereby grant them access to complementary assets (Cohen et al., 2000, Levin et al., 2000, and Gans et al., 2003). In turn for similar reasons, if a innovator has access to complementary assets, it can diminish the need for a patent if complementary assets are seen to be sufficient protection for the innovation and a patent is unnecessary. Patents and complement and complementary assets can also complement each other for instance in a co-specialized relationships.

That patents have a positive effect on the acquisition of complementary assets is partly supported by an independent research of the author and his discussions with innovative firms and other innovators. Innovators, especially small innovators can find themselves in a disadvantageous position if they approach a larger firm without having a patented innovation. The possible reason for this disadvantage, can be that patent signals intent of the small innovator and essentially shows that he is capable and has serious intentions to commercialize his innovation. For an innovator that lacks complementary assets, a patent can therefore increase bargaining power of the innovator. Approaching a larger firm with simply an idea
places the innovator in a weak position and bears the risk of disclosing the idea with out having a strong case for being rewarded with compensation. The information about a new product can be valuable for the larger firm that can run with the innovation if they see fit, leaving the innovator with little value if no means have been made to secure the disclosure. The patent can as well act as a protection for the innovator during discussions with the complementary asset owner and without a patent the innovator bears the risk of disclosing information unilaterally, as a patent essentially provides some protection from imitation.

For innovators that control complementary assets patents are likely to be less important than for innovators that lack access to complementary assets. An innovator that controls complementary assets can be better positioned to commercialize the product. Unless innovators are prepared to go to legal court to protect their patents from infringements the patents provide little extra protection and therefore he might be better off with devoting his resources to commercializing the innovation.

Further, in situations where there is an option for a natural monopoly by the control of complementary assets a patent would not serve as a big additional protection, if the resources are scarce rather than generic or abundant. On the other hand when the resources are generic or abundant and multiple manufacturers are able to manufacture the product, a patent in theory has more value as it creates a barrier for entry. For similar reasons, a patent could be more valuable for independent innovators that need generic complementary assets. This is derived from the fact that when complementary assets are generic, it is relatively easy for other complementary holders to enter the market, and in turn a patent has the possibility to block competitor entry. Ziedonis (2003) comes to a similar conclusion and finds that patenting in fragmented markets is more prevalent and patents are held by multiple players rather than few large corporations or players.

Patents can open up the potential for a co-specialized relationship under the definition of Teece (1987) where the complementary asset owner needs the patent in order to manufacture the product, for instance by licensing or joint ventures. Access to complementary assets whilst having a patent to protect the innovation can therefore be beneficial for both the patent owner and the complementary assets owner.
The conclusion is that a patent can serve as a bargaining chip for the independent innovator in negotiations and in establishing relationship with complementary asset owner, whereas complementary asset owner would not need to patent unless the complementary assets are generic and they need the patent to create a barrier for entry. The patent of course provides some protection, but when resources are generic, the costs of protecting the patent, must provide the complementary asset holder with benefits that outweigh the benefits of devoting their time and resourcing towards commercialization of the product.

A2: Patents ↔ Lead Time

The effect of patents on lead time is that patents can help deter competitors and imitators from entering the market and building strong patents contributes positively to lead time as it can provide time to establish first mover advantages. Cohen et al. (2000) conclude similar as they note, that in their factor analysis that lead time loaded partially on patents. Lead time in turn is unlikely to contribute much to patents, and moving first into the market can have a negative effect on the patent itself as it risks premature patenting of a design that is not optimal.

If the patent holder is successful at deterring entry he can use the time to establish lead time or first mover advantages. These advantages have been described as technological leadership and acquisition of scarce resources or increasing buyer switching costs (Lieberman and Montgomery, 1988). Technological leadership can be gained through learning curve advantages as the innovator is freed from competition. Acquisition of scarce resources can be derived from the fact that the innovator is essentially the only player that can benefit from the resources for the purpose of commercializing his innovation. A patent can further increase buying switching costs, for instance by using the time in the market to build their brands. Deterring entry can therefore allow the innovator to establish lead time or first mover advantages that can be a competitive advantage for the innovator.

Moving first into the market does however contributes little to the protection of a patent. If a product is commercialized prematurely it can destroy the novelty of the innovation and the innovation will not be patentable. Filing a patent application too early can lead to the patent lacking claims and therefore the acquired patent will provide limited protection. The first mover advantages that were mentioned above could have unforeseen benefits, for instance in
technological leadership if moving first into the market will lead to a patented innovation in the future, and similar can be said about preemption of scarce assets and buyer switching costs. However, the direct effect of lead time on patents themselves is little or none.

Further, there is therefore tradeoff between developing a product and perfecting the design before filing a patent on one hand or rushing to commercializing the product. Waiting too long will increase the risk that other innovators will come up with a similar product and enter the market. This is however partly dependent on the legal environment. For instance, in the United States changes have been made to the patent law that relates to this issue. The patent system had a first-to-invent clause. The clause had the effect that an innovator was granted a patent if he provided proof that he had invented the innovation, even if another innovator had filed for a patent. Recent legislation in patent law has been changed and now the innovator that is first to file for a patent will be granted the patent and post grant reviews will not be authorized\(^\text{21}\). Therefore waiting too long can be seen as having increased risked related to others inventing or commercializing a similar innovation. Rushing to the market can however lead to a premature patent application that will perhaps be lacking claims or in other ways be immature. Therefore the innovator who rushes to the market might file a patent application that will provide limited or less protection than if he had spent more time in developing the product before filing the patent.

The conclusion here is therefore that patents effect lead time advantages more positively and have more effect than the effect of lead time on patents. A strong patent will buy the innovator more time to make develop the advantages of moving first into the market whereas moving first into the market does not increase the protection of a patent. Rather, moving too early into the market or rushing the process of filing for a patent can result in a immature patent that will lack claims and provide less protection than a mature one.

**A3: Secrecy ↔ Complementary Assets**

The effect of secrecy on complementary assets is limited. The use of secrecy and complementary assets can help to protect the innovation but secrecy does not have a direct impact on complementary assets, especially in terms of acquisition. In turn, complementary

\(^{21}\) S. 25 America Invents Act, passed march 9th 2011 – source http://en.wikipedia.org/wiki/America_Invents_Act
assets can have a positive effect on secrecy, meaning that if the complementary asset holder is well positioned and can protect the innovation by keeping the information secret, he might want to resort to keeping the information secret rather than filing for a patent. Therefore, if an innovator owns the complementary assets himself he might be more likely and better off to protect the information using secrecy.

Secrecy can both have positive and negative effect on the acquisition of complementary assets. The notion that secrecy have a negative impact on the acquisition of complementary assets is derived from what has been discussed before that patents can signal intent and perhaps capability of the innovator. Larger firms are hesitant to enter into discussions with non patent holders and are hesitant to sign non-disclosure agreements, which is a form of secrecy. As was mentioned earlier, a patent it signals some level of capability of the innovator while secrecy does not specifically signal capability or intent. Therefore larger firms can be deterred from entering into discussions with a innovator that uses secrecy.

This response of larger firms that use patents as a screening mechanism for outside ideas can be seen as being logical from their standpoint. First, it screens the capable ones from the non-capable ones only have an idea and secondly it can protect the larger firms from lawsuits from outsiders that share ideas and want to be compensated for their input. This is supported by both discussions with other innovators as well independent research of what channels larger firms offer to innovators. Both the 3M corporation and Colgate invite customers to submit their ideas. However, for formal discussion a patent is needed. It is further likely that for larger firms, it is beneficial to maximize outside ideas from customers that approach them with a certain need they want to be fulfilled rather than an idea for a commercial venture. A patent therefore is perhaps an efficient way to use for these screening purposes.

