

# Freedom to Operate: The Impact of Patent Awareness on Patent Litigation Risk in High-Tech Small Firms

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## **ABSTRACT**

Due to our globalized, knowledge sharing economy, patenting has gained more importance during the last decades. Patent awareness within startups is low due to the lack of monetary resources, knowledge about patents in general and expertise. Due to the lack of knowledge about the field of patent law, high-tech small firms are not involved in prior patent search - a freedom to operate assessment - which could improve the strategic choices a startup makes with regard to patenting inventions. Research shows that patent awareness is economically beneficial in patent intense industries, like the high tech industry. This paper analyzes the impact of patent awareness on patent litigation risk in high-tech small firms. In particular, the freedom to operate assessment as a tool for patent search will be examined. A literature review has been carried out to derive a guideline for patent awareness in high-tech small firms. As a practical implementation, options for pursuing different strategies during the decision-making process for patenting will be provided. In the business environment, theoretical frameworks and models are being used widely in large, established companies. However, there are few practical models available in the literature for startup patenting. The contribution of this research is to enhance the usage of analytical tools such as the freedom to operate assessment in startups. Furthermore, recommendations will be given for involved stakeholders on how to practically enhance patent awareness.

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## **Keywords**

Patent Awareness, Patent Law, Patent Litigation Risk, Patent Infringement, Freedom to Operate,

Small Medium Enterprises (SME), High Tech Small Firm, Startup

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# 1. INTRODUCTION: THE LACK OF PATENT AWARENESS IN STARTUPS

Intellectual property is the legal right to safeguard the inventions of inventors and the public rights to access these inventions (WIPO, 2008). In order to be patentable, an invention must be novel, have utility and be non-obvious (Business Dictionary, 2015). Patent law and infringement issues date back a long time in history. The first patents have been established in Venice in the year 1474 (Moser, 2013). The glass industry there has been the first to make use of patents to protect inventions from being copied by competitors (Intellectual Property Office, 2008). The legal protection of inventions also played an important role during the industrial revolution between the years 1750 and 1852 (Dutton, 1984). After the diffusion of a set of regulations for patents over the world, the modernization of patent systems enhanced the invention processes (OECD, 2004). Technology development has increased exponentially ever since and with it the urge for patenting inventions increased as well (Sideri & Giannotti, 2003). Knowledge sharing and constant innovation have further strengthened the public interest in intellectual property rights (López, 2009). For businesses in order to sustain global competitiveness it is essential to engage in today's knowledge intensive economies (WIPO, 2014). Companies can therefore profit from investing in knowledge exploitation. One category of knowledge exploitation is also the knowledge about patents and their value to businesses. The importance of intellectual property management for (new) enterprises, especially within the high tech industry (WIPO, 2014). The high-tech industry faces rapid developments and innovations on a global scale which leads to high turn-over, economic growth as well as the creation of new workplaces (European Commission, 2015). This research will focus on small firms within the high-tech industry.

The monetary success and importance of intellectual property in companies is significant. For instance, 39% of the economic activity, GDP, and 29% of employment is created by those industries within the European Union with an urgent focus on intellectual property rights, such as patents, trademarks and copyrights (Industry-Level Analysis Report, 2013). Pitkethly (2010) illustrates that patent-sensitive companies can yield economic benefits by applying patent knowledge for economic utilization. Another advantage of engaging in patent awareness is that enterprises with patents are more willing to improve their inventions in order to sustain the patent and exploit economic benefits.

Before applying for a patent, it is advisable to conduct a patent search or hire a patent attorney to conduct a patent search to minimize the risk of patent litigation. The freedom to operate assessment can support enterprises with the search for existing patents (IP Inform, 2015). For example: To decrease patent infringement risk, company A can run a freedom to operate assessment, whilst checking if company B is infringing a patent, before the patent is made publicly available by company A.

Especially small companies are vulnerable to this case as they might be sued by companies with more financial resources and power in the high-tech industry. Related to the risk of patent litigation are also the so-called patent trolls who enforce the right for a patent (Lerner & Poltorak, 2011) and hold the patent without developing them further with the sole aim to gain profits from patent infringement (Business Dictionary, 2015).

Among other resources, patent utilization requires a financial investment, time to file the patent application and knowledge, which constitutes a challenge for high-tech small firms (Quinn, 2015). There is a tendency for small enterprises not to make use

of appropriate patent applications (WIPO, 2014). Small enterprises do not use the available information about patents provided in, for example, patent databases (WIPO, 2014). The European Commission report of 2000 states that the usage of patents in new enterprises in the EU is not sufficient. This leads to the question, what could be done in order to increase awareness about the opportunities related to patenting. According to Vregelaar (2015), an extensive use of knowledge from patent literature could encourage the awareness of patents. Vregelaar (2015) states that the current status of patent awareness is that patents are not in the focus of academia. In his recent paper he illustrates that many of the interviewed small and medium-sized firms do not have patent policies or a person who is responsible for managing patents or patent information.

