View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Lund University Publications - Student Papers

LUND UNIVERSITY
School of Economics and Management

Master program in Economic Growth, Innovation and Spatial Dynamics

Leveraging Uncertainty:
Private gains at public cost by PMEs

John Johnsen

John.c.johnsen@gmail.com

Abstract: Incidences of patent litigation have increased dramatically in recent years. A growing share of this activity is being taken by patent monetization entities (PMEs). Through descriptive statistics and case studies, this article explores the relationship between PMEs, patent litigation and market uncertainty. The lack of rigid judiciary structure within the field of software patenting has left it particularly susceptible to uncertainty. The goal is to incrementally advance the knowledge base around the subject and promote further research.

Key words: Patent, Uncertainty, PME, IPR, Innovation

EKHM51

Master Thesis (15 Credits ECTS)

June 2014

Supervisor: Carl Frey

Examiner: Lars Coenen

Table of Contents

Section 1: Introduction

Innovation and the diffusion of related knowledge has been a key driver of growth throughout the world for centuries, particularly since the industrial revolution. Intellectual property rights (IPRs), such as patents, were developed as an institution to promote research and development (R&D) by protecting the investments of innovators through temporary exclusive rights to manufacture and sell a patented invention. The arrangement is meant to be mutually beneficial to the innovator and society as a whole. In exchange for disclosing the details of a new invention to the public domain, which allows for the diffusion of related technical knowledge, the innovator receives a 20-year monopoly on the sale, manufacture and distribution of the invention. Not only is this meant to increase the incentive for new R&D, but also to ensure that new disruptive innovations are not lying dormant due to the inventor's lack of resources or will to manufacture it. However, the increasing complexity of innovations, especially in the high-tech and software industries, has led to ambiguous boundaries in patent protection. Business methods and software patents are particularly troublesome because 100% of the patentable "invention" lies within abstract ideas implemented in code and subsequently explained in a patent claim. Unclear boundaries create legal uncertainties and there is growing evidence of companies taking advantage of these unclear boundaries willingly through patent monetization entities (PME) and strategic patenting. These types of activities create uncertainty in the marketplace and raise the barriers for market entry, therefore creating a disincentive to invest. This article will explore the characteristics of the contemporary institutional environment of IPRs in the United States in an attempt to identify some causal factors for the rapid expansion of incidences of patent litigation and the ensuing market uncertainty that follows through the usage of descriptive statistics and case study methodology.

This paper is organized as follows: Section 1 is the introduction and definitions. Section 2 will cover a brief history of patent litigation in the United States. After shortly covering two patent crises in the 19th century and their causes, Section 2 will continue with major benchmarks in patent legislation in recent decades. Finally the section will conclude with discussing the inherent issues of software patents and the typical PME case type. Section 3 will be focused primarily on the theoretical

framework of the article, including the origins of property rights theory, the effects of market uncertainty on investment, the nuisance suit economic model, and the effect of PMEs on innovation. Section 4 is where the methodology of the article is discussed, complimented by the help of descriptive statistics. Benefits and limitations of case study methodology are covered, as well as any possible biases in the data. Section 5 is comprised of four separate case studies within separate patent classes, three of which are from the software and high-tech industries. Finally Section 6, the conclusion, will reiterate the main points of the paper and discuss the findings.

1.1 Research Question

What are some ways that PMEs are contributing to the increase in litigation and legal uncertainty in the current institutional environment of IPRs in the United States?

1.2 Definitions

It would be difficult to hold a discussion about IPR policy in present day context without the term "patent troll" being mentioned. However, regardless of which side one lands on the IPR patent litigation issue, it is hard to deny the negative connotation that comes with the term troll. Other more neutral terms, such as non-practicing entity or patent assertion entity, have been proposed as alternatives but might be a little too broad for the sake of this article. By definition, a non-practicing entity (NPE) is literally any patent holder that does not manufacture the patent that they possess. While this does indeed include the population that this article is wishing to include, it also includes single inventors and start-ups that are wishing to transfer their technology to manufacturers for a licensing fee. These groups of people are not part of the problem that this article is attempting to address, as they are utilizing the patent system as it was intended to be used, as a means to transfer technology, promote innovation, and protect the investment of the inventor. Another term, patent assertion entity, which has gained popularity recently, includes a population of entities that use patents to assert them against businesses already using the technology in order to attain licensing fees. While this is closer to the definition the author is searching for, the clever wording has allowed some entities, such as the RPX Corporation, to mask the true characterization of itself through using third parties. For example, RPX is a for-profit corporation that buys broad or poor quality patents and, for a monthly fee, will license out their patents. RPX's entire vision is claimed to protect business

through a sort of crowd funding operation to buy up poor quality patents and RPX vows to never assert them against anyone. However, RPX sells their patents to a third party who has no restrictions on patent assertion outside of RPX's customer base. So if all parties are included, RPX is indirectly a patent assertion entity in itself as a conglomerate (Jeruss, Feldman & Walker 2012). Due to this, hereinafter this article will refer to entities that monetize patents, in any way, without actually performing any technology transfer as patent monetization entities (PMEs). It has been noted in relevant literature that universities have in the past been included into NPE, PAE, or PME categorizations but for the sake of this paper universities will be left out as they include only 0.2% of all patent litigation and therefore are not of significant relevance (ibid.). In order to clarify, this study is not interested in patent litigation between two manufacturers, such as Apple and Samsung, as the current system in place is a disincentive to frivolous lawsuits by competing manufacturers due to high costs for both parties in legal fees, manufacturing delays, and counter-suits.

Section 2. Literature Review: A History of Patents in the US.

The USPTO was established in 1793 and within the first century of its enactment there were two events with striking similarities to contemporary times that led to diminishing public opinion of patents and almost caused the dismissal of the entire patent system (Granstrand 2006). This section will cover events that happened in the agriculture and railroad industries, during the end of the 19th century to illustrate the similar nature of PME activity in contemporary times. Moreover, some major benchmarks in contemporary patent legislation will be discussed to give further contextual knowledge to the development chronology of nuisance patent litigation and PME activity.

2.1 Patent Sharks in the Agricultural and Railroad Industries

The establishment of the USPTO is regarded as playing a crucial role in setting up an institutional environment that helped transform an infant nation into the industrial powerhouse it had become merely a century later. The potential of the new market awoke schemers and con men to apply for patents on prior art in attempts to receive easy money. Initially this plan worked because under the first set of patent laws, all applications were approved and any conflicts had to be taken up in court (Usselman & John 2006). Similarly to contemporary times, litigation defense was a costly matter

200 years ago, and the patent holders would adjust licensing fees to be less than the cost of defense, therein making a settlement the most economical decision regardless of the patent's merit. Unfortunately, this problem is one that has not entirely been addressed in the modern judicial system and will be explained further in a nuisance patent economic model. This issue of universal application granting was finally addressed by the USPTO in 1836, which left the conflict portion of patents with the courts but the USPTO took on the initial responsibility of deeming whether a patent is novel, non-obvious, and should be approved (Merges 2009). The real shock that led to crises in two major industries and almost led to the downfall of the entire patent system due to unpopular demand came down to an amendment of a single word. In 1869, the USPTO decided to allow incremental improvements of current patents to be patentable by extending the range of design patents from "new and original" to "new, *useful*, and original" (Chien 2012). This alteration of one word opened the floodgates for the opportunists once again, and a tsunami of new patent applications washed into the USPTO. The majority of these patents were for everyday farming tools, such as spades, rakes, and seed planters. Undoubtedly, the reason for this is at least half of the American economy at this time was still involved in the agricultural sector and these tools were what were most common to the majority and minor improvement ideas were apparently not in short supply. It has been reported that an ordinary corn planter had 647 patents, a corn sheller had 378, and all of the different parts of a plow totaled 6,211 patents (ibid.). Drawing another parallel to contemporary times, the patents were typically applied for and retained by inventors, or in this case mostly farmers, who would then sell the patents to lawyers and technocrats that had the knowledge and capital to assert the patents against others (Magliocca 2003). Once this type of activity gained momentum and everyday farmers were being hit with the choice of licensing fees or lawsuits over using the same tools that they had been using for decades, a grassroots resistance within the agricultural sector arose that threatened the patent system.

During the same period of time, initiated by the 1869 USPTO amendment, the railroad industry experienced an enormous surge of patents on different parts of a train. The sudden influx of applications caused a significant increase of the patent backlog, which was addressed by the USPTO by increasing success rates of applications (Usselman & John 2006). During this era, the railroad was the epitome of

technology and once word of this exploitable market got out, patent speculators began patenting parts ranging from double-acting air brakes, to sleeper cars or safety equipment (Gallagher 2011). In defense, the railroad industry bound together through the Eastern and Western Railroad Associations through hiring patent attorneys and lobbying Congress to address the issue (Chien 2012). The fundamental strategy of patent litigation during this period parallels contemporary PME procedures.