However, if the innovator has superior knowledge that he can protect with secrecy it can act as a source of strategic advantages as it essentially is a source of asymmetry of information. As described by Carow et al. (2004) asymmetry of information can be valuable, for instance in the acquisition of scarce resources. Therefore, having superior knowledge can provide the innovator in a better position and he will be able to access resources at a lower cost as he has more information about how they can contribute value to the venture.
The effect of complementary assets on secrecy perhaps connects to the discussion of patents. If the innovator has complementary assets, the need for a patent might be less than if he lacked access to complementary assets. Therefore if the innovator is a owner of complementary assets, he might be more inclined to choose secrecy over patents if he either sees it as efficient protection for the innovation or that his resources are better spent on commercializing the innovation rather than spending the resources on protecting the patent.

The conclusion is therefore that secrecy provides limited bargaining power with complementary asset owners, except when secrecy provides enough asymmetry in information that the innovator can access the complementary assets at a lower price than if complementary asset holder shared the same knowledge. In turn, if the innovator himself owns the complementary asset needed, he should be more likely to choose secrecy over patents to protect the innovation. This is likely to be the fact in situation where secrecy provides either more protection than patents or that the benefits of using resources to commercialize the innovation outweigh the benefits of a patent.

**A4: Secrecy ↔ Lead Time**

The effect of secrecy on lead time can be both positive and negative. First, secrecy is important in the early stages of a patent, which can contribute lead time advantages. Therefore secrecy can have an effect on lead time through a patent. Secondly, if secrecy provides similar protection as a patent would, secrecy is likely to provide similar advantages that will result in lead time or first mover advantages, i.e. technological leadership, preemption of scarce assets and buyer switching costs. In turn, the effect of lead time on secrecy is limited. Rushing to the market can have negative impact on the future potential of the innovation as it can give information to the market.

In terms of the positive effects of secrecy on lead time the following can be stated. Learning curve advantages can be protected and kept within the corporation with use of NDA's, confidentiality agreements and non-competition agreements with employers and partners. Therefore technological leadership can be protecting with secrecy. Secondly, secrecy can also be described as being a source of asymmetric information. Therefore, if the innovator has superior knowledge to acquire complementary assets as was noted in the relationship of
complementary assets and secrecy it can help with preemption of scarce assets. Lastly, buyer switching costs can be increased by either brand building or if secrecy can protect the innovation from imitators to successfully imitate the innovation. An example of this is the Coca-Cola recipe, which has been kept secret allowing the Coca Cola company to build a strong brand and a relationship with its customers and no other products have been viewed as being identical to the Coca-Cola soft drink.

The effect of lead time on secrecy is limited. If secrecy is not an effective protection against imitation, rushing to the market can have adverse effects and knowledge about the innovation leaks out in a short period of time. If the innovation can be easily reverse engineered when it is launched before the public, imitators can do as they can see fit. Therefore the innovator looses its technological leadership. Preemption of scarce assets can in theory result in use of secrecy in later stages of the innovation, if the innovator can use secrecy post acquisition of these resources. Buyer switching costs are further more likely to be a result of secrecy or other protection rather than the other way around.

The conclusion is therefore that secrecy can contribute to technological leadership as it can protect learning, preemption of scarce resources if the innovator has superior knowledge and increase buyer switching costs. The effect of lead time on secrecy is limited, although there might be situations where lead time advantages might lead to more use of secrecy. For instance after an innovator has preempted scarce resources and can then in later stages use secrecy to gain technological leadership or increase buying switching costs. Rushing to the market can however result in loss of lead time advantages if secrecy is not a sufficient protection and therefore it can be said that moving first into the market does will not increase the use of secrecy. Innovators should therefore exercise caution before rushing to the market without efficient protection for the innovation.

**A5: Complementary Assets ↔ Lead Time**

The relationship of complementary assets and lead time is perhaps more intertwined than for the other mechanisms. For instance, technological leadership can be directly attributed to complementary assets. Preemption of scarce assets can essentially translate into preemption of complementary assets. Lastly buyer switching costs can also be directly linked to
complementary assets, whether these assets in the form of protected knowledge, a strong brand or a good relationship with the customers. This is perhaps what Cohen et al. (2000) meant when they discussed that complementary assets and lead time should be viewed together as one appropriability rather than two separate mechanisms.

However, if the relationship is viewed in the sense that lead time advantages source of moving first, it can be said that complementary assets are necessary in order to obtain lead time or first mover advantages. Therefore, simply moving first is unlikely to provide any benefits if the innovator has no access to complementary assets that are beneficial to the commercialization. Therefore, complementary assets can be described as contributing positively to lead time. In turn lead time does not contribute to complementary assets. If the innovator is able to gain either access or have an effect on complementary assets through lead time or moving first, it can essentially be traced back to knowledge, finance or other complementary assets that will provide the innovator with benefits.

The conclusion is that lead time advantages are unlikely to be achieved without complementary assets. Technological leadership, preemption of scarce assets or buying switching costs all require complementary assets in some way or form and simply the fact of moving first will not have a large or any effect on complementary assets. Therefore lead time or first-mover advantages are achieved through the use of complementary assets but not vice versa.

A6: Combination of Secrecy and Patents ↔ Comp. Asset & Lead time

In general it can be said that using a combination of secrecy and patents can have similar effect on both lead time and complementary asset as secrecy and patents have individually. How effective the combination of the secrecy and patents depends on the ability to maximize the effect, for instance keeping some elements of the innovation secret while patenting others. The idea is therefore that using a combination of patents and secrecy can provide in some situations the optimal protection as it utilizes the most effective attributes from both secrecy and patents that can complement each other. The effects of combination of secrecy and patents on both complementary assets and lead time can therefore be viewed beneficial when the innovator combines secrecy and patents to reach the desired effect of maximizing the
utility of the other mechanisms. If an innovator has access to, or owns complementary assets, he might be more inclined to use a combination of patents and secrecy.

For a innovator that lacks access to complementary assets a patent can increase bargaining power with complementary asset holders. If the innovator can successfully patent the innovation while not disclosing information that are essential for the innovation he can be better positioned in negotiations compared to an innovator that discloses all information in the patent. Using secrecy can therefore decrease the risk that the complementary asset holders will imitate or run with the technology, whilst maintaining a strong bargaining position. The patent should provide some protection as well as it is a signal to the complementary asset holder.

It can also be stated that firms will in most cases use secrecy and patents to strengthen the protection around an innovation at some stage or phase. For a patented innovation that is manufactured and marketed, learning can be kept secret by the innovator, which is a form of combination. Using the combination can of secrecy and patents can contribute to technological leadership.

To list examples of how the combination of secrecy and patents can benefit the innovator and would be repetitive as it has been covered by analysis the mechanisms individually. Rather it is put forth here that combining the use of secrecy and patents can have the advantages of maximizing the protection for the innovator. The innovator can use the benefits of each mechanism to reach the desired effect in relation to complementary assets and lead time. Therefore this section does not provide any conclusions but is presented to point out how combination of secrecy and patents can be beneficial for the innovation and their effect on the other appropriability mechanisms.