This research is focused on answering the following research question related to the aforementioned issues:

*To what extent does patent awareness in high-tech small firms decrease patent litigation risk?*

The contribution of this research is to enhance the usage of analytical tools used for patent search, namely the freedom to operate assessment, in small high-tech firms. The outcome of this research is a model of five strategic options that can be used by startups as a guideline when deciding a patenting strategy. Additionally, this research offers a policy recommendation for involved stakeholders on how to practically enhance patent awareness. More specifically, the research is providing a policy recommendation for technology firms on how to manage patent awareness in order to respond efficiently to patent litigation.

In the following, the methodology will be illustrated, which explains the research model that has been developed. Subsequently, the variables patent awareness, patent litigation risk and freedom to operate will be presented in a literature review. The literature review will be followed by the discussion part, which discusses the patent search implementation. Additionally to the literature review, 2 entrepreneurs have been interviewed briefly. Within the discussion part a strategic policy recommendation for raising patent awareness will be provided. The paper will be finalized by the conclusion, limitation of the paper and suggestions for further research.

## 2. METHODOLOGY

The topic of this bachelor thesis has been chosen based on the university research suggestions of the track innovation and entrepreneurship. The core relevant literature of Vegelaar (2015), Heiser (2014) and Nijmanning (2015), and the university track topic of patent awareness in high tech small firms, on which this research is based on, has been provided by Dr. A.H. van Reekum. Furthermore, in an empirical brainstorming process, the variables to be investigated have been identified as (a) patent awareness, (b) patent litigation risk and (c) freedom to operate.

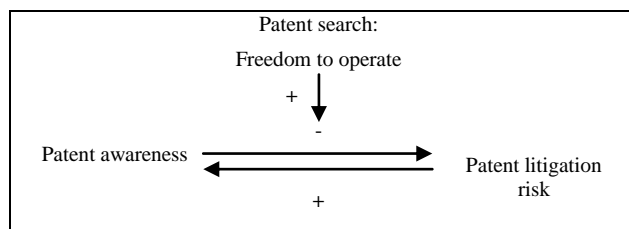
To begin with, the topic related search terms have been analyzed. The search has been conducted via the University of Twente library, Google scholar and Scopus. Additionally, the related keywords have been searched for in relevant articles, namely:

For awareness, relevant synonyms found are knowledge, alertness, appreciation, attention, consciousness, experience, information, perception, realization, recognition, understanding (Dictionary.com, 2015).

For litigation, relevant synonyms found are lawsuit, process, action, case, dispute, prosecution, suit, trial (Dictionary.com, 2015).

For freedom to operate, relevant synonyms found are Patent search, Invent around (Kowalski, 2007).

The preliminary literature scan has led to a consecutive relationship between patent awareness that can be increased by a freedom to operate assessment which would lead to a decrease in patent litigation. However, after a more specific literature selection, the literature provided evidence for the following model;



**Figure 1. Relationship between variables**

From the identified literature, it has been emphasized that patent litigation depends on patent awareness, thus, patent litigation serves as the dependent variable and patent awareness as the independent variable. First, there has to be patent awareness and because of that and after that the patent litigation risk decreases or increases. The causality between patent awareness and patent litigation risk is reciprocal. If there is patent awareness the patent litigation risk might be decreased. The freedom to operate variable is independent of the relationship between patent awareness and patent litigation risk because patent awareness does not mean that high-tech small firms are conducting a patent search. High tech small firms can still apply for a patent without conducting the patent search and have a probability to have a low patent litigation risk. On the other hand, a previously conducted patent search by means of a freedom to operate analysis might decrease the patent litigation risk. Adapting the work of Vregelaar (2015) the relationship between patent awareness and litigation has been examined towards the use of a freedom to operate assessment. After introducing the variable freedom to operate, the positive relationship between a patent litigation case and patent awareness is strengthening the original bivariate relationship. The variable freedom to operate serves as an intermediate variable.

The outcome of the conducted literature review is a contribution to the awareness by means of the strategic options of the freedom to operate assessment and a practical recommendation for the stakeholder. In addition to the literature review, two semi-structured/unstructured interviews with entrepreneurs have been conducted to complete the research and get insights from real life examples. One of the interviews has been conducted in an unstructured manner and the second one has been semi-structured.

### 3. LITERATURE REVIEW

The literature review consists of the method/theoretical framework of patent awareness and of the opportunities and drawbacks of a freedom to operate assessment. Based on the literature about the patent search tool freedom to operate, the strategic options have been illustrated subsequently.

The relevant literature is displayed in Table 1 below, including the variables patent awareness, patent litigation risk and patent search, freedom to operate.