2.2 Contemporary Patent History

It has been argued that the contemporary problem of the surge in patent applications and ultimately a rapid increase in patent litigation began in 1984 with the Court of Appeals for the Federal Circuit (CAFC) deciding to exclusively hear patent disputes, in order to specialize and fully understand the complex conflicts. Before this event, patent disputes tended to favor the defendant, but after this incident the courts began siding much more commonly with the plaintiffs (patent holder) and damage awards dramatically increased simultaneously (Granstrand 2006). Patent protection was extended to software in 1994, which was formerly only allowed copyright protection, when the CAFC ruled that software was eligible for patentability as long as its utility was, "…a specific machine to produce a useful, concrete, and tangible result" (Sterne & Bugaisky 1994). In 1995 the largest international IPR agreement occurred with the Trade Related Aspects of International Property Rights (TRIPS) agreement, which linked international trade to international IPR protection. This strengthened the power of patent holders as it allowed for their patents to be enforced to a further extent in foreign countries. The TRIPS agreement has received much criticism for having a "developed" country bias and has been accused as hindering a virtuous catch-up cycle for developing countries (Forero-Pineda 2006). Regardless of the validity of those claims, it is apparent that the relative strength of IPR and patent holders became stronger after TRIPS, which presumably contributed to the rise in patent applications in recent decades. Finally, one of the main enabling decisions leading to the rise in nuisance patent litigation comes from the 1998 decision in State Street Bank and Trust v. Signature Financial Group where it was ruled that business methods were patentable as long as they were incorporated into some sort of software (ibid.). While this did not have an immediate effect, as e-commerce had not yet fully developed and the diffusion of knowledge about the settlement took time to disperse. Around a decade after this decision, it is shown that this specific class of patents, Class 705, has

begun to take flight (See Figure 1). The relevance of this particular patent class will be discussed further in this section.

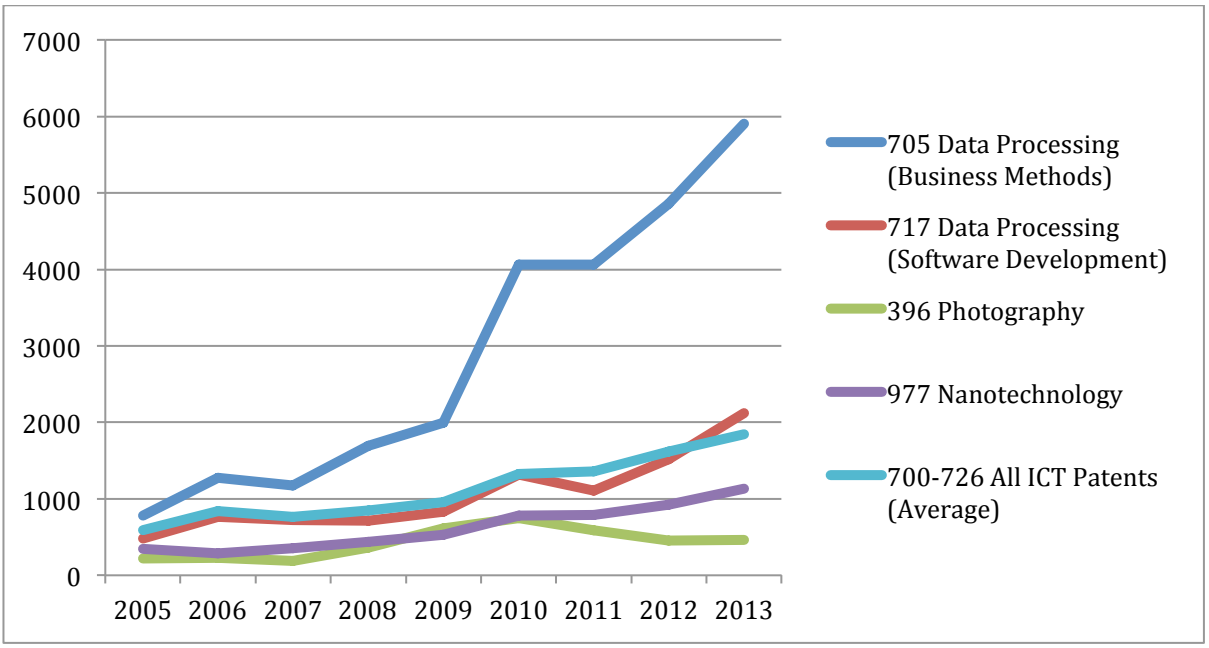

Figure 1

2.3 What is the problem with software patents?

As mentioned in Section 1, an idea is not enough in itself to warrant patent protection. A patentable invention needs to have clear boundaries that can be understood and replicated by a third party. By definition, abstract ideas and algorithms are not patentable on their own but that is essentially what software patents are. With the additional business method patents being allowed after 1998, which merely required that a business introduces a new method of doing business (e-commerce, insurance, retail, banking, etc.) integrated within software, a dramatic increase in software patents has occurred along with the number of patent lawsuits per year. With business methods becoming patentable, it became entirely possible to patent abstract ideas without a tangible invention. The issue with an entirely abstract patent is that patent's need to have clearly defined boundaries, as to only cover the extent of the invention being patented. With abstract ideas, boundaries can easily become unclear and often times certain words have multiple embodiments that could make a claim's boundaries interpretable in several different ways. As a result, certain abstract patents violate the "rule of first possession" by allowing a patent holder to claim a broader range of

technology than what was actually invented (Bessen & Meurer 2008). While not all software patents break this rule, the technology itself facilitates the potential for abstract claiming and statistics are showing that more people are taking advantage of this potential. All of the top 12 patent classes asserted by patent monetizers are software related. It has been estimated that software patents are litigated seven to ten times more often than average patents (Allison et al. 2012). Patent Class 705 (business methods) is ranked third most litigated with 128 patents and 844 defendants (RPX Corp. 2012, see Figure 2). In 2012, out of all the NPE cases filed, 92% of them were filed by PMEs and only 5% by inventors (ibid). This rapid acceleration of patent lawsuits within the software industry leads one to believe that this loophole in IPR legislation has significant economic values and more economic actors are jumping on the bandwagon each year. Interestingly enough, some researchers have found that most of those in the software industry itself are against software patents, and software companies are more often defendants rather than plaintiffs in patent lawsuits (Oz 1998).

After potentially vague boundaries of software patents, it could be argued that notice failure is the next largest issue for software and high-tech patents. Notice failure is when patent infringers do so unknowingly due to not being aware that a certain technology is already patented. In certain industries, such as chemical, notice failure is not nearly as much of an issue because there is no disputing the boundaries of a chemical compound and a quick Google search will notify the searcher if a compound is patented or not. With software and high-tech industries this is not the case at all- the iPhone has reportedly over 250,000 patents for all of its different components (Chien 2012). Despite the fact that only a tiny fraction of those patents will ever be enforced or asserted on other mobile phone manufacturers, these “patent thickets” make it nearly impossible to know if a they are infringing on a patent and exactly which ones they are infringing on until after the manufacturer has invested into the technology or have started production and a cease and desist letter arrives in their mailbox. It is common strategy for PMEs to wait until an “infringed” technology is fully embedded into a product before requesting licensing fees or suing a defendant because the defendant will be more committed to the current path and more likely to settle out of court (Bessen & Meurer 2008).