Lastly, it must be mentioned that secrecy and patents can as well sometimes be alternatives and can substitute each other rather complementing each-other and inappropriate combination can result in less protection for the innovator. Therefore using a combination of secrecy and patents should be exercised with caution.\(^\text{22}\)

\(^{22}\) For examples on combination of secrecy and patents please see (1) the example of Robert Kearns on page 43 where he “he disclosed information both about operating principles as well as functionality of the innovation”. (p. 43) where the he would have been better of using a combination of secrecy and patents. Or
Co-operative strategies for Rotulus

The author of this thesis sees it as imperative to go into some type of co-operation with other parties in order to be able to commercialize the Rotulus innovation. As Berends et al. (2007) noted, entering a market with limited know-how about the technology needed falls into the area of being suicidal from a commercial viewpoint. Therefore co-operative strategies need to be investigated to understand how they can be beneficial in commercializing the innovation and understanding what type of relationships can be established with other parties.

Two distinct co-operative strategies for Rotulus believed to be an option. Either to seek revenue from the innovation through the market for products or through the market for ideas, i.e. either joint ventures/ manufacturing or licensing. Manufacturing the product is however not considered a realistic option. Manufacturing is not considered a real option due to a lack of resources and high risks associated with commercializing the product. For the time being the strategy that is believed to be realistic is to seek patent for the innovation, to license it or to go into joint ventures in manufacturing the innovation with a patent as a primary asset. This section has the aim to compare these strategies in order to provide recommendations at the end.

Licensing

The benefit of licensing is that it requires less upfront financial investments on behalf of the innovator as opposed to manufacturing and marketing the product. Teece (1986) stated that it is mainly recommended to enter into licensing agreements if an innovator holds strong patents and lacks access to complementary assets. However, licensing technology is exposed to risks, for instance that the potential partner will simply run with the technology early or late in the relationship, by either inventing around or simply imitating or copying. The case of Robert Kearns comes to mind, where he had invented windshield wipers for automobiles and presented his idea to the Ford Motor Company and during their meeting he disclosed information both about operating principles as well as functionality of the innovation (Davis, 2(2)) the case of Scripps Clinic & Research on page 25 of this thesis. As an example of a innovator that was worse off by using a combination of secrets and patents -intentional or unintentional- where he failed to disclose the best mode of operation for carrying out the invention, which resulted in invalidation of the patent.
2008; 9). Long story short, Ford commercialized Kearns' innovation and not until decades later did he receive compensation for his contributions after a court ruled in his favor. (Davis, 2008).

Licensing is a low-cost strategy compared to manufacturing and launching the innovation yourself. The disadvantage of licensing is that licensing revenues are likely to be a small percentage of the sales price. Independent investigation and conversations with innovators suggest that a realistic share for an innovator to earn in licensing fees is between 1,5-3% of the sales price depending on the type of patent and how much bargaining power it brings about. The position in negotiation of licensing fees will further be influenced by the relative effectiveness of the patent, which depends on the patent itself and the capability to protect the license in court. In that situation it is necessary to bear in mind that in the courtroom a small innovator is at a less advantageous position as opposed to a larger company with access to good legal aid and resources to protect the innovation. The type of innovation is also likely to come into play, as noted by Davis (2008), that the more codified and “observable in use” the knowledge is, the lower the cost of transfer (2008; 9). If the knowledge is codified, for instance; a formula, software or similar, the codified knowledge can easily be copied between organizations whereas learning by doing and other knowledge that is embedded in a behavior is harder to transfer. Further, as noted by Mornet (2007), that over 95% of patents are unlicensed and further that 97% of patents generate no royalties. This could be reflecting the fact that licensing is relatively hard and the majority of patented innovations are patented with an aim other than licensing the innovation. The other aims could for instance include commercialize the innovation, use in blocking strategies or cross licensing agreements It is therefore worth asking how realistic strategy it is to seek a patent solely for licensing purposes.

**Licensing Strategies**

Davis (2008) developed a framework that can assist innovators in selecting strategies for licensing their innovations and this framework will be used to identify the available strategies for Rotulus. Originally, the intention of this section of the thesis was to compare the options of creating joint ventures or licensing the rights to the innovation, but Davis' framework is sufficient as it addresses both issues, namely stand alone licensing and licensing-plus
strategies, that rely on cooperative R&D agreements that can be seen as a form of a joint venture. Therefore her framework is introduced and will serve the purpose to supplement a recommended strategy for Rotulus.

Stand alone Licensing

Davis (2008) presents two types of standalone licensing strategies where the difference lies in the degree of technological cumulativeness, namely the independent strategy for low technological cumulativeness and the complementor strategy for high technological cumulativeness. The independent strategy can have benefits since it is relatively low cost as its aim is to license the patent without a long term relationship for developing the product. As Davis (2008:16) states, innovators that would pursue this strategy would develop a new product or process to the point they can demonstrate its potential commercial value, and then license it out.

Stand alone licensing

For Rotulus the independent strategy means that it is relatively low cost, and only R&D prior to commercialization is needed. The licensee would then commercialize the product and the innovator of Rotulus would earn licensing revenues or other compensation. It further opens up the potential to use resources to build fences around a patent and thereby increase the protection for the patent and the innovation instead of allocating resources to R&D and setting up manufacturing and sales teams. The source of value for the innovator is in the patent and the focus can be put exclusively on that area. Therefore the innovator of Rotulus could earn royalties through this strategy. There are however risks to this strategy. The risk that is considered the highest is that the potential partner will run off with the technology. This can be partly counteracted by entering into non disclosure agreements, confidentiality and non-competition agreements. For an innovator, a patent can increase bargaining power. The increased bargaining power could for instance be used to enter into such agreements.

The complementor strategy relies on the innovator's capability to leverage the potential licensee. The leverage is based on the fact that the licensee has already invested in complementary assets and feels inclined to license the innovators technology to utilize his
assets to the maximum capability. In the case of Rotulus as an innovation, this is not an option at the moment as no such situations have been noticed. Further, this strategy is the one that patents trolls most likely utilize. The complementor strategy is therefore not believed to be realistic for the time being but could come under consideration after a patent has been filed.

**Licensing-plus**

The difference between the licensing plus and the standalone licensing strategies is that in licensing plus strategies there is a more intimate relationship between the innovator and the potential licensee of the innovation. Davis distinguishes between the strategies depending on the degree of technological cumulativeness where the directed strategy has low technological cumulativeness and the reciprocal knowledge sharing strategy has high technological cumulativeness. Both these strategies involve a relationship between the innovator and the licensee that involves cooperative R&D agreements over the period of development and commercialization.

The directed strategy has a low degree of technological cumulativeness and is similar to the independent strategy except that the directed strategy is reliant on cooperation while developing the product. There the innovator invests in and patents the innovation, but does not license the product directly. The co-operative partner enters into a development agreement with an outside partner and both contribute to the development of the innovation in what could be described as being a joint venture or a co-specialized relationship as was mentioned by Teece (1988). The upside of this sort of an arrangement or agreement is that both parties contribute to the development of the innovation and therefore share responsibility. The relationship is often built on milestones, where one party agrees to devote more resources to the project when predefined milestones or goals have been reached. It can be argued that this sort of arrangement would therefore have a co-specialized incentive system built into the relationship that could motivate both parties. Further, if the relationship comes to a halt or either party wishes to discontinue the relationship, each of the parties can in theory pursue with the innovation, but it depends on the specifications in the agreement. This sort of relationship could be beneficial for Rotulus, especially when negotiating with Angel Funds or Venture Capital investors. Investors could take part in the development of the innovation and
based on milestone more resources would be devoted to the project when and if specified
milestones were reached. Therefore seeking a directed strategy could benefit Rotulus.