**Table 1. Literature Review**

Authors and year	Patent Awareness	Patent Litigation Risk	Patent search (Freedom To Operate)
Chien (2012)			x
Cremers (2007)		x	
Blackburn (2003)		x	
Davis (2006)	x		
European Commission (2000)		x	
European Patent Office (1995)	x		
Heiser (2014)	x		
Hynnen (2013)	x		
IP Inform (2015)			x
Kowalski (2007)			x
Nijmanning (2015)	x		
Pitkethly (2007)	x		
Pitkethly (2010)	x		
Pitkethly (2012)	x		
Sandal & Kumar (2011)			x
Vregelaar (2015)	x		
WIPO (2014)			x

### 3.1 Theoretical framework of Patent Awareness

In the following section, the term patent awareness concerning high-tech small firms will be discussed more in depth. To begin with, patent awareness comprises the knowledge about the patent system (Heiser, 2014). Furthermore, Heiser (2014) conducted a research about patenting behavior, containing the two concepts of patenting motivation and patent awareness. Patent awareness does not receive sufficient attention by literature despite its importance for each patenting process (Heiser, 2014). There are different theoretical frameworks for patent awareness. Endsley's (1995) model of situational awareness describes the cognition of the surrounding environment concerning the variables time and space. He defines situational awareness as to be aware of the activities that are taking place within the setting of the researcher. Additionally to the awareness of the current situation, time and space have to be made sense of and include estimation about the future awareness of time and space (Endsley, 1995). Based on Endsley's (1995) model of situational awareness, the cognition of high-tech small firms about patents can be assessed. Investigating the awareness of patents in high-tech small firms might give insights on how to raise awareness. The model by Endsley (1995) has been previously applied at the University of Twente by Tom ten Vregelaar (2015) in his Master thesis and for patent awareness and by Dexter Nijmanning (2015) in his Bachelor thesis. Vregelaar (2015) illustrates that it is of importance to have a certain awareness of patents when dealing with inventions.

If there is no existence of awareness about a topic, in this case patents, the researcher or the small enterprises cannot make use of knowledge (Vregelaar, 2015). In the study by Vregelaar (2015), a survey and interviews have been conducted to collect usable data on patent situational awareness. The relationship between patent awareness and patent infringement risk has been investigated and a positive relationship has been found

(Vregelaar, 2015). Furthermore, the outcome of the research illustrated that a higher awareness of patents decreases patent infringement risk (Vregelaar, 2015). By implementing the findings of the data collection, the initial model of patent situational awareness could be modified by Vregelaar (2015). Figure 4 in the appendix shows the recent conceptual model for patent situational awareness by Vregelaar (2015).

The World Intellectual Property Organization (2014), states that the existing patent databases are not sufficiently explored by companies. The industries with an increased patent application trend are, according to WIPO (2014, p.3), knowledge-based industries such as the biotechnology industry, information and communication technologies (ICT), nanotechnology industry or advanced chemicals industry. Also, Vregelaar (2015) illustrates that companies do not make use of patent databases sufficiently enough. Going into detail, the type of companies that do not encourage awareness for patents are not only large companies but also small ones, especially high-tech small firms (HTSF) (Vregelaar, 2015). Situational awareness in new product development is beneficial for sustaining a proper protection for the invention (Vregelaar, 2015). The goal of the new product development process is to decrease risk and increase profits by introducing successful products to the market (Vregelaar, 2015).

Phase 1 of the situational awareness model, is the perception of elements in current situations (Figure 4). The competitive position of a firm and their financial success is dependent on an effective adaptation to the external environment (Vregelaar, 2015). Furthermore, it is possible that the external environment could be a great source for the information collection (Vregelaar 2015). The external information source can be used as an opportunity for completing necessary tasks within the company (Vregelaar, 2015). It is important for a patent search in new product development, to eliminate the infringement risk through an efficient environmental scanning (Vregelaar, 2015). For instance, the patent database could be used or external IP experts could be contacted (Vregelaar, 2015). Phase 2 is the comprehension of the current situation (Figure 4). Hereby, it is of great importance to understand the elements of a priori defined phase (Vregelaar, 2015). It might be effective to know the patents of the competitor, but it is more important to investigate what the patents will be used for in the future (Vregelaar, 2015). Thus, the future prediction of the usage of patents can be seen as a strategic decision, which Vregelaar (2015) refers to as “dissemination function of patents” (p.14). The strategic decision comprises to use the dissemination as a source of information for patents (Vregelaar, 2015). Once the patents which emerged from the environmental scanning are being understood, the comprehension for their similarity and connectivity with other patents will be discovered (Vregelaar, 2015). Vregelaar (2015) defines the important aspects of Phase 2 as “Patent Scope, Technological Domains Covered, Patent Impact (i.e. Citation Count) and Patent owner’s competitive position” (p.24). The benefit is that uncertainty and liability risk can be thus reduced (Vregelaar, 2015). The last Phase 3 is the projection of the future state (Figure 4). In the first two phases, possible patents have been identified and evaluated and extended based on their strength (Vregelaar, 2015). Afterwards, the future can be projected by defining the possible consequences for the company (Vregelaar, 2015). The “systematic analysis” and the “integrative planning” need to be used for the future projection (Vregelaar, 2015, p. 25). Last but not least, if the patent information could be obtained, it might lead to new insights into technology for future projects (Vregelaar, 2015). Additionally, Vregelaar (2015) refers to the

information collection as “the evaluation of plausible alternative futures and their consequences for the organization” (p. 25).