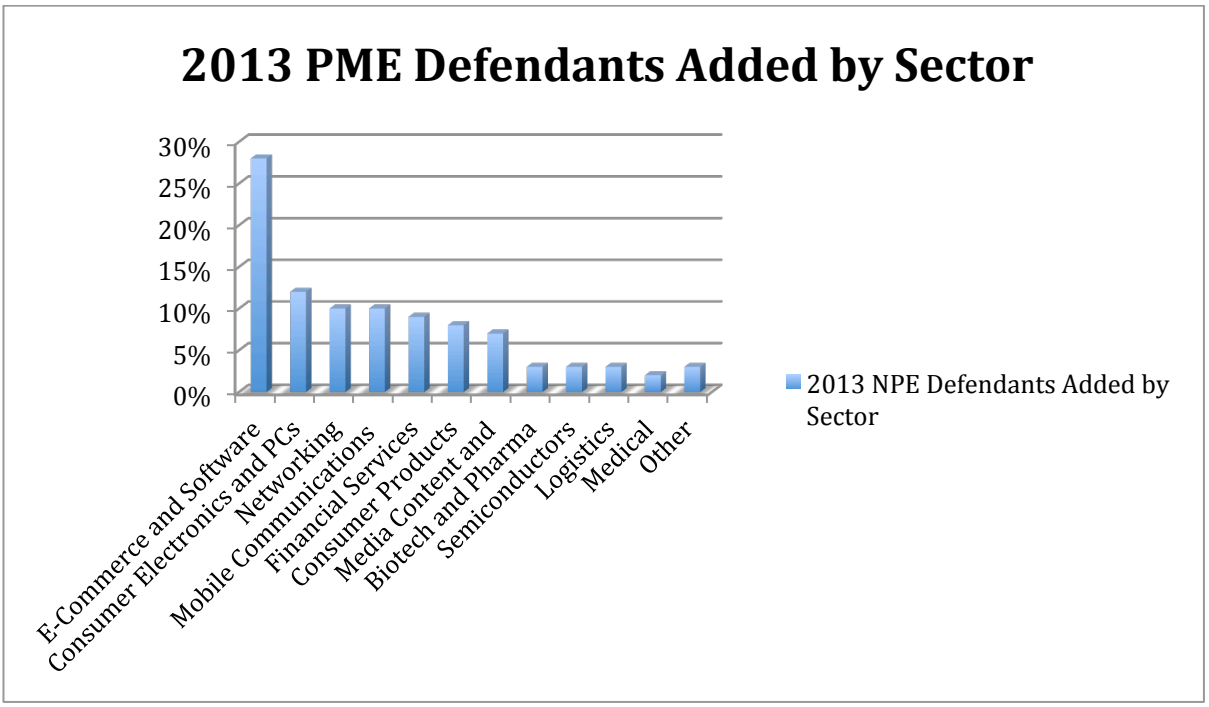

Figure 2

2.4 What does a typical PME case look like?

In 2012, the top 10 patent litigators comprised 30% of all PME lawsuits (RPX Corp. 2012). These patent aggregators are normally businesses comprised merely of a legal team and accountants that actively scour the patent logs for weakly defined or overly broad patents that could be exploited or asserted for financial gain. These PME's do not actually manufacture anything and their main revenue stream is from obtaining licensing fees or winning settlements in court. As will be shown in the nuisance suit economic model in Section 3, the fact that PME's do not manufacture their own patents gives them a substantial advantage over manufacturers because the defendants do not have the opportunity to file counter-suits as a defensive tactic to drive up the legal costs of patent assertion. For example, if Apple frivolously sues Samsung over a weak patent and interrupts production at Samsung, or at the very least costs Samsung significant legal fees for a weak patent, then Samsung can file a counter-suit with their own patent portfolio and apply the same strategy back on Apple (Graham & Vishnubhakat 2013). The legal frameworks creates a sort of equilibrium that disincentivizes Apple from initially bringing suit, as everyone is on the same playing field, unless they have a legitimate claim that they are confident can and should win.

However, from a PME's cost-benefit standpoint in regards to time as well as capital, it is more beneficial for the them to settle for a licensing fee than take the case to court. Some reasons for this are that licensing fees are always a win for the PME because their balance sheet is positive and their patent is not at risk. Even if the potential settlement is very high for a given patent, there is always the chance that if taken to court a judge could rule against the plaintiff and nullify the patent, making it void and useless in subsequent lawsuits. So for this reason, the business model for PMEs is typically to sell as many licenses as possible without having to go to court. This strategy greatly influences a PMEs selection of defendants as larger corporations have more expendable capital and/or dedicated legal teams in order to defend themselves and are therefore more likely to challenge an infringement claim instead of paying a licensing fee (Rivette & Kline 2000). Over half (63%) of the new defendants added in 2012 were from companies with less than $100M in revenue. Also, patent assertion is not limited to producers or manufacturers, and there have been several cases where *users* of software were sued for using patented software, despite the fact that they had nothing to do with creating the software in question (Bessen & Meurer 2008). The median total cost of litigation defense for small/medium companies is $318,000 and $646,000 for large companies (Bessen & Meurer 2014).

Section 3. Theory

3.1 Why are property rights necessary?

It seems appropriate to begin with a basic foundation of property rights theory in order to simplify the understanding of intellectual property rights (IPR) development in the United States. As technology has advanced, the legal boundaries of patents have become more abstract and harder to define. Jumping into contemporary IPR issues without understanding the basis of property rights theory and patent history runs the risk of misinterpreting the reality of the current IPR institutional environment. Douglass North has argued for decades over the importance of property rights as a crucial institution for economic growth to reduce transaction costs and promote commerce (North 1990). Strong property rights are not independent of other institutions and are linked to others such as social capital and rule of law. Joseph

Mahoney (2004) argues that there are three important prerequisites for the efficiency of property rights,

> *(1) universality – all scarce resources are owned by someone;*
>
> *(2) exclusivity – property rights are exclusive rights;*
>
> *(3) transferability – to ensure that resources can be allocated from low to high yield uses.*
>
> (Mahoney 2004)

The exclusivity and transferability of property rights are meant to promote investment and increase efficiency, which is a pretty straightforward concept. However, since the industrial revolution the increased mechanization of the world created a demand for intellectual property to be also covered under a property rights institution. High-tech machinery and tools took large investments to develop and the innovators needed some guarantee that their investment would be protected from counterfeiters and reverse engineering. Unlike physical property, IPR is a non-rival good, meaning more than one person can use it at a time. Due to this, the exclusivity variable of property rights needed to be adjusted to fit IPR. The solution was to enable patent holders to legally be able to exclude others from the use of their patents, enforceable through civil litigation. Giving an exclusive monopoly over an idea can be a powerful economic asset, and with the primary focus of the USPTO being on promoting economic growth and innovation, novelty and non-obviousness requirements were placed upon patent applications to avoid giving exclusivity rights without just cause. However, an idea alone is not sufficient enough to warrant patent protection. While a prototype is not needed in order to receive a patent, a detailed description of the invention must be sufficient enough that a person could read the patent application and utilize the information to manufacture a product (USPTO 2012). Due to the scalability potential of a monopoly on an idea, a new market opportunity emerged if one was able to receive a poor quality (broad or abstract) patent, which could legally be leveraged to seek rents without providing any real innovation (Merges 2009).

There are two sides to every story, and proponents of PME's and software patents argue that they have merely realized a viable market opportunity and seized it. However, just because a market exists does not mean that it is facilitating innovation and has any social benefit. The aim of the IPR system in the US and throughout the world is to achieve a net positive social benefit for society to promote growth in

economies as a whole. In *The Problem of Social Cost* (1960), Robert Coase examines several incidences where businesses incur some form of social cost on society, such as a factory polluting a river, and the course of action taken to resolve the altercation. In such a situation, Coase argues that the polluting firm should not automatically be punished for incurring a social or environmental cost, but rather an analysis should be conducted regarding if the social benefit of the factories output is greater than the negative effects of the pollution (Coase 1960). This example may not be an ample choice in contemporary times as altercations such as this are highly politicized, but in another more socially neutral case, Coase discusses two radio stations battling over the same frequency. Due to interference, it is disruptive to both radio stations to broadcast over the same frequency. According to Coase, if transaction costs are low enough, the initial allocation of property rights (the radio frequency) to a certain radio station does not matter, because the more efficient (popular) station will then pay the less efficient station to switch frequencies (ibid.). Therefore, the Coase theorem states that initial property rights allocation is irrelevant and the market will sort out the most efficient solution as long as transaction costs are low.

The problem of social cost is that it is one of reciprocal nature. If group A were harming group B, to avoid the harm group B would have to harm group A. The question remaining is which group should be allowed to harm the other? Which would induce the lowest social cost? (ibid.). In relation to IPRs, if a person or firm patents a novel innovation and receives exclusive property rights, the loser or the harmed would be any competing firm, but the societal effect would be positive as efficiency would increase in the industry, ultimately resulting in better quality and/or lower prices therein boosting the economy. Institutional tools such as FRAND (Fair, reasonable and non-discriminatory licensing) agreements coupled with low transaction costs, according to the Coase theorem, should reduce the importance of the initial allocation of a certain property right or patent. In reality, however, the emergence of patent fragmentation has caused transaction prices to rise. High-tech gadgets such as smartphones have hundreds of thousands of patents within a single phone, and the fragmentation of intellectual ownership rights can make license bargaining a complex and exhausting endeavor. In a study on market for innovation through the settlement of patent disputes, Galasso and Schankerman conclude that:

Delay and uncertainty in the settlement and licensing process mean slower diffusion of patented technology. Moreover, longer delays would typically be associated with higher transaction costs for the negotiating parties.