The reciprocal knowledge-sharing strategy is built on a similar co-dependent relationship
between the innovator and the licensee as the directed strategy. The difference is that the
relationship is more intimate and coupled. In this sort of a strategy both parties are heavily
dependent on each other in the development of the innovation. An example explains this as
put forth by Davis (2008) where the firm ARM holdings licenses its innovations to a number
of companies and then helps them to develop and customize the licensed innovation. ARM is
then allowed to use the experience and new designs with other companies, sometimes even
with competitors that have relationship with ARM. At the moment, entering into such an
agreement is not believed to be a realistic option for Rotulus as it is still in the developmental
phase. This strategy is rather an option for larger companies that have relationships with
multiple partners. In theory, this strategy could provide benefits in later stages, but at the
moment such stages are out of reach.

**Licensing conclusions**

The licensing strategies that could benefit Rotulus therefore are either to seek the independent
strategy of the stand alone licensing, or the directed strategy of the licensing plus strategies.
Both strategies have in common that they are have low technological cumulativeness. This is
logical as for the time being there is a lack of complementary assets and technological know
how by the innovator of Rotulus. Therefore seeking these strategies could require lower
development in the early stages of the product and then license the innovation to a more
capable partner. That way, both parties can benefit. The licensee gets a product to manufacture
and market, while the innovator gets access to technological capabilities that can benefit the
commercialization of the innovation. Although the potential profits are lower, as in this case
the complemenary asset owners will appropriate some of the profits, these strategies require
considerably less capital expenditure and therefore lower profits can be justified. The risk of
complementary asset owners running with the technology are further believed to be more
acceptable than launching and manufacturing the product itself with low technological know
how, as the risk would then be associated with manufacturing the product which could result
in a large irreversible losses.
3. Deriving the PAR framework

After having discussed and investigated the appropriability mechanisms in focus, it is time to introduce the original framework that will be used for analysis. The framework, that has been named The Potential of the Appropriability Regime framework, or the PAR framework, conceptualizes the factors that affect the decisions of innovators and the appropriability mechanisms. The framework shows that choice of appropriability strategy is an important decision for any given innovation. The PAR framework uses three factors; 1) the potential of the appropriability regime, 2) innovator's firm specific factors, and 3) the external environment. This framework is both easy to understand and helpful for identifying the areas that need to be considered in order to build a successful appropriability strategy. First the framework is introduced to give overview and is then followed by an in depth analysis of each of the three factors to explain the framework better. It is acknowledged that Teece's work is an inspiration for the framework as well as Porter's 5 forces model.

![The PAR framework](image)

**Figure 3.1 The PAR Framework:** The figure lists the factors that affect an innovator's ability to appropriate value from the innovation. To describe the forces of the external environment the model is supplemented with Porter's five forces model, that lists the threats in in a market.
Potential of the appropriability regime

The first factor of the framework is derived from and inspired by Teece's appropriability regime. As described and defined by Teece (1986; 287) an appropriability regime refers to the environmental factors, excluding firm and market structure, that govern an innovators ability to capture the profits generated by an innovation. Further, in tight appropriability regime technology is relatively easy to protect but when it is weak the technology is almost impossible to protect (Teece, 1986; 287). Teece's concept of a regime implies that depending on type of innovation and its regime, the choice of appropriability strategy can affect potential profits of an innovation. Therefore by a firm can either choose a right or a wrong strategy to protect the innovation, where the right strategy will result in potentially larger profits but the wrong strategy will provide limited protection.

The concept; Potential of the Appropriability Regime, or PAR, however describes three factors and is therefore slightly different from Teece's concept. First it acknowledges the input factors and whether they limit the manufacturing process or not. Secondly it appreciates the realistic value of the market which determines the size of the potential appropriability regime. Thirdly it looks to what extent the innovation can be protected by use of the appropriability mechanisms, which is similar to Teece's concept. It therefore represents the potential appropriation of an innovation in terms of the potential value that an innovation creates. For instance, the larger the potential of the appropriability regime the larger is the potential value that can be created and appropriated from a specific innovation. From the innovator's perspective, the aim is to appropriate as much of that value for himself. A simplified example is that if an innovator has the option to patent an innovation that would provide him with a guaranteed monopoly but he fails to do so, his inactions represent a failure of taking advantage of the appropriability regime as competitors would enter and take a share of the market. The following figure describes the concept.
Figure 3.2 Potential of the appropriability regime: On the left the potential of the appropriability regime is larger than on the right. This means that there is larger potential for value of the innovation. If the innovation is in a tight regime, the innovation is easier to protect with appropriability mechanisms but if the regime is weak it is harder to protect.

Rarely if ever will a patent, secrecy, complementary assets or lead time by itself enable an innovator to appropriate all the value created by an innovation. Firms' ability to capture the value from an innovation depends on their ability to turn the innovation to sales, manufacture at a lower cost or other means of creating value. This brings into the second factor of the framework, the innovators firm specific factors, or in other words his abilities to take advantage of the potential of the appropriability regime.

**Innovators firm specific factors**

Innovators firm specific factors describe the innovators ability to capture value from the innovation. Using the same example as above can help to explain innovators ability using the patent as put forth in the example above. The innovator has come up with an innovation that can create value and be patented so tightly it would in fact be a monopoly. For example, it can depend on that the innovator has understood the importance of the patent and has filed for the
right type of patent, and therefore is able to secure the market. In this example the innovator is able to exclude all competition from the market and therefore in theory, he can appropriate all of the value to himself. However, for him to do so depends on that he has the complementary assets needed to manufacture and sell the product on the market and build and maintain relationships with his customers. If he does not have what is needed to appropriate the full potential for himself, some of the potential value is simply unappropriated as he has the monopoly over the innovation and competitors cannot enter. The following picture describes this example.

**Potential of the Appropriability Regime II**

![Diagram](image)

**Figure 3.3 Innovators Firm specific factors:** On the left the innovator is capable of taking advantage of the full potential of the appropriability regime. On the right he is not capable of taking advantage of the full potential of the appropriability regime, leaving part of the potential unappropriated.

The innovator on the left has monopoly over the innovation with a patent and has all the complementary assets needed and can successfully commercialize the product and thereby realize the full potential of the appropriability regime. The innovator on the right also has monopoly over the innovation but does not have all the complementary assets needed to successfully realize the full potential of the appropriability regime and therefore part of goes unappropriated.
External environmental factors

The example described above are unlikely to depict real situations. Firms are rarely able to have a monopoly over an innovation. Even if the innovator does everything correctly in terms of seeking the maximum protection for the product, it is more likely that even with a patent, competitors will try to enter the market with a similar product if the market has the potential and therefore the competitor will capture some of the value. Further, forces in the external environment affect the innovators ability to be successful and counteract the innovators abilities to realize the full potential of the appropriability regime.

Figure 3.4 The external environment: On the left, the innovator is relatively strong and the effect of the external environment is limited. On the right, the innovators ability to realize the potential of the appropriability regime is limited and his weaker position is counteracted and affected by the forces in the external environment. Therefore, he appropriates less of the value of the innovation for himself.
Similarities between the PAR model and Porter's Five Forces

In many ways the PAR framework is similar to the Porter's 5 forces model (2008), except for the difference that the PAR framework is built around product innovations/innovations whereas the Porters 5 forces model describes existing industries rather than the new ones. As innovations are in their nature new to the world, it cannot be stated that rivalry exists between competitors. Using the Porter's 5 forces model however helps to clarify how an appropriability strategy can deal with in the external environment. The appropriability mechanisms are at the center of the framework and can decide how the innovator will manage to appropriate the returns from the innovation. To demonstrate the relationship between Porter's 5 forces model and the PAR framework a comparison of the two frameworks helps to conceptualize the differences and examples can describe how the appropriability mechanisms and deal with the Porter's forces.