The attention on high-tech small firms has risen recently due to the economic growth potential (Davis, 2006). Davis (2006) states that, despite the lacking resources of high-tech small firms, if successful, economically they have a higher success rate. The advantage of small firms is that mostly they are specialized to detect a potential gap in the market and to quickly change their business towards the customer needs (Davis, 2006). The pitfall, however, is, that smaller firms have to compete with large firms directly, at some point of their life cycle (Davis, 2006). There is competitive pressure to perform efficiently in a fast changing environment forces high-tech small firms to make a fast decision to secure their patent (Davis, 2006). Davis (2006) also states that small firms have to file a patent application in an early stage due to the fast changing technologic environment.

In terms of their competitors, small firms are forced to quickly adapt to market changes (Davis, 2006). There are high costs involved for small companies, when it comes to patent litigation, depending on the defending strategy the company decides to undertake (Chien, 2012). The survey conducted by Chien (2012, p.2) showed that 79 out of 223 respondents had to deal with patent litigation, where 35 percent of the respondents fight, 18 percent settle, 22 percent do nothing, 9 percent change the product or business and 17 percent are unresolved or decide on another court strategy. The question arises why small and medium-sized companies, especially high tech small firms have difficulties with managing intellectual property. WIPO (2014) illustrates that the companies do not have enough information about the intellectual property system. Further, new enterprises are not aware of the business impact patents can make in terms of sustaining competitiveness (WIPO, 2014). Often, the small and medium sized companies within the high tech industry see intellectual property as too complex and difficult to implement (WIPO, 2014).

Davis (2006) states, that the patent process requires a significant investment of time for high-tech small firms. Further, the problem with the patenting process is the inflexibility as the patenting process has to follow a precise guideline (Davis, 2006). Again, it is stated, that patenting requires monetary resources for the high-tech small firm (Davis, 2006) that might not be available. The usage of intellectual property in high-tech small firms, more specifically the likelihood to apply for a patent, is related to the size of the firm (WIPO, 2014). The reason why patent information sources are of importance is to not waste financial resources on unnecessary R&D (WIPO, 2014). Patents alone are not sufficient for monetary success (Bontis, 1999). The holder of a patent needs to commercialize the patented innovation in order to gain value out of it (Bontis 1999). Intellectual Property could result in creating wealth for the company if the technical experience is used efficiently (Bontis, 1998).

Process patents and product patents are differentiated in the study of Davis (2006). The outcome of the respondents illustrated that products have been patented due to the simplicity of commercialization (Davis, 2006). After that, it is easy to reverse the technology (Davis, 2006). On the other hand, process patents have not been patented immediately in order to keep the trade secrets unpublished (Davis, 2006). Another reason according to Davis (2006), for not patenting a process is due to the fact that infringement could not be comprehended easily. The process was patented after the final product was developed and the process could have been analyzed through the new product (Davis, 2006). Finally, one

respondent illustrated, that it might be a more efficient resource exploitation to hire an engineer for a full year instead of spending the money on the patent (Davis, 2006).

### 3.2 Patent litigation risk for HTSF's

Pitkethly (2010) illustrates in his report for the Intellectual Property Institute that the global increase in innovation and technology demands higher standards for intellectual property. The observed problem is that SMEs, startups and entrepreneurs do not recognize the potential value of being aware of intellectual property (Hynynen, 2013). Further, Hynynen (2013) illustrates, the main problem is that the firms pay attention to patenting when there already is an intellectual property rights issue. The solution approach would be to increase awareness so that the companies do not get caught up in that situation. Looking at the European Patent Regulations, there are regulations about the patent court and the unitary patent application form (Mavroyiannis & Schulz, 2012). The European Patent Office has an agreement on a Unified Patent Court (Mavroyiannis & Schulz, 2012). The member states<sup>1</sup> within the cooperation of the unitary patent protection project in Europe face a central patent court (Mavroyiannis & Schulz, 2012). The Unified Patent Court thus eliminates the unequal conditions for patent proprietors or third parties who want to withdraw European patents (Mavroyiannis & Schulz, 2012). Since, filling or withdrawing a patent includes high costs, different court decisions and no assertiveness in legal procedures (Mavroyiannis & Schulz, 2012). Additionally, the litigator might choose a court which is more likely to file in favor of the litigator, a court that might proceed faster or a court that renders a meeker verdict (Mavroyiannis & Schulz, 2012).

Mostly, SMEs, startups, and small high-tech firms experience the lack of patent awareness compared to larger firms (Heiser, 2014). The problem investigation of lacking awareness for patents might decrease the patent infringement risk for SMEs, and small high-tech firms. Whilst increasing patent awareness, the freedom to operate assessment might find an increased usage to decrease patent litigation risk.

