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美国专利商标局专利诉讼数据,
识别和评估高价值的技术领域和合作伙伴

Using Patent Litigation Data to Identify High-Value Software Related Technology Areas and Find Potential Partners

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Abstract

This thesis develops a model for using patent litigation data in conjunction with traditional patent value indicators such as patent age, Technology Cycle Time (TCT), citation index (CI), and patent scope to identify high value technological areas and potential cooperative partners. The model produces firm-centric value reports that focus on a particular firm's strategic perspective. The purposes of these reports are to (1) aid technology forecasting and strategic planning, and (2) strategically identify and assess potential cooperative partners. Patent metrics are used to rank USPTO subclasses and defendant firms. Three software-related scenarios (HTC, Luxgen and Big Data) have been used to test the efficacy of the model. The results of the reports are also analyzed to determine their viability.

Keywords: Patent litigation data, M&A valuation, Technology forecasting, Software patents

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Chapter 1
Introduction

Technological change effects the competitive structure in many industries and companies who fail to recognize the potential of emerging disruptive forces can be driven out (Ernst, 2003). Fred Phillips (2011), editor of Forecasting and Social Change recently wrote and published an editorial outlining his perceptions of the current technological paradigm. In his view, the technological development has slowed and social change is outpacing technological change. In his own words, he "believe(s) the socio-cultural effects of cumulated and ongoing technological change are accelerating, even if technological progress itself is slowing". He also points out the employment crisis in Asian countries that have "pushed their universities to world-class levels, turning out graduates who cannot find jobs because manufacturing corporations have not innovated".

Does software represent a more social sector of technology than other hi-tech areas? Although this is a difficult question to answer, software does involve more social elements. While technical aspects such as performance are major considerations in software development, software design also requires sensitivity to social elements such as social applications, aesthetics, and user requirements. Also, an ever-diminishing barrier to entry to becoming a software developer ensures that more software innovation takes place outside of a large company and in a way more intimately connected to society (Boudreau, 2011). Certainly in recent years, new developments in software are constantly changing the way we live from ordering food and tickets, shopping online, communicating with friends, and conducting research. Software is also facilitating the intermediation of existing hi-tech components in a paradigm shift known as the *'appliancized PC'* (Zittrain, 2006). An example of perhaps the most exciting application of appliancized PCs is the *'Google Car'*, which combines the automobile, and the PC using motion sensors, lasers, GPS, robotic control units, and advanced artificial intelligence software. This intelligent autonomous vehicle could potentially reduce highway fatalities to zero before the middle of the next decade. Also, all other human-computer interaction is intermediated by software. Software is a major driving force behind the social technologies that will change our society, and software development will continue to develop new products in the face of slowing technological change in other industries such as semiconductors. Also, the pace of change in the software industry remains faster than other industries (Mann, 2006), and the employment outlook for software development jobs in the US has been predicted to grow 30% before 2020 (US Bureau of Labor Statistics, 2012). These two facts together indicate that software will continue to be a driving force of technological change and hence business strategy in the future. The fact that software patent grants are an increasing portion of all patent grants, and that software patent litigation is an increasing portion of all litigation indicate that software's value is increasingly important in big hi-tech business (Sarazin & Sikes, 2013).

Although Taiwan's software patenting activity in the USPTO has lagged behind its rate of patenting in other areas, software joint ventures are evidently an important part of many Taiwanese firms' current growth strategy. In late May 2013 Hon-Hai announced that they would be joining with Internet software company Mozilla to develop and release a tablet with Firefox OS[1]. Also in 2013, regulators just approved NFC joint venture between major mobile companies and EasyCard Corporation for a $US 6.2 million total investment project[2]. In the recent past, Teco Electrical and Machinery Co, Shining Group, the Industrial Bank of Taiwan, and their Vietnamese partner, Saigon Tel Co. signed agreements in 2008 to build a US $1.2 billion software park in Vietnam[3]. In 2007 Microsoft inked a software deal with Chunghwa Telecom to develop VOIP and business software[4] and Fujitsu joined Taiwan's Institute for Information Industry to jointly develop WIMAX software[5]. Also, across the straight in