Figure 3.5. Comparison of Porters five forces model and the PAR framework: The figure shows the differences between the models. External forces are similar, but industry rivalry is not present. Depending on the appropriability regime the innovator/innovator can use appropriability mechanisms to deter entry to the new market.

Appropriability mechanisms and the Five Forces model

Patents can in theory affect the bargaining position of an innovator or help the innovator to gain access to complementary assets and therefore affect the bargaining power of suppliers. A patent can as well limit the threat of new entrants and the threat of substitute products as they create barriers for entry and imitation. In theory, a patent can as well affect the bargaining
power of buyers, but it is likely that the buying decisions will mostly be affected by the nature of the product and it's perceived value for the customer. None the less, a patent can decrease buying power of customers, for instance in the pharmaceutical industry. A pharmaceutical drug that is patented and patients needs gravely, the bargaining power of buyers is limited and they are left with buying expensive drug without having alternative solutions as an option. Patents -or other legal protection such as trademarks or copyright- can therefore help to counteract the forces in the external environment.

Secrecy is likely to have limited effect on the bargaining power of suppliers. This is mainly derived from the fact that patents are seen to have increased bargaining power and the fact that secrecy and patents are alternatives in most situations. Threat of new entrants and threats of substitute products can be decreased if secrecy creates a barrier for entry. Secrecy should as well have some effect on the bargaining power of buyers, given that the secrecy has provided the innovator with an advantage or asymmetry. Examples of such situations are most commonly described by the concept of market for lemons, where the seller has more knowledge than the buyer about the product. Secrecy can therefore as well affect the forces of the external environment.

Complementary assets affect the bargaining power of suppliers first and foremost. If the innovator has access to the complementary assets needed, he is not as dependent on suppliers as essentially he is his own supplier. If the complementary assets have natural monopolistic traits, for instance that they consist of scarce resources or require large capital investments, they can build a barrier for entry and therefore decrease the threat of new entrants and/or substitute products or services. Bargaining power of buyers is decreased by complementary assets if the innovator can for instance use them to provide better perceived brand quality or loyalty. Complementary assets therefore can as well deal with the external forces in the environment.

Lead time advantages are more complex within the framework as there is confusion on how lead time is defined. To recap, lead time or first-mover advantages are seen to be derived from three sources; (1) Technological leadership, (2) preemption of scarce assets, and (3) switching costs and buyer choice under uncertainty (Lieberman and Montgomery, 1987). It is
the underlying thought of the current author that lead time should rather be viewed as a byproduct from the use of the other appropriability mechanisms and for true innovations lead time is not essentially a choice, as true innovations are new to the market. Therefore the decision to enter first is not a strategic choice per se, rather the decision is to enter or not to enter. However, using the concept of lead time as it has been defined as moving first into the market, the following can be stated as being true;

In terms of bargaining power of suppliers, the innovator can preempt scarce resources, as his original thought acts as a source of asymmetry in information. Preemption of scarce assets could further in theory decrease threat of entry and substitute products, similar to complementary assets in the discussion above. Further, as the innovator has moved first into the market, building a brand or customer loyalty will have an effect on switching costs and buyer choice under uncertainty and therefore affect the bargaining power of the buyers if the first mover is successful in establishing a good relationship with its customers. Therefore, lead time, as it is defined as an appropriability mechanism can deal with the forces in the external environment.

As this discussion shows, the appropriability mechanism can affect the forces of the external environment and can deal with the five forces in Porter's model. This list is however not exhaustive, but rather is meant to show how the appropriability mechanisms can in fact deal with these forces. An exhaustive list with examples is further believed to be too long to serve the purposes of this thesis and it is rather suggested that this could be an area of future research.

Is the PAR framework a copy of the 5 forces?

There are similarities between the Porter's 5 forces and the PAR model and some could argue that the PAR model is a copy. However, it is the opinion of the author of this thesis and the PAR framework that this is simply a new way to utilize the Porter's 5 forces and the two models are fundamentally different. The PAR model builds on innovations and the fact that the market does not exist yet. Therefore on a time line the PAR model could depict the market at t0 but Porter's 5 forces depict t1 -or the time when others have entered the market-.
Therefore, for innovations, the PAR model can be utilized to create a competitive advantage in the time frame between t0 and t1, and the innovator has a clearer notion of the factors that lay at hand and how he can utilize the appropriability mechanisms to his advantage. Innovators might find it useful to build the appropriability strategy for their new innovations early on in the process and understand the factors that they need to consider before launching their innovation. The PAR-framework further deals with the use and effectiveness of the appropriability mechanisms and also identifies threats that the Porter's 5 Forces does not discuss. For instance, using the theoretical part in this thesis to understand the appropriability mechanisms can help identify the threats that innovators are faced with when they choose a certain mechanism and in turn how the choice of appropriability mechanisms can counteract the forces in Porter's model.

Perhaps the most value that is added by the PAR-framework is that it conceptualizes the market and how the appropriability mechanisms deal with the external forces in the environment and enables innovators to understand how the appropriability mechanism deal with the external environment.
4. Strategy

This chapter aims to build the strategy and analysis for Rotulus applying the original PAR framework. It starts by analyzing what advantages the appropriability mechanisms in general are affected by Porter's 5 forces and is followed by an in-depth analysis using the PAR framework, namely the: 1) potential of the appropriability regime, 2) innovators firm specific factors, and 3) the external environment. Then it continues by expanding on the use of appropriability mechanisms for Rotulus and provides arguments for different choices and alternatives and provides an overview of the strategy and a timeline for the implementation of the strategy.

The five forces and appropriability mechanisms in the case of Rotulus

Patents have the potential to increase bargaining position with complementary asset holders/suppliers and limit the threat of entry. In the case of Rotulus, complementary asset owner are however generic so there are many potential asset owners that could manufacture of supply the input factors needed. Substitute products are already available on the market but are different as compared to Rotulus. Direct competition is therefore limited and a patent can decrease the threat of entry, but the size of the market is dependent on whether or not customers will choose Rotulus over the existing eBook readers available. A patent can in theory decrease buying power of customers, but in the case of Rotulus is believed to be limited and buyers will have some or fair bargaining power in light of the number of substitute products.

Secrecy does not increase bargaining power with suppliers, but is rather likely to decrease it. The source of the decrease of bargaining power is derived from the fact that approaching complementary asset holders without effective protection of a patent leaves the risk of them running with the technology. Further, without a patented innovation they are likely to be hesitant to enter into negotiations let alone enter into NDA's. Secrecy will further not have a large impact on the threat of entry or substitute products as the product is relatively easily replicated or reverse engineered. Secrecy has further limited impact on buyer power, if any.
The innovator has limited access to complementary assets and therefore they do not provide any positive benefits to the innovator at this stage. Complementary assets are further seen to have limited effect of blocking new entrants as the product is made from generic components as has been stated. Complementary assets do not limit the threat of substitute products for the same reason. Complementary assets could have impact on the buying power for instance if there was a respected brand that the customers would trust, but this is not a reality.