The problem of a lack of patent awareness is worth solving since patent awareness can sustain a competitive position for new emerging companies or to existing SMEs (Hynynen, 2013). Additionally, the resources invested in R&D and the results of R&D can be used more efficiently to facilitate the companies' effort (Hynynen, 2013). The relationship between patent awareness and patent infringement risk has been further investigated by Vregelaar (2015), concluding that high patent awareness decreases patent infringement risk. In order to ensure freedom to operate, prior patenting knowledge is important (Heiser, 2014). Further, small firms are more affected by the problem of lacking patent awareness than large firms (Davis, 2006). That leads to a higher number of small firms being involved in patent litigation suits rather than larger firms (Cremers, 2007). Further, it is of importance to educate high-tech small firms about patenting and freedom to operate due to the cut throat competition. For instance, rival companies might

intentionally use different keywords for their inventions to exacerbate the patent database search for other parties (Davis, 2006). Hence, the company which is conducting a patent search, for instance a freedom to operate assessment, needs the underlying knowledge of patent searches in order to not be tricked by rivals.

Cremers (2007, p. 13) has collected data files on patent litigation from four court archives "from May to July 1999 in Mannheim and from October 1999 to February 2000 in Düsseldorf from the District Courts in Germany". Cremers' (2007) results of the data collection illustrate the sample litigation rates of patentees of the different sizes: individual person, small firm, medium-sized firm and large firm and their number of patent portfolios owned. The used sample size of Cremers' (2007) is compiled as following;

*"The final sample of litigated patents contains 824 patents with application dates from 1978 to 1993, and the final reference group of non-litigated patents consists of 824 patents."* (Cremers, 2007, p. 16)

The research shows that large firms have a sample litigation probability which is smaller than the average of 0.44 (Cremers, pp 44, 2007). The higher the size of the patent portfolio is, the lower the probability gets with 0.22 for more than 2,000 patents owned (Cremers, 2007, p.44). Further, Cremers (2007) found that the smaller the firm, the higher is the change of litigation. Additionally, for firms with maximal ten patents within the portfolio, the chance of litigation is 0.80 (Cremers, 2007, p. 44). Cremers (2007, p.44) illustrates that medium sized firms with a high number of patents within their portfolio have a high chance of litigation (0.70) and smaller medium-sized firms with fewer patents do not differ much from half of it (50 percent). The problems of patent litigation have been experienced commonly by 842 companies (Cremers, 2007, pp. 44).

Due to the waste of monetary resources and time, the problem of patent litigation due to a lack of patent awareness is a severe problem worth investigating. Beyond the problem of lacking patent awareness, it might be interesting to investigate the consequences of having IPR knowledge but not perusing with patent applications anyway.

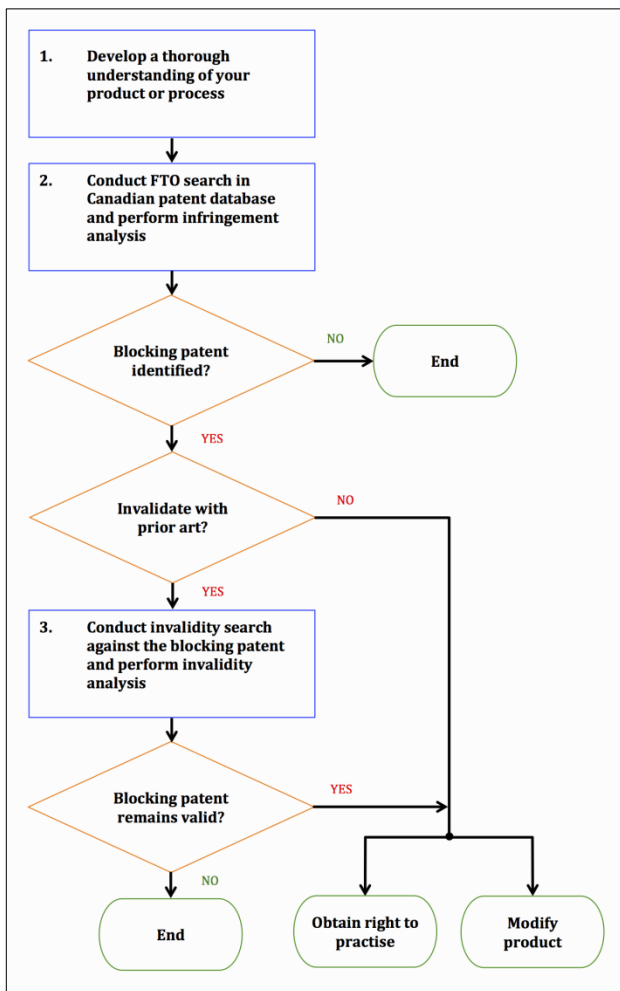
### 3.3 Opportunities and Drawbacks of a Freedom to Operate Assessment

The freedom to operate assessment is a supporting tool to check whether a company is infringing another company's patent. FTO is an analysis of all intellectual property rights in order to plenary check for prior art, including patent, designs, trademark, agreements and licenses (Sandal & Kumar, 2011, p.204). Kowalski (2007) describes FTO as to avoid infringing third parties and to ensure the continuation of the commercialization of the newly developed product. Vregelaar (2015) states, that using a freedom to operate assessment is mostly observed in large companies, rather than smaller companies. Conducting research and scanning patent databases involves time and financial resources. Additionally, whilst conducting a freedom to operate assessment, the patentee needs to have sufficient knowledge of intellectual property. Due to the fact that rivals might modify their patent applications so that they are more difficult to find in the patent database (Davis, 2006). For example, the rivals might use misleading keywords; hence, the concept would not be easy to find in the proper area (Davis, 2006). Thus, knowledge and a general awareness for the changing environment could be beneficial. The reason why large companies are more involved with the freedom to operate assessment is because larger companies possess patent related knowledge and resources (Vregelaar, 2015). The problem for

