Exploring the patent thicket problem: a literature review

Introduction

Today, many millennials remember those days when their grandmothers had excellent skills to repair their clothes. Some of us may have the joy to remember our grandmother and her precious Singer treadle sewing machine. Nowadays, in our fast paced and high-tech world, our society reinforces consumerism by stocking our stores with low cost and disposable clothing. As a matter of fact, not many of us repair our clothes anymore, and not many millennials may be able to say that they have ever used a Singer treadle sewing machine. But in early 19th century, sewing and clothing repair was a valuable and an important life skill. The sewing machine as we know it today was developed over the course of two centuries, starting in the late 1755, with the invention of the eye-pointed needle by the German mechanic Charles Fredrick Weisenthal and the embroidery machine in 1804 by John Duncan [1], [2]. In the early 1840’s Elias Howe, Jr. invented and patented his own version of the sewing machine, a machine that was functional but far from perfect. Howe’s machine was able to stitch 250 stitches per minute and it was constructed by a combination of his inventions and the improvement of previous inventions [1]. It was not until the year 1850 that an innovative invention came to light, a sewing machine that could stitch straight and curved lines, that had a foot pedal, and that could produce 900 stitches per minute [1]. This practical machine was developed by Isaac Merritt Singer, an American inventor and entrepreneur founder of the Singer Sewing Machine Company. Singer was granted a patent for his invention in 1851, but on the same year Howe had filed for a series of patent infringement lawsuits against Singer, claiming that Singer’s “innovative” invention was infringing the patent that he was granted in 1946 and demanded a royalty payment. Over the period of five years, Howe and Singer entered a patent infringement war. Howe had started the war, but later a large number of patent owners filed for different patent infringement lawsuits against Singer. This war, described in detail by Mossoff [1], and known as “the Sewing Machine War”, was just the beginning of a much larger problem, the problem that many call Patent thickets.

The Sewing Machine War ended in the late 1950’s, but the “patent litigation wars” have grown, moved to different technological fields, and are fiercer than before. Just in 2012, two smartphone and electronics industry leaders made news, Apple and Samsung, when a federal courthouse in San Jose, California found that Samsung infringed on six Apple patents on mobile devices and ordered Samsung to pay 1 billion dollars as compensation for infringing Apple’s intellectual property rights. This verdict was for one out of the numerous lawsuits that Apple, Samsung, Google, Microsoft and many other high-tech firms have against each other [3]. Recently, this increasingly number of patent-infringement lawsuits has captured the attention of policymakers, lawyers, economists, scholars, and even the United States Supreme Court (for more information see [4]).

In this context, the paper aims to provide a literature review on patent thickets, which are argued to create and nourish conflicting patent claims, friction between different technological industries and have an adverse effect on innovation. Additionally, patent thickets can have a negative impact on several industrial sectors, including the transport and logistics, inhibiting its development and reducing innovation.
Current situation in patenting innovations

A patent has been described in literature as a tool to promote innovation and that is used by inventors to obtain exclusive rights to make, use, sell, and import their discoveries for a certain period of time [5], [6]. Some of the statutory requirements for patentability described by the U.S. Patent and Trade Office (PTO) are: Innovation on a patentable subject matter, the invention must specific and useful, non-obvious, and not have been disclosed prior to the patent application. In addition to those requirements, in a patent application, the claim construction or the wording of the claim is what defines the scope of protection [7]. Patents have been known to incentive innovation since the 14th century but in 1883 at the Paris Convention for the Protection of Intellectual Property, eleven countries singed the first treaty for international validity of property rights [8]. Since then, revisions and different amendments to the initial treaty has changed the filing and granting process of patents around the world.

For instance, in the United States Patent and Trade Office (USPTO), inventors have a one-year grace period to file a patent application after disclosing the invention to the public. On the other hand, in the European Patent Office (EPO), inventors do not have this one-year grace period and the patent will be given to the first person to file an application [9]. Additionally, there is a difference between the USPTO and the EPO in the way an examiner adds references to a patent. In the USPTO, patent applicants have provide a list of prior art relevant to their patent application. With this list, the examiner can properly catalog the invention and add or expand the list of relevant patents. However, in the EPO, only examiners are allowed to add references to a patent, and applicants do not have to provide a list of prior art [10]. Harhoff et al. [11] argued that the difference in patent systems may have caused that “Non-European applicants are significantly less likely to face opposition than European patent holders”. The main reason for his argument is that non-European patent holders have gone through a more rigorous evaluation by the examiners, and that the exclusion rights granted by the EPO may be too broad. Moreover, the Intellectual Property Office of the United Kingdom (UK-IPO) [7] showed evidence that North American and European applicants frequently file applications with a broad scope of claims, whereas applicants in Japan file applications with a much narrower scope. Furthermore, according to the UK-IPO [12], when a patent holder’s license a patent in a specific country, there is no obligation for that agreement to be recorded in other countries or systems around the world. Thus, for patent offices is very difficult to know for which country a patent has been licensed or if the patent has been licensed or not. The increasing growth rate in patent applications (Fig.1, Fig. 2), the differences in the reference information of each patent, and the difference in the examination process, has made the patenting procedure a lot more complex and has increased the pendency of patent applications around the world.