(Galasso & Schankerman 2010)

Due to the rising transaction costs and relative advantage of patent holders, it has become common practice for firms to aggregate as many patents as possible for both offensive and defensive purposes. This, in turn, only perpetuates the increase of transaction costs and as a result commerce has nearly reached a point analogous with the prisoner's dilemma in game theory. Strategic patenting and patent aggregation to ensure a firm's own assets have resulted in a confusing web of property rights weaving through all facets of industry.

3.2 Market uncertainty effects on investment

The link between market uncertainty and investment is not ambiguous. Investors seek positive returns on their investments and when the market is uncertain, the most common course of action is to wait until the market stabilizes or new factors increase the probability of returns. Investment in R&D is commonly viewed as an irreversible investment, as much of the capital goes towards the salaries of the researchers (Czarnitzki & Toole 2011). According to real options theory, greater uncertainty reduces the incentive of investing irreversible capital by relatively increasing the value of waiting to invest (Pindyck 1991). Patent protection can be a powerful tool to mitigate uncertainty on a firm's R&D decision, as exclusive rights rule out much of the threat of competition, at the very least generating licensing fees for the patent holder. Although, the mitigating effect is contingent on, "…patenting being an effective means of market protection. As one would expect, patent protection does not mitigate the effect of uncertainty in industries where patents are ineffective" (Czarnitzki & Toole 2001). In order to test this claim, it is important to first understand which industries are most problematic. Software and business methods patents have commonly been characterized as having the potential for being of poor quality due to their inherent abstract nature (Hall 2010). While Galasso and Schankerman (2010) hypothesized that higher fragmentation of patent rights would increase transaction costs, when they empirically tested their claim, they chose to analyze within the biomedical industry. Their major error in choosing that industry is that the biomedical industry is efficient in determining property boundaries, so there

is no room for debate over the extent of patent protection. If the study were re-administered in an inefficient patent industry such as software or business methods, the result would presumably be different.

In high-tech industries, including software, innovation is often cumulative and firms resolve patent disputes through cross-licensing agreements and patent pools. In order to be a part of one of these cooperative mechanisms, a firm must have patents to offer in return for receiving another firm's license or a royalty fee agreement must be settled. While FRAND agreements exist to keep royalties at a reasonable rate, they are only applicable to standard setting organizations, which result to only a fraction of total patents (Layne-Farrar et al. 2007). Due to the apparent pro-patent status of the judicial system in the post-1982 era, the relative patent premium (value added from patenting) has been rising and firms have begun to take notice. Evidence of this is seen in firms implementing strategic patenting schemes. In such cumulative industries, fragmented property rights can be destructive for innovation, as firms need to be able to secure the licensing rights of complimentary technologies before moving ahead with R&D (Noel & Schankerman 2006). This issue, dubbed the problem of the anti-commons, creates an incentive for firms to develop defensive patent strategies, which normally consists of accumulating patents to use as bargaining chips to preserve their freedom to operate (Heller and Eisenberg 1998). This problem is exacerbated in the software industry, partly due to notice failure and fuzzy boundaries, and the result is patent thickets, multiple patents on the same technology and a race to preemptively patent new technology before any competitors. The marginal benefit of patenting in high-tech industries has been rising disproportionately to the marginal cost of applying for the patents, and as the industries becomes more fragmented the relative value of patents goes up, therein perpetuating the cycle (Bloom et al. 2007). From strictly an economic standpoint, this preemptive nature of high-tech industries skews the traditional system of deciding when to invest, ultimately resulting in inefficient investments.

The optimal point to invest should balance the profits foregone by delaying the investment against the option value relinquished when the investment is made. This leads to a decision rule under which an investment is made when its net present value (NPV) is strictly positive.

(Hsu & Lambrecht 2007)

It has been suggested that in industries where preemption and first move advantages are the norm, the potential for delaying investments may be limited. This type of environment encourages speculative patenting and investment before the relevant technology is fully developed, often leading to poor quality patents with unclear or excessively broad boundaries (Weeds 2002). The increasing relative power of patent holders and the growing utility of patents being used as bargaining chips to deter high transaction costs incurred by litigation has created a reinforcing environment that has helped fuel the surge of patents in high-tech and software industries. However, while greater patent fragmentation results in more R&D and patenting by the firm, it also lowers market value due to higher transaction costs. Furthermore it has been suggested that the current level of patenting is socially inefficient and impedes cumulative innovation in complex industries with fragmented patent ownership (Noel & Schankerman 2006).

3.3 Nuisance Suit Economic Model

There are several models describing the economic incentives to filing a nuisance suit, but the clearest and most concise model comes from Ranganath Sudarshan's (2008) article *Nuisance-Value Patent Suits: An Economic Model and Proposal.* In this model, the Plaintiff is a PME that does not produce any commercial product, but merely is asserting their patent against a producer, the Defendant, who allegedly infringed on a patent. In his own words, the variables for the model can be defined as such:

V: *The maximum amount of damages that Plaintiff can hope to reap from Defendant for infringement of Plaintiffs patent.*

p: *The probability (O<p<l) that both a) Plaintiffs patent will withstand Defendant's challenges to the patent's validity, and b) Defendant infringes Plaintiff s patent.*

Cp: *Plaintiffs prospective cost of litigation, including attorney's fees, court costs, expert fees, internal litigation costs, etc.*

Cd: *Defendant's prospective cost of litigation, including attorney's fees, court costs, expert fees, internal litigation costs, etc.*

NS: *The nuisance amount which Plaintiff can offer Defendant to resolve/prevent litigation*

(Sudarshan 2008)

When looking from the Plaintiffs perspective, it is economically beneficial to bring a suit against the Defendant if:

1. $Cp < pV$

In other words, if the expected probability of winning a lawsuit multiplied by the amount of projected damages awarded is higher than the cost of litigation fees, then it would be economically beneficial to file a nuisance suit. From the perspective of the Defendant, the threat of a suit is expected to have the value (or loss) of:

2. $p(V+Cd) + (1-p)(Cd)$

Therefore in order for a settlement or license amount to be worthwhile for the Defendant, it must only be less than the expected value of the suit in equation #2. This distorts the value of holding a patent because the value of NS does not reflect the potential worth of infringing on a patent, but rather the cost of the Defendant to fight a lawsuit. Herein lies one of the fundamental problems with the contemporary patent system, even if the Plaintiff has a p value of nearly 0, meaning that their probability of winning the case is almost impossible, the Cd costs are still applicable to the Defendant, allowing the possibility of a NS settlement to occur as long as it is less than the amount in equation #2, or rather the cost of Cd. Furthermore, there is an array of tactics that can be utilized by the Plaintiff to raise the costs of Cd, which would subsequently raise the value of NS, therein giving higher returns for the Plaintiff. Under the Federal Rules of Civil Procedure (FRCP), discovery requests can be made regarding anything that may reasonably lead to the discovery of admissible evidence (Sudarshan 2008). The Plaintiff can exploit the aforementioned article of the FRCP by making excessive discovery requests to the Defendant. The Defendant is bound under penalty of the court to produce evidence requested by the Plaintiff, which often times is very costly and time consuming to produce, directly increasing Cd costs. Another tactic to raise Cd costs is to add subsequent infringement claims on other irrelevant

patents held in the portfolio of the Plaintiff as long as they are remotely relevant and fulfill the FRCP article 11 requirements (FRCP 2014). Finally another tactic to raise Cd costs is to file the suit in a jurisdiction that is inconvenient for the Defendant. The Plaintiff has the option of placing the jurisdiction where the Defendant resides or in any jurisdiction where the Defendant has "committed acts of infringement", so it is not uncommon for Plaintiffs to choose "magnet jurisdictions" that are most favorable for the Plaintiff and inconvenient for the Defendant, raising Cd costs for travelling and litigating in a distant location (Sudarshan 2008).

The plaintiffs of nuisance suits also have certain methods to decrease their own litigation costs, which therefore increases the number of suits they can bring with the same amount of money. One method is to employ lawyers that work with a contingency fee arrangement; meaning that the Plaintiff does not need to pay for the costs of litigation upfront, and the fees will only be paid if the case is won or a favorable settlement is awarded. In this type of scenario, lawyers often take a higher percentage of the profits when litigation is successful to cover the costs of when their efforts fail, so in order to maximize profits, a scale economy approach is usually taken by the Plaintiffs in the form of filing as many lawsuits as possible (Bessen et al. 2014). As has been demonstrated throughout this paper insofar, the Plaintiff seems to have a formidable advantage in regards to leverage over the Defendant in patent infringement litigation.