<sup>1</sup>Member States: "On 10 March 2011, the Council adopted Decision 2011/167/EU authorising enhanced cooperation between Belgium, Bulgaria, the Czech Republic, Denmark, Germany, Estonia, Ireland, Greece, France, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Malta, the Netherlands, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden and the United Kingdom (hereinafter 'participating Member States') in the area of the creation of unitary patent protection." (Mavroyiannis & Schulz, 2012, p. L 361/1)

small companies is that they often lack the required resources or the knowledge about patents since they are occupied with the core business tasks of their new ventures. Kowalski (2007, p.1330) suggests certain steps to take into consideration when conducting a freedom to operate analysis: Possible pertinent patents, including their prosecution and/or litigation status:

- Patent applications
- Third party trade secrets, including whether they might have been misappropriated
- All third- party TP rights
- All research tools used to make the agri-biotech product or pharmaceutical innovation
- Any agreements (for example, trade secret licenses, MTA's, bag-tag [shrink-wrap], or technology-use licenses, noting conditions and restrictions appurtenant)



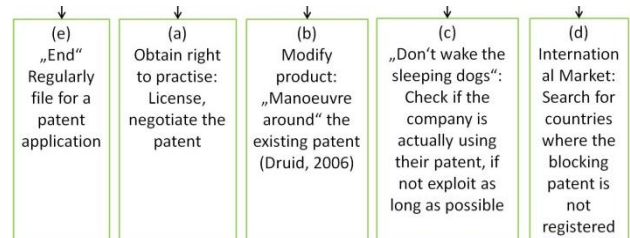
**Figure 2. Freedom to Operate Assessment by IP Inform (2015)**

Kowalski (2007) suggests the steps as an example of possibilities to include in a checklist within the early stages of conducting a freedom to operate assessment. The following assessment scheme is providing a sort of checklist for companies in order to investigate the availability of their patent. IP Inform (2015) is a Canadian law firm which is providing the assessment for freedom to operate. FTO models have been researched, and the IP Inform assessment model for FTO happens to be more accurate than the other descriptions that can be found online. The drawback of the assessment model by IP Inform (2015) is that does not illustrate alternative solutions if

the blocking patent does not remain blocked or if it remains blocked.

*“Small firms can’t survive by fighting against the big companies with patents, they can only survive by creating something new.”* (Davis, 2006, p.11)

Hence, the assessment model has been modified with alternative options as a possible next step.



**Figure 3. Modified Strategies for FTO assessment outcome**

Thereby, the model can be used for strategic options to evaluate the next steps. The freedom to operate assessment begins with developing an understanding of the product or process (IP Inform, 2015). Thereby, the definition of the invention can be determined accurately in order to develop a definition for a possible patent application. Further, the freedom to operate search can be continued in patent databases and an infringement analysis could be performed (IP Inform, 2015). Due to the fact that by looking into the prior art of others, by means of databases, patent infringement can be avoided (Nijmating, 2015). If there is a blocking patent identified as a result of the previous research for patent infringement, the inventor can continue with the innovation and file a patent application. If the blocking patent is not identified, it has to be checked if the prior art is invalidated by the researchers invention. Additionally, an invalidity search against the blocking patent could be conducted and an invalidity analysis could be performed, if the patent does invalidate with the prior art (IP Inform, 2015). Further in the assessment model by IP Inform (2015), the question is whether the blocking patent remains valid or not. If the blocking patent is valid, one strategic option would be to go out of business for the inventor. Going out of business is not a recommendable strategy; however, it is a possible option if there is no other solution.

(a) Apart from going out of business, the inventor could obtain the right to practice by acquiring a license for the patent. Negotiate with companies that hold the right for a specific patent that is needed by the high-tech small firm.

*“There are a lot of crazy patents on things that are so broad they cover virtually anything, and inventive step is minimal. You can use them for bargaining.”* (Davis, 2006, p. 12)

Ask the inventor if the patent could be used by the small company as well.

(b) Another option would be to modify the product, as already suggested by IP Inform (2015) and as Davis (2006) suggests, “maneuver around” the existing patents.

(c) My other empirical option includes investigating the antecedents of the patent owner. The case might happen, where companies with a variety of patents are not checking whether their patents are being infringed or not. Hence, this weakness by the other party could be exploited by the inventor as long as possible.

(d) Also, the inventor could search for other countries where the blocking patent is not valid.

(e) Lastly, if the blocking patent does not remain valid, the inventor can regularly file an application, first for the local country and then optionally apply for a European Patent (Sandal & Kumar, 2011).

The modified strategies for a freedom to operate assessment outcome can be used as a model to help startups as a guideline when deciding on a patenting strategy. Additionally, this research offers a policy recommendation for involved stakeholder on how to practically enhance patent awareness in the following discussion part.