Lead time advantages can be reaped by accessing complementary resources and starting the move down the learning curve that will translate into profit in the long run. Prior to the commercialization this is however limited. By moving first into the market it is possible that buyer choice or buying power in favor of the innovator, but this is dependent on the relationship with the customers and quality of the product. Lead time advantages provide little protection against the forces and it should be relatively easy for larger corporations to move into the market if no protection is sought. None the less, if the market is relatively small and could be described as being a niche, it is possible that moving first into the market could secure profits and keep others from entering the market on the grounds that the market is small.

**Potential of the appropriability regime**

The underlying assumption for a potential of an appropriability regime, is that the innovation can be protected in some way. The size of the potential appropriability regime is further determined by access to input factors and the potential market size. The regime therefore operates on the fundamentals that the innovation has the potential to create value.

**Input factors**

Input factors are rather generic and should be considered abundant. There is no natural resource or natural monopoly of any sort and this is supported by the fact that multiple manufactures offer the components needed. If there were any components that were held and patented by a single corporation, this could pose a threat to the commercialization of the product as component needed to commercialize the product would decrease the ability to manufacture it. Further, if the product would need materials that would be hard to come by
this could have an impact on the potential of the appropriability regime as it would decrease the ability to supply a demand. Input factors are therefore not considered to be a limiting factor to the potential size of the appropriability regime.

**Market Size**

Sales of eBooks went from $100 M in 2008 to $500 M in 2010, which translates into a growth of above 100% per annum. None the less, the eBook market currently is only a fraction of that of traditional printed books and it is estimated that eBooks are 2-5% of the traditional market, and are expected to reach a market share of about 10% by 2013. This expected growth can be traced to the fact that the eBook concept has evolved leading to it being embraced by a growing population, with Amazon’s Kindle as the current most popular eBook reader with sales of 4 million units in 2010. Amazon's Kindle is however the not only type of eBook readers available, but a number of different reader devices, each with its own attributes that appeal differently to the individual consumer. The fact that there are substitute reader devices on the market can therefore decrease the size of the potential appropriability regime. As the Rotulus product is differentiated from what is already being offered on the market essentially it could be a substitute product for the current market and further attract new customers. Non the less the market is of a fair size and its growth leads to it being considered to be attractive from a commercial point of view.

**Protection of the Innovation**

Rotulus is believed to fulfill the criteria for being patented. A patent has the potential to hold imitators at bay, but the protection is however possible limited. However, the fact that there are related patents on the market poses threats and limits the potential of the appropriability regime. The existing patents on the market prevent a broad scope patent application and leaves the option for a narrow scope patent application. The advantages of broad patent scope would have resulted in a larger potential of the appropriability regime as a broader patent in fact means options, although it can be harder to defend in court (Bernard and Yinianka, 2010). Though a narrower patent limits the field, there is the advantage of providing a stronger legal protection in infringement lawsuit. The narrow scope of the patent potentially shrinks the potential of the appropriability regime but in turn the protection or the fence is stronger.

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23 Source: Information Today
Secrecy offers some short term protection, but secrecy in the long run does not provide much protection for Rotulus. This is derived from the fact that the product can easily be reverse engineered and can be built from off-the-shelf hardware with the right software. Rather, secrecy protects the idea for the product and enforces the novelty criteria before filing a patent application. In later stages, secrecy can however help to protect learning that might occur in later stages of development.

The complementary assets needed are relatively generic, and the product can be manufactured from off-the-shelve components. Complementary assets for manufacturing therefore do not have a direct effect in terms of protecting the innovation from being imitated and manufactured by others. Complementary assets will however affect the innovators ability to appropriate profits through sales and manufacturing. Lower cost and better quality can have an impact on competition in the long run and the diffusion of the product along with an effective sales channel.

Moving first into the market can have an effect on the protection of the innovation and waiting too long to file for a patent bears the threat that others will develop and/or patent a similar product. Further, there are advantages that lead time can provide in the long run and buyer choice under uncertainty can be of value in the future, namely through building a strong brand and relationship with customers. As the resources needed are rather generic, preemption of scarce resources are believed to be limited.

**Firms Internal Factors**

The firm's internal factors are considered weak especially in light of lack of complementary assets. This lack of complementary assets will most likely result in returns from the innovation to go to the complementary assets holders to some extent. Further, the firm's technical capabilities are low, and therefore there is a need for assistance in product development. Pursuing a venture without the relevant technological knowledge is considered to be risky. However, a patent can strengthen the bargaining power and therefore help in negotiations with selected complementary asset holders. A patent, if it has been granted, could therefore become the biggest asset. Further, there are potentiality valuable players in the extended network of the innovator, but without proofed viability and/or predicted commercial
success of the product the effect of the players is limited. In later stages, when the product has been developed, and the product is believed to have potential for commercial success, these players could help with financing and growth.

Acquiring the right complementary assets could help with the development of the product and further have reputation spillovers that would support new users’ adaptation of the products. Reputation spillovers might have impact on buyer choice and increase the diffusion of the product. For instance, it is easy to imagine how diffusion of the innovation would occur in a faster pace with a renowned brand like Apple backing the innovation instead of a small independent innovator with little or no reputation.

**External environment**

The external environment poses considerable threats, namely substitute products, competition and existing patents. Competition for substitutes is large and a variety of eBook readers are available for customers. The fact that the market is growing and that firms have already invested heavily in capital could benefit Rotulus as if it would become successful competitors would resist responding to a new product on the market. However, it is realistic to assume that in coming years the product will still be in early diffusion stages.

The growth of the eBook market suggests that there are new actors entering the market. Larger firms might not consider entering the same market space with a similar product as they are likely to experience growth as is. Further, their prior capital investments might provide as an incentive not to compete and rather focus on their current product line. Small and medium firms however might see opportunities in a new market and find it easier to compete with a differentiated product in the same market space as Rotulus. This could especially become true if they are holding complementary assets and can be more flexible than the larger firms.

Existing patents on the market can pose various risks. The risks involved with entering the market without a patent risks infringement lawsuits with little or no protection in the court of law. Existing patents might as well affect the patent application process negatively and there is risk of some patent claims being denied and the patent scope might be narrowed during the application process. Further, there are two known patents on the market that could possibly
affect Rotulus patent application and even with a Rotulus patent there is the risk of lawsuits from existing patent holders that could try to force an injunction or invalidate the patent and try to claim damages. However, in defense of the patent applications it should be noted that the differences between the Rotulus innovation and the existing patents is substantial.

The existing patent holders are two separate entities. One patent is held by a major corporation and the other is held by a reputed patent troll. To predict about the actions of lawsuits from the holders are perhaps at best speculative but none the less their background can serve as an input for understanding their potential strategies.

The corporation holds a number of patents and is not in the eBook industry, and background investigation of the innovator suggest that the product is aimed at different markets, for instance in aviation. The patent is further almost 13 years old and the fact that the corporation has not commercialized the innovation supports the argument that they do not intend to. There is however the possibility that the corporation has licensed their patent out or are utilizing it in fences.

The threat by the patent troll is however believed to be more worrying and if the commercialization should be a success one could expect legal action or accusations of infringement. A patent is believed to decrease the threat of an infringement lawsuit. However, perhaps most depending on the patent, there is also the opportunity of potential input from partners in the external environment. For instance, holders of complementary assets could become partners and therefore instead of competing they would become co-operators. Such strategic alliances could enhance the ability to appropriate from the potential appropriability regime and further hold competitors at bay.