The submarine patent is a strategy that was legislatively addressed in 2000 but is still relevant in cases today. Before 2000, details of a patent application were not published until after the patent was approved and it became a strategy to intentionally delay the approval of a patent in order to retain secrecy and extend the length of patent protection. The protection is extended because the applicant will wait until the technology that they are patenting blossoms and becomes widely implemented by other companies, and then the applicant can suddenly appear, get their patent approved and receive royalties due to their early filing date (Bell 2013). With the TRIPS agreement in 1995, patent protection was changed from 17 years after acceptance to 20 years from filing date, and even though this reduced the incentives for submarine patent behavior, it did not abolish the problem (Primo Braga et al. 2000). Submarine patents are able to exist because often times patents are not

approved because of clerical error in the application or one of the requirements is not fulfilled, but since the USPTO would like to avoid disenfranchising inventors of their own patents due to a small mistake, it allows some opportunists to take advantage of this loophole and intentionally delay a patents approval (Bell 2013).

3.4 Effect of PMEs on Innovation

IPRs are designed to increase innovation through incentivizing research and development and protecting the investment of the inventor. If an inventor does not have the resources to exploit their technology, then they can sell the patent or license its use out to the free market and society as a whole will benefit from it. This is the one of the main intended functions of the USPTO and IPR laws. The difference with PMEs is that they often rely on broad or vague patents that cover a wider range of technology than was initially intended because of clever language and the ambiguity of software patent boundaries. The utility requirement for patents is designed precisely to prevent rent seeking such as this but fails due to the nature of software patents (Merges 2009). PMEs typically do not approach the market when a patent is brand new, but rather waits until the technology develops and becomes adopted. Notice failure allows for "infringers" to invest in a technology organically for years without realizing anything was wrong and then suddenly become ambushed by lawsuits or royalty claims. PMEs should also not be confused with patent brokers, who buy patents and actively try to grant licenses for its use through advertisements and collaboration with industry rivals. A patent broker, while being the middleman, is still promoting the diffusion of technology and innovation because they approach the market immediately and are transparent about their patents, as opposed to hiding them and encouraging notice failure (Penin 2012).

Although not exclusive to PMEs, patent ownership fragmentation, known commonly as "patent thickets", poses a threat to future innovation by raising the barriers of entry into certain industries (Galasso & Schankerman 2010). As mentioned in Section 2, a smartphone can have over 250,000 patents on a single phone, essentially creating a weave or "thicket" of patents that fragment ownership. With so many different patents and owners on a single product, transaction costs go up and innovation is slowed down in the process of sorting through legal boundaries, ownership, and attaining licenses (Bessen & Meurer 2008). Opponents of the idea that patent thickets are a

problem in the software industry, such as Campbell-Kelly (2005), argue that the flow of new software products has not yet been impeded and entry into the industry is not limited only to large firms so therefore patent thickets must not exist or must not be a problem. Furthermore Noel and Schankerman (2006) find in their research that patent thickets reduce the market value of software companies, but they argue that this disadvantage is equally balanced by the fact that software companies can attain their own patents. The reality of the matter is that the most extensive patent thickets occur in the semiconductor, electronics, telecommunications and computer hardware industries despite the fact that they have very little to do with software creation (Bessen & Meurer 2008). One study found that only 5% of software patents are held by software firms, which suggests that there is more speculative patenting behavior going on rather than actual innovation (Bessen & Hunt 2007).

Section 4. Methodology and Descriptive Statistics

4.1 Present Day USPTO

Legal gaming of IPR in the patent system is no new phenomenon, as was detailed in Section 2. This section aims to utilize descriptive statistics to aid in visualizing the dynamics of the IPR environment, particularly in relation to software patents and PME litigation and to describe the case study methodology being utilized for subsequent analysis. The USPTO has experienced a steady increase in patent applications for decades but the last decade in particular has been difficult for the USPTO. Despite the hiring of patent examiners at a proportionate rate to the growth of patent applications, the USPTO has encountered a growing backlog of patents pending approval. It took only 6 years for the total application backlog to double from 485,000 in the year 2000 to over a million in 2006. In comparison, the previous doubling of the backlog from 250,000 took 12 years starting in 1990 (USPTO 2013). In 2009, when David Kappos took over as director of the USPTO, he made it clear that reduction of the backlog and improving patent quality were the main priorities. “A cornerstone of our plan is reducing patent pendency and optimizing patent and trademark quality.” (Kappos 2010). Figure 3 shows the logarithmic values of total patent applications and total grants per year for the USPTO over the last decade. The results of Figure 2 show that the trajectory of patent grants has steepened since around

2008/2009, meaning that a higher ratio of patents grants to application has occurred therein increasing the grant percentage. There could be a myriad of reasons for this to happen, for example a publicized clarification of USPTO prerequisites could improve the quality of applications being received and could increase the approval rating. Moreover the widespread adoption of electronic filing as opposed to traditional handwritten application could indeed improve efficiency and allow examiners to assess more patents and consequently approve more patents. Under the same time period, the prevalence of PME activity has drastically increased. Figure 4 shows that the share of PME litigation activity has nearly tripled from 26% in 2008 to 67% in 2013. This relationship between growing incidences of PME activity and total patent approval ratings has motivated the author to qualitatively investigate individual case studies to analyze the quality of some controversial patent cases in recent history.

4.2 Methodology

With aid from descriptive statistics, the methodology of this article will implement a comparative case study design of 4 separate cases. Case studies were chosen due to their unique ability to collect detailed data that would be unavailable under other research methods (Bryman 2008). Data on patent litigation is often hard to come by. Even though court cases are public domain, the vast majority of agreements happen before it reaches court and deals are often brokered under non-disclosure agreements (Merges 2009). Another benefit of using the case study method is that it can aid researchers in adapting ideas and producing novel hypotheses. Statistics from the USPTO and RPX Corporation show some interesting trends to consider, but they lack enough insight and context to draw any kind of concrete causal linkages. "The case study offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon" (Merriam 2009).

Two software patents were chosen (wherein one is a business method patent), one high-tech patent was chosen within communications, and one photography patent was chosen to illustrate that poor quality patents are not only limited to software and high-tech industries.