#### 4. DISCUSSION AND PATENT SEARCH IMPLEMENTATIONS FOR HIGH TECH SMALL FIRMS

Based on the outcome of the literature findings it can be assumed that on the one hand emerging firms might increase awareness about IP and patents after a court dispute. On the other hand, if companies build up their knowledge about IP and patents before they have experienced a patent litigation process, it would be more beneficial, than the other way around. In the case of the latter, improved awareness of IP and patents would increase the awareness of patent searches; mostly common used assessment is an FTO investigation. The causality between patent awareness, patent risk, and the patent search will be discussed in the following. Since there is no model or framework about how to patent, the first checklist is the modified FTO assessment and the options can serve as a guideline for high-tech small firms. The modified FTO assessment holds as the first guideline for startups to consider whether it makes sense to patent or not and what strategies to undertake. Whether to patent or not depends on multiple factors. Especially among startups in the high tech industry, each patent case should be handled individually, since it is rather inefficient to generalize that patenting is the most efficient option. Two entrepreneurs have been interviewed, on their opinion about patenting.

4.1. *Unstructured interview with the entrepreneur from ICE-Africa BV (African Energy & Consulting BV*<sup>2</sup>: The entrepreneur of the company ICE- Africa BV is working on startup projects for sustainable development in Africa. During the interview, the interviewee mentions that if applying for a patent is necessary

or not depends on the location of the emerging enterprise. For example, in the USA it is not of importance which company has the first patent issued, but rather who commercially exploits the innovation first. In Europe, it would be more important to first make sure to have the patent rights. From personal experience, the interviewee states that, in China, patents are not of great importance, as they have rapid technological change and short product life cycles. If the startup has the capacity to manufacture a lot of products and thereby gain a large market share, it might be beneficial to risk it and pursue with the commercialization without a patent. Further, the interviewee mentions that until the other company files for patents, startups can earn profits and in the case of losing the litigation process, pay a fee and still have profits. An alternative for startups to patent on their own could be to cooperate with the company and share the patent rights.

4.2. *Semi-structured interview with an entrepreneur from the company Eureka*<sup>3</sup>: The startup invented a bendable ceramic together with MESA+ Institute for Nanotechnology in Enschede, the Netherlands. In 2015 they started with their idea to change the state of ceramic that has been solely used for one specific purpose. An unstructured interview has been conducted with the responsible for business development and sales from Eureka. The company Eureka has knowledge about patenting and is aware of intellectual property protection. They learned about patenting from their experience while working in startups. Eureka is currently in the seed stage of the startup financing cycle. In general, it is useful for their invention to be patented, although the interviewee mentions that certain technologies are not patentable. In the case of Eureka, they evaluated the importance of applying for a patent from inception. Further, Eureka has the time and financial resources to apply for a patent which might not be the case for other startups with fewer resources. Ideally, Eureka would file a design patent since the design patent offers a more comprehensive protection. Since Eureka has a general awareness of patents and sees an economic advantage in patenting, they suggest looking for a patent attorney if it can be afforded. The high-tech startup suggests that there is rather plenty of information online, for instance, Google patents, but nonetheless with a patent attorney the company is on the safe side. When asked whether the startup

Table 2. Literature Review

Authors and years	Awareness of IP/ awareness of patents and patent litigation (HTSFs, SMEs) incident	Patent litigation (HTSFs, SMEs) incident influences awareness of IP/ awareness of patents	Relationship between awareness of IP/ awareness of patents concerning Prior patent search (FTO)	Relationship between patent search (FTO) and patent litigation (HTSFs, SMEs)
Parchomovsky (2000)	x	X		x
Heiser (2014)			x	
Pitkethly (2007)	x	x		
Vregelaar (2015)	x			
Hynnen (2013)		x		
Graham et al. (2009)			x	
Nijmanting (2015)				x

<sup>2</sup> <http://www.afenecon.com/>

<sup>3</sup> <http://www.eureka.com/>

would commercialize the invention without a patent, the interviewee suggests that it depends on the specific case. If Eurekite would be sued by a larger company they would immediately consult a patent attorney and company lawyers and decide what steps to undertake.

Eurekite is aware of patent search, more specifically of freedom to operate, but have not conducted a freedom to operate search. The startup has used Google patents and searched with keywords for other patents. At the same time, they assigned a patent attorney to conduct an individual patent search. The interviewee mentions that indeed he has heard of freedom to operate but has not become aware of any freedom to operate framework or checklist. Nonetheless, he explains that it sounds interesting to use strategic guidelines for the patent search, like the freedom to operate analysis.

#### 4.3. Results

There are individual case studies on patent litigation and infringement cases from which startups might gain insights into previous experiences. Nevertheless, a more effective assistance for startups is the implementation of strategic models, for example, a recommendation checklist. Hence, the outcome of this research paper is to contribute to the awareness of patents by providing a policy recommendation to raise patent awareness for universities, governmental institutions, and the startups.