24 Names of the existing patent holders are omitted in agreement with CBS to protect the innovation.
Implementation of strategy

This section provides overview of how to implement the strategy which is divided into early and later stages. It is important to divide between the early and later stages as in the early stages the focus is on developing the product whereas later stages refer to the phase where a design has emerged that can be commercialized. The section ends with a time line that displays the use and importance of the mechanisms.

Early Stages

The early stages are defined as the time when the product is still in development, testing of prototypes and market research take place. At this stage it is important to scout for possible partners while developing the product. The aim in the early stages is further to build a case and a decision point on whether to continue or discontinue with the project. Having enough information, for instance how well potential customers respond to the product is important.

The importance of secrecy in the early stages is namely to protect the idea of Rotulus as well as it protects the novelty criteria that is required if a patent application is to be successful. Secrecy is further important in the early stages of the development as it allows for the time needed to keep the design afloat (Teece, 1986) before filing a patent application. Patenting early on bears the risk that a patent is less mature and the product is not developed to its full potential, and therefore the patent might lack claims that might be of value. Premature patenting therefore bears the threat that a patent looses value. Secrecy in the early stages is seen therefore to counteract this risk and enable a better design to emerge as it allows for a longer period for development.

Secrecy in a more form manor can also be used in the search for complementary assets holders where those contacted should sign non disclosure agreements or other confidentiality agreements. However, contacting complementary assets holders is recommended to occur in later stages when a patent has been applied for or granted. This is recommended as non-disclosure agreements are hard to establish with firms as well as they provide protection from imitation. However, direct contact with complementary asset holders is recommended to occur in later stages after a patent application has been filed or a patent granted, as it is
believed to strengthen the bargaining positions. In the early stages, delaying the patent application is exposed to the threat of another innovator coming up with a similar idea and will apply for a patent or that the idea of the product will leak out and be commercialized by imitators. In early stages it is however important to attract human capital -smaller complementary assets- to help with development of the product, and to secure the novelty criteria of the innovation, non-disclosure or other forms of confidentiality can serve as sufficient protection.

**Later Stages**

In later stages it becomes important to patent the innovation. The effect of a patent blocking entry is considered minimal. However, it is important to patent the innovation as a patent opens up channels to complementary asset holders and can increase the bargaining position. Further, a patent provides protection from potential lawsuits from existing patent holders. It is proposed to first file for a national patent. The national patent provides the innovator with a priority to file an international patent twelve months after the national patent has been filed. The twelve months can therefore be used to scout and contact complementary asset holders to see if there is interest from the market place.

Secrecy is not considered a major mechanism for appropriation in the later stages of the product development, but will supplement the strategy to some extent. As the innovation attributes and technical construction of hardware are relatively easy to imitate through reverse engineering, secrecy cannot be used in a combination with the patent itself. However, learning can occur alongside the development of the product that can be of value for the future of the innovation. The use of NDA's, confidentiality- and non competition agreements with partners protect the innovation keeping the information or learning in house. The single use of NDA's without patents is likely to limit the opportunity of discussing further development as it decreasing the number of available channels with potential partners. By relying solely on NDA's, the protection from companies simply running with the technology is considered ineffective. Secrecy further decreases chances of entering into licensing agreements, which is considered to be a possible opportunity for the innovation.

Complementary assets are especially critical for commercializing the innovation. Acquiring
or accessing complementary assets is however dependent on the value that can be offered to the complementary asset holder. Entering into agreements with manufacturing assets holders can provide the access to a know how that will result in lower the manufacturing and better quality. Complementary sales can open up channels to the market and possible better product placement with retailers. A patent is believed to serve as a signal to the complementary asset holders.

Lead time or first mover advantages in the case of Rotulus are considered to be byproduct from the use of the other mechanisms. For instance, patents can deter entry of competitors, buying time for learning advantages. Further, secrecy can help to secure the knowledge from learning inside the team of development, and further, both secrecy and patents can help in the search for scarce resources.

**Licensing options**

From Davis' (2008) framework, there are two strategies of licensing that are considered plausible. Namely, the independent strategy and the directed strategy. Choosing the independent strategy is a low cost approach with the aim of limiting the investment costs and earning royalties through the license. The upside of this strategy is therefore the low cost as the patent is the essential investment and only requires minimum capital to create a design and file for the patent. Essentially this strategy is beneficial for the innovator as it does not involve the high capital investments that are needed to launch the product. The risk of choosing the independent strategy is however that a patent will not provide sufficient protection and partners or competitors can invent around the patent, or simply move on with development of the project as the innovator has limited access to legal resources. Further, the risk of non-commercialization of the innovation has to be addressed prior to licensing. Meaning, that there must be agreement on time and ensure that the innovator will be compensated for the license and the licensee will not simply acquire the license, being able to halt the commercialization of the project leaving the innovator uncompensated.

The directed strategy is also considered, and has the aim of attracting angel or venture capital funds to the project. For instance, the innovator and the funds could agree on milestones and use the milestones as decision points for whether or not to continue with the project. The
directed strategy could in such situation be successful in attracting human capital for developing the innovation. For instance, the directed strategy could therefore even be employed during the early stages to develop the product and then depending on if there is proofed viability for the innovation, the independent strategy could be sought where the angel or venture funds would share the returns from that licensing agreement.

Time line and overview of strategy

![Time Line of Strategy](image)

**Figure 4.1 Time Line of Strategy**: Shows the use and importance of each of the four mechanisms in a hierarchy. Most important mechanism is mentioned first at each stage.
5. Summary and Conclusions

This thesis started by posing a problem that an innovator faces in terms of how to build an appropriability strategy for an innovation. An appropriability strategy can help the innovator to successfully commercialize and protect his innovation. By exploring existing literature, the different appropriability mechanisms and how they are applied in practice were analyzed and discussed. Further, the relationship between the different mechanisms was investigated. All of this was done with the aim to build an appropriability strategy for Rotulus, an innovation of the author.

It is clear from the literature that the use of the appropriability mechanisms is different between the characteristics of the innovation, firm's internal factors and external environment. When these differences had been established, the differences were brought together in an original framework, or the PAR Framework. The PAR framework conceptualizes the dilemma innovators are faced with in identifying what types of threats they have to deal with and how the appropriability mechanisms can help to counter these threats. With sufficient knowledge about the appropriability mechanism the framework can support innovators or innovators in building the right appropriability strategy.

The thesis ended with a recommendation of strategy that is derived from the theory and after an analysis using the PAR framework. The potential of the appropriability regime for Rotulus can be said to be fair, but when it comes to taking advantage of the potential the matter becomes more complicated. The input factors are abundant and the market –the eBook reader market- is growing and attractive. In terms of protecting the innovation the appropriability mechanisms won't block entry, but they can help both in commercializing the product and therefore appropriate a larger share from the innovation.

In the case of Rotulus, the innovators/firms specific factors are limited and access to complementary assets are lacking. A patent can essentially become an important asset but at the time being the innovator is weak, mainly because of lack to these complementary assets and financing. Overall there are threats from the external environment but these can partly be counteracted by selecting the right appropriability strategy.
In short the strategy builds on secrecy in the early stages of development and then filing for a patent. Secrecy will buy time for development but in later stages reasons for applying for a patent before commercializing the innovation are that the patent will help to deter risk of infringement lawsuits and as well it is believed to serve as a bargaining chip in the search for partners or owners of complementary assets. A patent can signal intent and competence and firms are more open to enter into discussions with entrepreneurs that have a patent rather than when the entrepreneur has only a great idea.