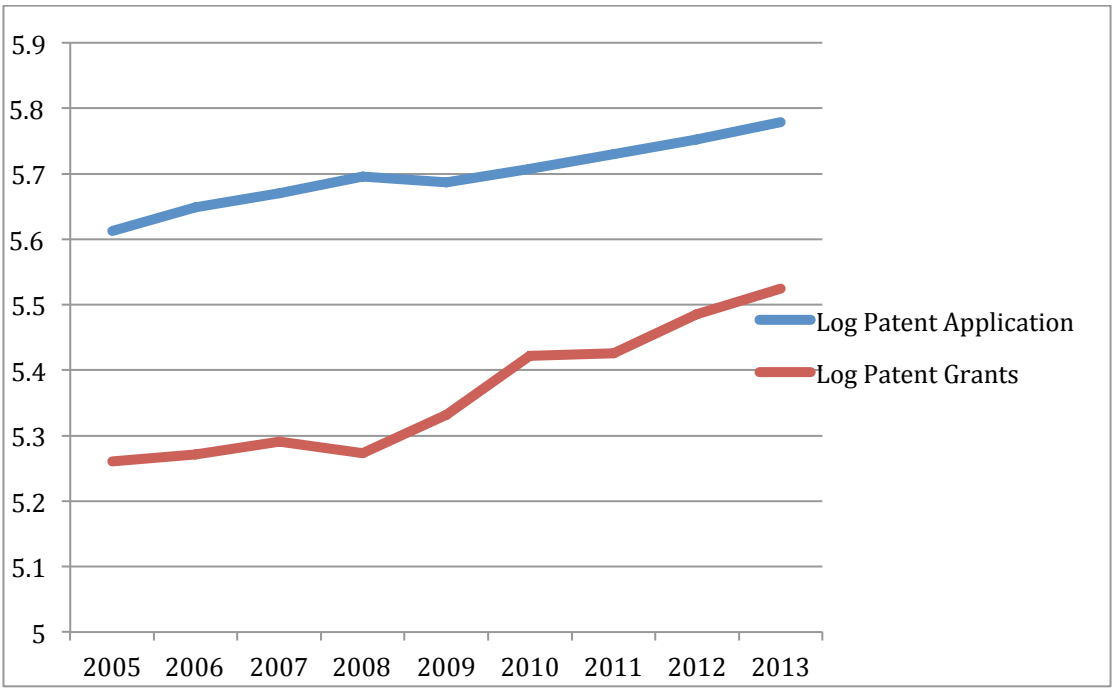

Figure 3

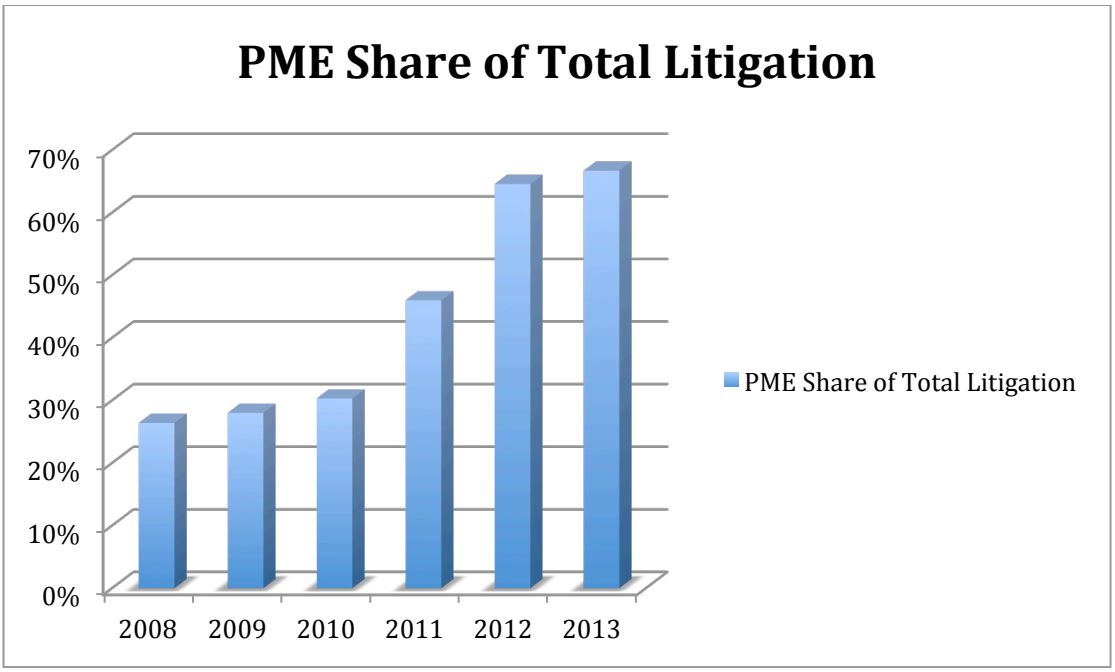

Figure 4

The subcategory of this case study methodology would be explanatory, as the aim is to explain how the theoretical framework in the previous section is materialized in specific cases. The four case studies were chosen to represent examples in the different patent classes with high litigation ratios.

4.3 Limitations and Biases

One of the primary criticisms of case study methodology is that it is often not generalizable to the wider population. This can lead to an incidence where collected data is not relevant or useful (Holliday 2007). This issue is not particularly relevant for this study because the aim is not to generalize the findings. Patent litigation statistics already supports the idea the patent monetization entities are multiplying and their relative share of total patent litigation is growing, currently at 67% in 2013 (RPX Corp. 2013). Moreover the case study analysis is not trying to assess a total economic impact of such activities extrapolated from the data, but rather to show real life examples of how the IPR system can legally be gamed to extract rents without adding any kind of novel innovation or how to artificially inflate patent values through aggressive legal tactics. It is also worthy to note that case studies lend their credibility to the ethics of the author and their own subjective biases. As only one person normally conducts the case study, data can be selectively chosen and/or omitted unethically as a strategy to strengthen one's argument (Merriam 2009). This study also contains a potential exogenous bias from the second hand patent data supplied by RPX Corporation. Due to the fact that RPX is a private, for-profit, company that profits on selling licenses to its own pool of patents that are claimed to be of low quality, there is a possible conflict of interest for RPX in inflating some of the statistics, as it could result in more business for them. Due to a lack of reliable alternate patent statistics, a decision was made that RPX statistics are the best currently available. Finally, it has been argued that it is very difficult to compose a definite cause and effect link from case study analysis (ibid.).

Section 5. Case Studies – 4 Approved USPTO Patents

5.1 Personal Audio US Patent 8,112,504 – Class 707/709 Software

Personal Audio is suing three of the most popular podcasters, Adam Carolla, HowStuffWorks and Togi Entertainment, claiming that Personal Audio owns the patent for podcasting. In most cases, the priority date and the filing date are interchangeable because the priority date is essentially when the patent goes in effect. Since 1995, the duration of a patent is 20 years with the priority date starting when the

patent was filed. Before 1995, a patent was granted for 17 years with the priority date going into effect after the final approval of the patent. The previous method created an environment conducive for submarine patents and the changes in regulation were aimed to deter this behavior. The one exception for having a priority date earlier than the filing date is when a patent is claimed to be a continuing application by an applicant who wishes additional claims to a "parent patent" filed at an earlier date. This is exactly the case with Personal Audio; this patent for podcasting was filed in March 2009, but claims US Patent 6,199,076 (which claims ownership of the playlist) as its parent patent and was filed in October 1996. With the parent patent successfully winning a settlement against Apple in 2011, it seems as if Personal Audio is looking to capitalize on this by applying for (and subsequently being awarded) the backdated priority, essentially transforming it into a submarine patent.

As mentioned in Section 3, submarine patents pose a major threat for honest businessmen. Due to non-public applications, notice failure, or intentional secrecy, anyone could potentially infringe on a patent unknowingly. Personal Audio's ability to get a priority date in 1996 is the only factor making the lawsuit possible, with both Adam Carolla's and HowStuffWorks' podcasts starting before the 2009 filing date. As a result, prior art must be found to exist before 1996. Nevertheless, the Internet was not the first and only way to share files via computer and one of which, named Usenet, was set up in 1979 between Duke University and University of North Carolina (LaQuey 1990) and could arguably qualify for prior art for the patent, proving that it does not fulfill the novelty requirement. Well aware of this, Personal Audio cleverly used their 13-year priority gap advantage to tailor their vocabulary towards present day's technology and use certain keywords to exclusively specify technology that is used today but is not applicable to previous systems.

> *each of said one or more media files being stored at a storage location specified by a unique episode URL;*
>
> (US Patent 8,112,504)

The operative term in that sentence is URL, which could easily be interchanged with domain name or web address normally, but URL is a term used exclusively for the

internet and did not exist in Usenet, and this careful choice of words could be the difference between winning or losing a lawsuit. The ambiguity of boundaries within abstract concepts, such as software patents, and their adverse effects on commerce and innovation has been sufficiently covered hitherto and further discussion behind the reasoning will not be covered, but a small excerpt from Personal Audio's claimed will be quoted as an example of how confusing and unclear it can actually become.

> *a processor coupled to said digital memory and to said communications port for performing a sequence of timed update operations, each of said update operations comprising:*
> *downloading via the Internet the current version of a compilation file identified by a predetermined URL and storing said current version of said compilation file in said digital memory, said current version of said compilation file containing attribute data describing one or more episodes of a series of episodes, said attribute data for each given one of said episodes including one or more episode URLs identifying one or more corresponding media files representing said given one of said episodes,*
>
> **(**US Patent 8,112,504)

The defendants of this case are podcasters, people who use podcasting software made by someone else, to have their voice heard over the Internet. Cases where PMEs target users rather than manufacturers of technology are currently gaining popularity in the media, but no legislation has been passed to directly address this issue (Bessen & Meurer 2008). The most probable reason for Personal Audio going after podcasters is that there are many more podcasters than there are podcast software developers, and furthermore the aggregate resources of the broadcasters is clearly larger but more disorganized, perfect for extracting licensing fees. Aside from the very top tier of podcasting, the majority of podcasters makes no money or operates at a loss, yet all of them are subject to royalty demands if the plaintiff prevails. This case is ongoing and a decision is yet to be determined.