![Fig. 1. Patent filings at selected patent offices](source: [13])
In 2012, the World Intellectual Property Organization (WIPO) estimated that 2.35 million patent applications were filed around the world, which represented a growth of 9.2% compared to the previous year (Fig. 2). For the WIPO, this was the highest rate that has been recorded in 18 years [14]. It is worth noting that 55.9% of the patent application filed were documented in different intellectual property offices in Asia (Fig. 3). The second highest concentration of patent applications were in North America with a 24.6% share, while Europe accounted for a 14.7% of the total patent applications around the world.

Recently, there is a growing debate that the increasing number of patent filings in Asia, North America and Europe, along with the differences between patent office regions, has increased the number of “weak” patents being granted. Currently, around the world there is a large backlog of pending patent applications. The WIPO estimates that in 2012, there were approximately 5 million patent pending applications undergoing examination around the world (Fig. 4). The USPTO had over 1.2 million pending applications, Japan over 1.07 million and the EPO approximately over half a million pending applications [12].
This large number of patent pending applications may pressure patent offices to speed up the examination process and force examiners to spend less time reviewing each patent [13], [15]. Usually, a USPTO patent examiner devotes around 18 hours on each patent application over the course of three to five years [9]. According to Lemley and Shapiro [9], several studies have shown that the large workload on a patent examiner and the lengthiness of the reviewing procedure may have an impact on the quality of the review, the validity of the patent granted, and even push the examiner to overlook some overlapping patent rights [9].

**Patent thickets**

Patents are one of the key incentives for innovation, research and development. For Galasso and Schankerman [16], not only patents, but the transaction of patents has improved the dissemination of knowledge, the diffusion of technology and has nurtured competition between firms [16]. Unfortunately, with the increasing number of patent filings, the enormous backlog in patent pending applications, the slow reviewing process, and technology changing rapidly, inventors file multiple patent applications as an effort to protect themselves from lawsuits, discourage others from the creation of new products, or simply as “lottery tickets” hoping that their invention may be the next billion dollar idea [9]. Furthermore, in industries such as biotechnology, pharmaceutical, telecommunications and electronics, filing multiple patents on related technologies, or technologies that are part of one commercial product, has become a strategic move that has led to the creation of fragmented patent rights.

The fragmentation of patent rights has been linked to the theory of the anticommons property. In the anticommons property, developed by Heller [17], a resource is underused when a large number of owners are given the privilege to use a specific resource. Likewise, in intellectual property rights, the anticommons thesis has been associated with the difficulty in bundling property rights for the development of new technologies and the increasing licensing transaction costs. For instance, in the pharmaceutical and biomedical field, Heller and Eisenberg [18] shows that industries are less likely to participate in patent pools since it may significantly decrease a firm’s revenue. Additionally, by not participating in patent pools, pharmaceutical and biomedical fields have a higher chance to monopolize the market and have a much more lucrative business [18]. Moreover, it has been seen in industry that the fragmentation of patent rights is widely used by firms as bargaining chips to obstruct rivals from launching new products or shutdown their business activities [11].

In 2001, Shapiro coined the term “Patent Thickets” and defined it as “an overlapping set of patent rights requiring that a company must hack its way through in order to actually commercialize new technology” [19]. Shapiro finds evidence that the overlapping and fragmentation of patent rights has decreased the patenting rate of new technologies and has hold back the diffusion of knowledge across technologies. The stifle in innovation can be seen when companies avoid developing and launching a new product for the fear of potential holdups or simply for the uncertainty and possibility that other companies may establish a patent infringement lawsuit [20].
Over the years, Shapiro’s definition of patent thickets has evolved and several researchers have contributed significantly to the expansion of the patent thicket definition. Currently in literature, patent thickets are also referred as “blocking patents”, “patent floods”, or “patent clusters” [7]. Von Graevenitz et al. [21] proposed an expansion to the definition of patent thickets arguing that “the combination of complex technology and high volume patenting creates patent thickets, which can be defined as dense webs of overlapping patent rights”. Three different types of high volume patenting strategies (valid patent, weak patent, patent thicket) employed by patent applicants has been described by the UK-IPO (Fig. 5).

**Fig. 5.** Patenting Strategies (a – “valid patent”, b – “weak patent”, c – “patent thicket”)

*Source: [7]*

In the patenting strategy for a “valid patent”, part (a), a patent is filed in one technology field with a narrow scope of claims and a specific wording. In fig. 5, part (a), the central star represents an invention developed by an applicant. After the patent is granted, the invention is protected within the scope of the claims. The protection of the patent is illustrated with the fence enclosing the star. The other fenced areas surrounding the central star represent similar patents that have been granted and that are protected by their scope of claims. It is worth noting that the fenced areas are not closely connected to each other, therefore it can be said that there is still plenty of opportunities for other firms to patent new inventions in a technology field. The opportunity for new developments is represented in the white space between different fences [7].