Right complementary assets can further help and are likely to be able to contribute lead time or first mover advantages. First, entering the market can help building a strong brand and learning curve advantages can in later stages lower costs of production.

In terms of buyer switching costs it is not necessarily that it will have great effect unless with brand relationships. None the less, moving first is also exposed to risks and if the quality of the product is lacking, then it could damage the reputation of the brand in the long run. On these grounds it is therefore further recommended not to rush the commercialization of Rotulus, but rather using secrecy and keeping the design afloat to avoid the risk of premature patenting. When the product has been developed, patenting the innovation and looking for complementary asset owners that might be willing to enter into a cooperative relationship, becomes important, using either a independent strategy or a directed strategy as defined by Davis (2008).
Contributions and Criticism

In terms of theoretical contributions this thesis has demonstrated two points that are of interest to the theoretical world.

First, it contributes to the theory as it presents a new theoretical framework or the PAR framework. The PAR framework helps to conceptualize the problems for innovators and how they aim to appropriate the returns from their innovations. The PAR framework further demonstrates the relevance of the appropriability strategy and how it connects to the forces in the external environment, or Porter's 5 Forces that are taught to industry competition.

What is interesting about the PAR framework and how it is different from the Porter's 5 Forces is that it builds on innovations or innovations that are new to the market--or the world--and there is not an established market for the product. Therefore, in theory, no competition exists in this market space and the innovator can use the appropriability mechanisms to protect his innovations to the best of his abilities.

Although the framework builds on this fundamental of innovations or innovations that are new to the market, it can be used and benefit innovators that are trying to form a new strategy in an existing market. It can therefore be helpful for innovators to analyze the market and to understand their own strengths and weaknesses and therefore map out the problems that they are faced with when launching a new product.

The thesis also criticizes previous studies that have investigated the appropriability mechanisms, how lead time is defined. It further asks the question whether or not lead time should be considered an individual mechanism or simply as a source or a byproduct from the use of the other mechanisms. That lead time advantages can be a byproduct from the use of the other mechanisms became apparent in analysis of the relationships of the mechanisms. It further became apparent that lead time and complementary assets are very much coupled and partly supports the views of Cohen et al. (2000) that these two mechanisms should perhaps be viewed together as one strategy rather than two separate strategies or mechanisms.
However, it also became apparent that both secrecy and patents can be a source of lead time advantages or first-mover advantages as described by Lieberman and Montgomery (1988) and therefore it is proposed that lead time can be viewed as advantages derived from the use of the other mechanisms, i.e. a byproduct from the use of the other mechanisms.

Firstly, for innovations, it is hard to say that there is a choice to enter the market first or second, as innovations are novel in their nature. Secondly, the sources of first mover advantages –technological leadership, preemption of scarce assets and switching costs of buyers- can in fact be a result from the use of the other appropriability mechanisms as the thesis and discussions demonstrated.

Technological leadership and learning curve advantages are directly connected to complementary assets, but at the same time secrecy or patents can play a vital role in securing either a monopoly or time to develop the product to reach the leadership.

Patents and secrecy can as well have an effect on the preemption of scarce assets. Patents can in theory block entry and therefore allow an innovator the position to acquire the assets needed with increased bargaining power. Secrecy can be a source of asymmetry of information and allow the innovator to acquire assets or materials that he –the innovator- sees more value in than the current market.

In terms of switching costs of buyers, patents and complementary assets and secrecy can all have an effect. Examples of how patents effect lead time include drugs that establish brand names -complementary assets- as they exclude competition from entering the market and provide a monopoly for period of time. Complementary assets can also have an effect on the buyer switching costs. For instance, brand names and loyalty towards the perceived quality of the brand. For firms establishing new relationships with buyers, the relationship can act as source of buyer switching costs if a sales team has established trust with a customer. Secrecy is perhaps the least transparent, but the example of Coca-Cola could be mentioned again. If secrecy had not been used for protecting the recipe, but rather it would have been patented other market entrants would have been able to enter the market with exactly the same product. In the meantime they established a brand name and relied on marketing to build loyalty. Therefore it can be said that secrecy contributed to buyer switching costs rather than simply...
moving first to the market with a new product. It is therefore proposed that lead time should not be viewed as an individual mechanism, but rather as an advantage that can be gained by the use of the other mechanisms.

In terms of literature and previous studies by Levin et al. (1987) and Cohen et al. (2000), the thesis also asks whether or not managers related the concept of lead time to first mover advantages or lead time as it is defined under managerial operations and if this has possibly affected the responses. The difference between lead time as an appropriability mechanism and lead time in managerial operations, is that lead time refers to first mover advantages within the appropriability literature while it refers to the time from initiating a process until it’s finished in managerial operation. If managers were not referring to lead time as a first mover advantage but rather the lead time as it is defined from the managerial definition, it is worth to ask whether or not the results from previous studies are perhaps not as accurate as they could be. Lead time under the process management definition rather connects to later stages of development, or as Teece (1986) described the paradigmatic stage. At this stage the focus of managers is to cut costs and have the manufacturing process as lean as possible. This definition of lead time is therefore different from entering the market first and gain the lead time or first mover advantages.

I cannot but stop to think if some of the managers were confused by the concept of lead time and therefore the responses from previous studies might contain errors. However, as I do not possess the questionnaires and how or even if the matter was addressed I encounter a problem of interpretation. In my defense, I tried to contact the authors of the studies, but was unsuccessful in getting answers. To remain unbiased and in defense of the studies, managers in R&D labs might also be knowledgeable enough to make the right connections so I am inclined to resort to settling the matter in favor of previous studies, despite that my intuition tells me otherwise.
Final Words

This thesis has been both inspiring and valuable for me personally as it has deepened my understanding on the topic of appropriability mechanisms. Perhaps the largest contribution of this thesis is the PAR framework that I believe can be helpful for innovators to build a strategy and conceptualize the problems of how to build an appropriability strategy for innovations. The PAR framework at this stage is none the less in early stages of the development, but connecting the appropriability mechanisms with Porter's 5 Forces I believe is valuable and shows the importance of a right appropriability strategy, and how it can help innovators.

The PAR framework was a result from the investigation of existing literature that is important for understanding the threats that firms face and can be especially important for small firms which seem to stand at a disadvantage when it comes to protecting their innovations. Helping smaller innovators to understand the dilemma and providing the knowledge about how the different mechanisms operate and what benefits the appropriability mechanisms can therefore be important. It is therefore my hope that the framework can assist innovators to commercialize their innovations.

I am grateful for the opportunity that Copenhagen Business School provided and helped me to investigate the different factors that need to be considered in terms of commercializing innovations which I believe answered my questions on what steps to take in order to build a successful strategy for Rotulus. It is my hope that my contribution will also be of value to others or serve as an inspiration for future research. Working on this thesis, has therefore provided me with the knowledge of how to build a strategy for my own innovation and the ability to build strategies for future projects.
6. References


Teece, D.J. 1986. Profiting from technological innovation: Implications for integration,
collaboration, licensing and public policy. 15. pp. 285-305


**Books**


**Websites**

3M Corporation: http://solutions.3m.com/wps/portal/3M/en_US/Submit/YourIdea/


Inventors Forum: http://home.ease.lsoft.com/scripts/wa.exe?A0=inventors

WIPO: http://www.wipo.int


Information Today: http://www.infotoday.com/it/

America Invents Act: http://en.wikipedia.org/wiki/America_Invents_Act