5.2 Walker Digital US Patent 7,835,950 – Class 705 Software (Business Methods)

Walker digital, the parent company for priceline.com, has become a notorious PME in recent years for suing tech giants such as Apple, Microsoft, Amazon and Facebook,

just to name a few, over their extensive patent portfolio. In fact, Walker Digital sued over 100 of the most successful Internet companies in 2011 alone (Masnick 2011). However, Walker Digital is not a non-practicing entity, but in fact has several operating companies, making it an atypical PME case. In 2010, Walker Digital was granted a business method patent on "a method and apparatus for product display." The method is summarized in the abstract section of the patent application as: De

> *Systems and methods are provided for receiving from a customer a selection of a product category. At least one product is determined that is associated with the selected product category. A substitute product for the determined product is selected. In one embodiment, a signal is transmitted to display the selected substitute product*
>
> **(**US Patent 7,835,950)

The innovative business method that this patent is claiming to embody is essentially the idea of sorting a product inquiry by keyword. If one were looking to buy a hammer at a retail home improvement store, it is safe to assume that all of the hammers would be located in a categorized location designated for hammers. It would make little sense for a store owner to separate products in any other fashion, for example by price or by make, unless it was subcategorized within the hammer department. The reason for this is when one wants to buy a product, it is not often known exactly which brand or exactly what price the item will cost, and therefore it is beneficial as a consumer to have products categorized by type in order to compare and contrast their characteristics, prices, etc. Walker Digital has seemingly taken this centuries old concept and patented it as an innovative business method, which is possible because it has been implemented through software. The first two paragraphs under the heading "Detailed Description of the Invention" is noted as follows:

> *Applicants have recognized that, in some situations, it can be advantageous to display products to customers who may be willing to purchase those products.*

> *Applicants have also recognized that, in some situations, it can be advantageous to display products to customers in exchange for money received from a seller of that product, such as a manufacturer or wholesaler.*
>
> **(**US Patent 7,835,950)

The description above entails the basic business method of virtually all retail stores in recent history, the only differentiating factor is that the transaction is made over the Internet with the aid of computer software. Cases such as this are a prime example of why other regional patent offices besides the USPTO, such as the European Patent Office, are resistant to allowing business methods to be patented (Harrison 2012). This patent allows Walker Digital to essentially sue any online retailer that uses keywords to search for and to suggest related products to the consumer. Considering the patent was approved in 2010 and the level of patent assertion committed by Walker Digital in 2011, the data may speak for itself in regards to its contribution to uncertainty in the online retail market. This patent speaks for the level of interpretation allowed on the non-obviousness requirement in the business method patent class.

5.3 Innovatio IP Ventures - 23 Patents - Class 370 Multiplex Communications

After over 2 decades of changing hands, a group of 23 patents deemed essential for Wi-Fi (or WLAN) arrived at an emerging PME named Innovatio IP Ventures. Once the patents were acquired, Innovatio sent thousands of letters targeting hotels, restaurants, and coffee shops that transmit free Wi-Fi to its customers. The monetary amount of royalties claimed by Innovatio ranged between $2300-$5000 (Nazer 2014). It is hard for anyone to argue that Wi-Fi is a significant innovation, bordering on a disruptive innovation. However, even if it is assumed that these patents are of sufficient quality and Innovatio is therefore legally entitled to royalties, the monetary value assigned to the royalties does not reflect the real economic value but rather reflects a value less than the cost of legal defense for the defendants. Litigation brought forth by Innovatio for this patent group is a textbook example of the nuisance suit economic model in practice. Due to the fact that it would be difficult to set up even the first appointment with a defense lawyer for less than 3000 dollars and there

are no shortage of hotels and cafés offering free Wi-Fi, the business model of Innovatio was to extract the maximum amount of money that would still discourage a defense and then scale it to as many businesses as possible. In an interview made on ipwatchdog.com, Innovatio's lawyer justified their price level by arguing that Innovatio attempted to strike a licensing deal with a hotel chain for 2 million dollars, but the hotel responded by saying that the chain was owned by 500 separate franchise owners so the cost should be split evenly. Therefore, Innovatio divided 2 million by 500 and sent out 500 licensing demands to the hotels and cafés and decided to keep the same pricing methodology for its other claims (Niro 2012).

Three of the largest wireless router manufacturers, Cisco, Netgear and Motorola, intervened in the litigation after word of Innovatio's actions became public news. This was, however, after Innovatio had sent out more than 13,000 letters requesting licensing fees for off-the-shelf routers bought in retail stores (Mullin 2014). Many of the routers owned by the recipients of licensing letters had already been licensed by the manufacturer of the router in previous agreements with Innovatio. Defendants were not made aware that some routers under certain manufacturers had already been licensed, prompting multiple licenses being pursued for the same router. This type of activity is known as patent exhaustion and is illegal (Kamdar 2013). Out of the 185 million wireless routers produced by Cisco, 100 million had already been licensed by the time the licensing request letters were being sent out, proving that the issue of patent exhaustion is not a minor one in this case. After accruing 13 million dollars in lawyer fees, Cisco reached a settlement with Innovatio to license their remaining 85 million routers for 3.2 cents each totalling 2.7 million dollars or 0.0000106% of their initial offer to end users per unit. To further illustrate the magnitude of Innovatio's initial royalty claims, if Cisco were to license all their routers at $3000 each, the total would come to 550 billion dollars, and that is only for 1 router manufacturer. Due to the FRAND commitments, a judge ruled that Innovatio's claim to royalties was worth 9.56 cents per unit for the remaining non-licensed routers from other companies (Mullin 2014). Despite the fact that its quite obvious that Innovatio would not have asserted the initial 3000-dollar royalty claim against all routers, the inherent problem lies in the potential of them being able to do so. While a fair settlement was ultimately reached, it came at the cost of 13 million dollars to Cisco in unnecessary litigation fees and the exorbitantly inflated licensing fees already paid by the hoteliers and café

owners. If not for the support of the router manufacturers, how long would it have taken for a small business owner to build a 13 million dollar defense over a 3000-dollar dispute?

5.4 Amazon.com US Patent 8,676,045 – Class 396 Photography

In November 2011, Amazon.com applied for a patent on the specifics of a standard photography studio setup. The patent description is essentially describing the optimal photo studio arrangement that one would be taught in an introduction to photography course (Kuruvilla 2014). There are several reasons for choosing this particular case to discuss: firstly, this is a photography patent and this example serves to show that the issue of abstract boundaries is not limited to software patents, even in contemporary times. Secondly it seems interesting to inquire as to why Amazon decided to pursue this patent- is it for asserting or for defensive purposes? Lastly, this patent serves as tangible evidence as to the quality level of at least some of the patents being approved through the USPTO.

This patent reduced from the technical jargon amounts to 4 lights, a curved white background, a podium, and a camera with the innovation being in the arrangement of the aforementioned items for the purpose of creating the illusion of a seamless white background. According to the application, the first 4 out of the 27 claims on the patent are as follows,

> *(1) a background comprising a white cyclorama;*
> *(2) a front light source positioned in a longitudinal axis intersecting the background, the longitudinal axis further being substantially perpendicular to a surface of the white cyclorama;*
> *(3) an image capture position located between the background and the front light source in the longitudinal axis, the image capture position comprising at least one image capture device equipped with an eighty-five millimeter lens, the at least one image capture device further configured with an ISO setting of about three hundred twenty and an f-stop value of about 5.6;*
> *(4) an elevated platform positioned between the image capture position and the background in the longitudinal axis, the front light source being directed toward a subject on the elevated platform;*
>
> (US Patent 8,676,045)

The latter description is a more technical narrative than the former, yet the substance and innovativeness of both are equivalent. According to Amazon the innovation lies in the ability to take photos (or video) seamlessly against a white backdrop without the need for post-production editing. If this technique had been brand new, the argument for innovation would be much stronger because there does indeed exist a degree of utility. Using this reasoning, the issue therein must lie with discovery failure of prior art. A quick Google search shows this photography method as being used as early as 1974 by Tony Frontera, long before personal computers were used for digital image editing, so techniques such as the one described in the patent were necessary in order to achieve a seamless photo or video (Russel 2005). In defense of the patent examiner, if one is not a photographer or familiar with studio arrangements, it could be easy to make this mistake without a having a systematic way of searching for prior art. However, regardless of ones photographical knowledge, uncertainty over such an issue should be forwarded to a specialist within photography in this case, who could then enlighten the examiner in order to make an educated decision.

Finally, the question of Amazon's motives is an interesting one; albeit the answer remains unsettling regardless of if their intentions are assertion or defensive. While aggressive patent litigation is the hallmark of PMEs, a White House report on patent assertion informs that some practicing firms are realizing the economic potential of such tactics and have started utilizing them (White House 2013). Amazon is the largest online retail store and is no stranger to patent litigation, and the nature of online commerce requires that Amazon photographs their merchandise against a neutral background and this patent could very well be a preemptive defensive measure. The logic is simple; if Amazon can be granted a patent like this then so could their competition or any PME that could therein assert the patent against Amazon. Amazon has been listed as being the third largest defendant in PME lawsuits with 36 new cases in 2012, fewer only to Apple and Samsung (RPX Corp. 2012). If Amazon's intentions are purely defensive, it is hard to condemn their actions and this example serves as proof of the additional social "tax" placed on business for operating business as usual. Nevertheless, the patent was granted on March 18, 2014.