In the patenting strategy for a “weak patent”, part (b), a patent applicant has been granted a patent in one technology field with a broad scope of claims, taking a large area of the technology field and reducing the opportunity for inventors to patent their innovations. Similarly to fig. 5 part (a), the central star represents an invention developed by an applicant. After the patent is granted, the invention is protected within the scope of the claims; however, the scope is written with an ambiguous language, leaving unclear boundaries. The protection of the patent is illustrated with the fence enclosing the star. In this patenting strategy, it is visible that there are no additional fenced areas surrounding the central star. This shows that a broad scope of claims deters other inventors to patent in the same technology field [7].

In the patenting strategy for a “patent thicket”, part (c), a key patent in one technology field has been granted by the IPO. This key patent is not only protected by the defined the scope of claims but also by surrounding patents that possibly have similar scope of claims. This is a strategy that dissuade inventors from filing new patents for their innovation. This overlapping scope of claims is commonly refer as “ring fencing” and it is commonly seen in complex technologies. In the case that any of the surrounding patents is challenged and overturned in court, the key or main patent will remain intact and protected from any future patent litigation [7].

What is more, in literature, several researchers consider patent thickets as economic barriers for small and medium-sized enterprises (SMEs). Harhoff et al. [8] show that patent thickets raise the cost of entry for SMEs. They argue that “patent thickets constitute a barrier to entry into patenting, if they raise the cost
of entry into patenting for outsiders such that social welfare is less than in the absence of patent thickets”. Furthermore, they develop various causal factors for the creation and growth of patent thickets:

- The expansion of patentable subject matter and the strengthening of patent rights after the approval of the Federal Court Improvement Act in 1982;
- Greater complexity in technological fields and a higher degree of specialization in certain industries;
- Technological change and the creation of new technological opportunities;
- Increasing strategic patenting behavior and higher degree of opposition for valuable patents;
- Massive application backlog and slow examination;
- World trade growth and increasing demand for high-tech patents.

Mariam et al. [15], shows that a patent that is part of a patent cluster “may generate very large rents to its owner even if in itself it is not “important”: it merely needs to block other patents owned by other firms in order to be a useful bargaining tool to extract profits from devices that infringe the patents”. For instance, in the smartphone industry (Fig.6), hundreds of complementary patents are required for the construction of one single product. In this industry, strategic patenting is used to obtain profits from infringers. This strategic patenting is also known as “defensive patenting” [15]. Additionally, a similar strategy has been used by large patent portfolio holders who would “selectively apply for patents which will present the best opportunities for cross-licensing”[22].

![Fig. 6. The Smartphone Patent Thicket](source: [23])

**Conclusions and plans for further research**

Currently, there are no effective scientific measures for the identification of patent thickets. In literature two main methods have been identified. Von Graevenitz et al. [21] proposes a method based on the blocking relationship of patents and the search for triples. “A triple is defined as a group of three firms in which each firm has critical prior art limiting claims on recent patent applications of each of the other two firms. Clearly such a group of firms is caught in the most basic type of a patent thicket created by potentially overlapping patent portfolios” [13]. Also, two companies holding limiting patents can settle for an agreement, while it is much more difficult for three companies. There are many triads in technological areas prone to patent thickets, what makes agreements between market players very difficult and often requires patent pooling. This may lead to a reduction in the innovation level of technological sectors, including the transport and logistics.

Moreover, Clarkson [24] builds a measure of patent thickets constructed on the network nature relationships between patents. The method is based on defining a measure of network density, where density relates to citations between patents, and then on the analysis of this measure – the higher density the better chance of patent thicket occurrence in the given area of a patent network. Clarkson states that his measure of patent thickets is not perfect and can indicate patent clusters where they do not exist. What is more, this measure
is also computationally challenging for large networks. Pertaining to the above explanation, in order to develop an efficient patent thicket identification method, further basic research is required, aimed at the formation of a robust theoretical background for thicket detection. In the future, this research aims to develop a computational method for patent thicket identification based on patent network analysis.

Abstract

A patent has been described in literature as a tool to promote innovation and an instrument used by inventors to obtain exclusive rights to make, use, sell, and import their discoveries for a certain period of time. In 2012, the World Intellectual Property Organization (WIPO) estimated that 2.35 million patent applications were filed around the world, which represented a growth of 9.2% compared to the previous year. For the WIPO, this was the highest rate that has been recorded in 18 years. The increasing number of patent filings has exerted tremendous pressure on patent offices to speed up the examination process, force examiners to spend less time reviewing patents, and possibly overlook the creation of fragmented and overlapping patent rights. The aim of this paper is to present a literature review on patent thickets, which are argued to create and nourish conflicting patent claims, friction between different technological industries and have an adverse effect on innovation. The paper ends with conclusions and a brief description of further research.

Keywords: patent thickets, intellectual property rights, patents

References

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