**Table 3. Strategic policy recommendation for raising patent awareness**

- Facilitate patent application process by the unitary patent application form (Mavroyiannis & Schulz, 2012).
- Patent law education at universities (Villasenor, 2013)
- Free online tools to facilitate freedom to operate analysis for small medium enterprises
- Shorter application time
- Flexible payments for registering patents

Another option for startups to manage their patenting process could be to collaborate with students who have expertise in that field. There is a spin-off from the University of Twente founded in 2010<sup>4</sup> that offers a platform where business consultancy is offered at an affordable price for startups. By providing a recommendation guideline, the stakeholder might get an incentive to implement strategies for enhancing patent awareness. Furthermore, the problem of patent litigation risk affects different stakeholder, for instance, government and startups (Blackburn, 2003).

## 5. CONCLUSION: INCREASE PATENT AWARENESS TO STIMULATE STRATEGIC APPROACH TOWARDS THE PATENTING PROCESS

In this paper, a literature review has been conducted on patent awareness and freedom to operate assessments. The goal of the research has been to investigate the relationship between an increase in patent awareness, by means of using a freedom to operate assessment more extensively, towards a decrease in patent litigation risk. To sum up, the research of Vregelaar (2015) found that patent awareness and freedom to operate is not dealt with sufficiently in management literature. The fact that there is little awareness of patents, leads to an increased risk for patent litigation. The high-tech industry is a patent intense area, where the urge for patenting is increasing over the

past years. Due to the lack of expert knowledge within the field of patent law, especially high-tech small firms are experiencing difficulties with protecting their intellectual property. The reason for lacking awareness is that patent databases are difficult to work with, new emerging enterprises and startups do not possess sufficient monetary resources to alternate with patents and do not know how to start a patent application. Pitkethly (2010) illustrates in his report, that awareness about IP and patents could be raised by providing information on websites, email bulletins, and brochures. Another possibility would be to provide online programs, games or softwares that teach about IP and patents. In general, the awareness for IP and patents should start in Universities, where future members of potential Startups are educated (Villasenor, 2013).

Whether it is a good idea to patent or not depends on the individual startup case and the resources. Nonetheless, if small firms would have a basic knowledge of patents it would increase their monetary exploitation and depth and cost of research. To increase patent awareness does not only decrease the risk of litigation, it also improves the strategic approaches towards the commercialization of inventions. In order to develop sustainable business strategies on how to deal with the different possibilities of patenting options, it is of importance to be aware of the existence of patents. Further, with an in-depth expertise of patents, the freedom to operate assessment can be of great assistance while developing strategic options for the enterprise. Some companies collected their knowledge about IP and patents due to a prior litigation issue. Other companies that are already aware of IP and patents would like to deepen their knowledge since they know it is beneficial. The disposition of high-tech small firms towards the interest in IP and patents is there due to the benefits during a patent litigation process.

## 6. LIMITATIONS AND FURTHER RESEARCH

The research covers the European Patent System. Also, it is not specified in literature what the different authors specifically mean by small firms, medium-sized firms, startups or high-tech small firms. Further, there are no companies from recent years included in Cremers (2007) research, thus, the tendency of small companies being infringed more might not be up to date.

Since the European Patent Office (Mavroyiannis & Schulz, 2012) recently implemented some new policies concerning the patent court and unitary patent application form, there might be an impact on the patent litigation cases on high-tech small firms that are not included in this research. The usage of the patent search analysis of freedom to operate is effective for developing strategies for various options for startups. Since it is difficult for startups to find guidelines or strategic tools tailored to the entrepreneurial need of developing a new enterprise, further research could focus on increasing the use of strategic analysis tools like the freedom to operate assessment. The relationship of using the freedom to operate assessment towards the development of patent litigation is interesting to further investigate.

The perspective on the relationship of the variables might be bias, since the topic has been provided pre-determined by the track options of the university. Nevertheless, that bias might be a more generic issue for academic literature.

The methodology has not been carried out carefully enough, and the synonyms of the variables have not been reported in the academic necessary jargon. Hence, the reliability of the results of this research is contestable. It might be difficult to come up with the same list of articles provided in this research, when searching for it, since the literature searching process is not

<sup>4</sup> website: <https://www.gruenden-live.de/ideenwettbewerb/6/3260/>  
<https://www.xing.com/communities/posts/unterstuetzt-unser-konzept-consulting-zum-pay-what-you-want-tarif-1010183961>



comprehensible enough. Additionally, the research is bias or unilateral, due to the fact that it is overly based on Vregelaar's (2015) work.

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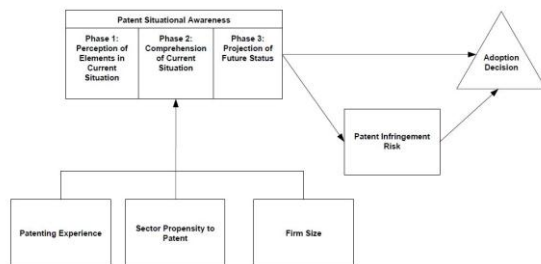
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## 9. APPENDIX

The advanced model by Vregelaar:



**Figure 4. Final Conceptual Model for Patent Situational Awareness (Vregelaar, 2015)**