Section 6. Conclusion

This article's purpose is to explore some ways that PMEs are contributing to the increase in litigation and legal uncertainty in the current institutional environment of IPRs in the United States. A brief exploration of the history of the patent system in the United States has been provided to give a more thorough understanding of the modern IPR system. The current IPR environment was described only in enough detail to give context to the arguments provided. Not all patents are equally susceptible to ownership disputes because different patent classes have varying degrees of clarity in the boundaries of patent protection. As software patenting is still a relatively new phenomenon, conflicts in the location of prior art have risen. This has led to cases of unintentional patent infringement and notice failure. Furthermore the lack of concrete boundaries in abstract concepts allows for the possibility of misinterpretation. This unpredictability can be leveraged by PMEs to extract licensing fees from alleged infringers. Consequently, the increased aggregation of patents for both offensive and defensive strategies creates a reinforcing cycle that perpetuates market uncertainty. Through the use of descriptive statistics and case studies, it has been shown that the patenting process and judiciary resolutions are skewed in favor of PMEs, contributing to the increase of patent litigation. The ensuing uncertainty creates a disincentive for investment and raises barriers for market entry.

References

Allison, John and Tiller, Emerson and Zyontz, Samantha (2012) "Patent Litigation and the Internet", Available at SSRN: http://ssrn.com/abstract=1989144

Bell, Alexander (2013) "An Autopsy of Submarine Patents: A Window into Expectations of the World Technological Frontier", Honors Thesis, Department of Economics and Computer Science, Brown University.

Bessen, James and Hunt, Robert (2007) "An Empirical Look at Software Patents". Journal of Economics and Management Strategy. 16.1. 157-189.

Bessen, James and Meurer, Michael (2008) *Patent Failure*, Princeton University Press, Princeton, New Jersey and Oxford, United Kingdom.

Bessen, James and Meurer, Michael (2014) "The Direct Costs from NPE Disputes", Boston University School of Law & Economics Research Paper No. 12-34.

Bloom, N. and Bond, S. and Van Reenen, J. (2007) "Uncertainty and Investment Dynamics", Review of Economic Studies 74, 391-415.

Bryman, Alan (2008) *Social Research Methods*, Oxford University Press, New York.

Campbell-Kelly, Martin (2005) "Not all bad: An Historical Perspective on Software Patents". Michigan Telecommunications and Technology Law Review. 11:2. 191-248.

Chien, Colleen (2012) "Reforming Software Patents", Houston Law Review, 50:2.

Coase, Robert (1960) "The Problem of Social Cost", Journal of Law and Economics, 56:4.

Czarnitzki, Dirk and Toole, Andrew (2011) "Patent Protection, Market Uncertainty and R&D Investment", The Review of Economics and Statistics, 93:1.

Forero-Pineda, Clemente (2006) "The impact of stronger intellectual property rights on science and technology in developing countries", Research Policy, Vol. 35.

Galasso, Alberto and Schankerman, Mark (2010) "Patent Thickets, Courts and the Market for Innovation". The RAND Journal of Economics. 41:3, 472-503.

Gallagher, William (2011) "Trademark and Copyright Enforcement in the Shadow of IP Law", Santa Clara Computer and High Technology Law Journal, Vol. 28.

Graham, Stuart & Vishnubhakat, Saurabh (2013) "Of Smart Phone Wars and Software Patents", Journal of Economic Perspectives, 27:1.

Granstrand, Ove (2006) “Innovation and Intellectual Property Rights”, The Oxford Handbook of Innovation.

Hall, Bronwyn and MacGarvie, Megan (2010) “The private value of software patents”, Research Policy 39, 994-1009.

Harrison, Robert (2012) “Business Method Patents in Europe”, Social Science Electronic Publishing, http://ssrn.com/abstract=2148338

Heller, Michael and Eisenberg, Rebecca (1998) “Can patents deter innovation? The anti-commons in biomedical research”, Science 280, 698-701.

Holliday, Adrian (2007) *Doing and Writing Qualitative Research*, Sage Publications, London.

Jeruss, Sara and Feldman, Robin and Walker, Joshua (2012) “The America Invents Act 500: Effects of Patent Monetization Entities on US Litigation”, Duke Law & Technology Review, 11:357.

Kamdar, Adi (2013) “Judge Sticks Up for End Users, Rules Against Text Message Troll”, Electronic Frontier Foundation, https://www.eff.org/deeplinks/2013/08/judge-sticks-end-users-rules-against-text-message-troll

Kappos, David (2010) “United States Paptent and Trademark Office 2010-2015 Strategic Plan”, http://www.uspto.gov/about/stratplan/

Kuruvilla, Carol (2014) “Photographers furious after Amazon patents technique for seamless white background”, New York Daily News, http://www.nydailynews.com/news/national/amazon-patents-technique-seamless-white-background-article-1.1808939

LaQuey, Tracy (1990) “The users directory of computer networks”, Digital Press. P. 386.

Layne-Farrar, A. and Padilla, J. and Schmalensee, R. (2007) “Pricing patents for licensing in standard setting organizations: making sense of FRAND commitments”, Antitrust Law Journal. Vol. 74

Magliocca, Gerard (2003) “Ornamental Design and Incremental Innovation,” Marquette Law Review, 86:5.

Mahoney, Joseph (2004) “Property Rights Theory”, Economic Foundations of Strategy, Chapter 3.

Masnick, Mike (2011) “Jay Walker Sues Nearly Every Succesful Internet Company, Claiming They’re All Built Off His Patents”, TechDirt, http://www.techdirt.com/articles/20110414/00445913887/jay-walker-sues-nearly-every-successful-internet-company-claiming-theyre-all-built-off-his-patents.shtml

Merges, Robert (2009) “The Trouble with Trolls: Innovation, Rent-seeking, and Patent Law Reform”, Berkeley Technology Law Journal.

Mullin, Joe (2014) ”Wi-Fi patent troll will only get 3.2 cents per router from Cisco”, Arstechnica, http://arstechnica.com/tech-policy/2014/02/cisco-strikes-deal-to-pay-wi-fi-patent-troll-3-2-cents-per-router/

Nazer, Daniel (2014) ”Infamous Wi-Fi Patent Troll Settles for Peanuts”, Electronic Frontier Foundation, https://www.eff.org/deeplinks/2014/02/infamous-wi-fi-patent-troll-settles-peanuts

Niro, Raymond (2012) ”Setting the Record Straight on the Innovatio Patent Portfolio”, IP Watchdog, http://www.ipwatchdog.com/2012/03/21/setting-the-record-straight-on-the-innovatio-patent-portfolio/id=22964/

Noel, Michael and Schankerman, Mark (2006) "Strategic Patenting and Software Innovation". CEPR Discussion Paper No. 5701.

North, Douglass (1990) *Institutions, Institutional Change, and Economic Performance*, The Political Economy of Institutions and Decisions.

Oz, Effy (1998) "Acceptable Protection of Software Intellectual Property: A Survey of Software Developers and Lawyers", *Information Management*, 34(3): 161-73.

Penin, Julien (2012) "Strategic uses of patents in markets for technology: A story of fabless firms, brokers, and trolls", Journal of Economic Behavior & Organization. Vol. 84. 633-641.

Pindyck, Robert (1991) "Irreversibility, Uncertainty, and Investments", Journal of Economic Literature, 29:3

Primo Braga, Carlos and Fink, Carsten, and Paz Sepulveda, Claudia (2000) "Intellectual Property Rights and Economic Development. World Bank Discussion Paper No. 412.

Merriam, Sharan (2009) *Qualitative Research: A Guide to Design and Implementation,* John Wiley & Sons Co. San Francisco.

Rivette, Kevin & Kline, David (2000) "Discovering New Value in Intellectual Property", Harvard Business Review.

Russel, Roger (2005) "McIntosh Laboratory Part 2", http://www.roger-russell.com/mcintosh2.htm

Sterne, R. and Bugaisky, L. (2004) "The expansion of statutory subject matter under the 1952 patent act", Akron Law Review 37, 216-229.

United States Patent and Trademark Office (2012) “Intellectual Property and the U.S. Economy: Industries in Focus”. Internally Published. http://www.uspto.gov/about/ipm/industries_in_focus.jsp

United States Patent and Trademark Office (2013) “Performance & Accountability Report: Fiscal Year 2013”, USPTO, Internally Published. http://www.uspto.gov/about/stratplan/ar/USPTOFY2013PAR.pdf

Usselman, Steven and John, Richard (2006) “Patent Politics: Intellectual Property, the Railroad Industry, and the Problem of Monopoly”, Journal of Politcal History, 18:96.

Weeds, Helen (2002) “Strategic Delay in a Real Options Model of R&D Competition”, Review of Economic Studies, 69:3.

White House (2013) “Patent Assertion and U.S. Innovation”, President’s Council of Economic Advisers, the National Economic Council, and the Office of Science & Technology Policy.