1 Jim, C. (2013). Hon Hai, Mozilla to launch mobile device running on Firefox. Reuters. Retrieved May 29, 2013, from http://in.reuters.com/article/2013/05/28/honhai-mozilla-idINDEE94R04A20130528
2 Balaban, D. (2013). Taiwanese Regulators Approve NFC Joint Venture, but with Conditions | NFC Times – Near Field Communication and all contactless technology. NFC Times. Retrieved March 12, 2013, from http://nfctimes.com/news/taiwanese-regulators-approve-joint-venture-nfc-conditions
3 Taiwanese firms to build $1.2 bn software park in Vietnam - Economic Times. (2008).The Economic Times. Retrieved March 12, 2013, from http://articles.economictimes.indiatimes.com/2008-06-17/news/27726638_1_taiwanese-firms-vietnamese-partner-joint-venture
4 Vilches, J. (2007). Microsoft, Taiwan's Chunghwa Telecom form joint venture. TechSpot. Retrieved March 12, 2013, from http://www.techspot.com/news/25376-microsoft-taiwans-chunghwa-telecom-form-joint-venture.html
5 (2007). Fujitsu and Taiwan's Institute for Information Industry to Establish Joint Venture for WiMAX Application Platforms. Retrieved from http://www.fujitsu.com/global/news/pr/archives/month/2007/20071204-02.html

China, plans for a homegrown operating system in conjunction with open-source guru Canonical creates a new potential market for software in the mainland[6].

As in other technological industries, property rights play an important role in software business strategy. Increasing patent litigation in the software industry is in part due to the policies that govern it, but also indicates strong competition in the emergence of a new wave of software companies and competencies. In fact an ongoing debate rages within the Silicon Valley tech industry about exactly how patent policy should evolve to deal with its inadequacies, for fear that poor policies are having a negative effect on the blistering pace of software development. Software development's many low barrier to entry has made innovation possible on an individual level for anyone with access to a PC, and very small software companies have blossomed with game changing innovation, raised enormous amounts of social attention, and captured capital wealth in a short period of time; such as the case with Mark Zucherberg's Facebook. Often, these companies face a harsh IP environment. Very recently New Zealand moved to abolish software patenting altogether; a decision that was supported by the IT industry there[7]. Perhaps the hope in abolishing software patents was that by allowing small companies to operate more easily and freely the economy would benefit. In the past 20 years there have been many judicial precedents set and policy adjustments made. Patent application processes, policy, law, and the legal system are not easy things for individuals or small companies to navigate or incorporate into their business strategy due to their high costs and complexity. Some experts even advise small companies and product developers to reduce legal liability by completely ignoring prior art searching in favor of 'playing dumb'[8]. In other words, if one has not researched patented prior art at all, proving willful infringement is more difficult in court, and therefore higher damages associated with willful infringement are less likely. In some ways then, a minefield of

6 Reisinger, D. (2013). China chooses Ubuntu as state-endorsed operating system. CNET News. Retrieved May 12, 2013, from http://news.cnet.com/8301-1001_3-57575827-92/china-chooses-ubuntu-as-state-endorsed-operating-system/
7 Cohen, R. (2013). New Zealand Government Announces That Software Will No Longer Be Patentable. Forbes.com. Retrieved May 12, 2013, from http://www.forbes.com/sites/reuvencohen/2013/05/08/new-zealand-government-announces-that-software-will-no-longer-be-patentable/
8 The Computer History Museum hosted a debate between Bob Zeidman, founder of leading consulting firm Zeidman Consulting and author, and Edward Lee from the faculty of the Electrical Engineering and Computer Sciences (EECS) department at U.C. Berkeley for more than 25 years. http://www.youtube.com/watch?v=f6Dh5NjlZMk (August 24, 2011)

litigation and potential patent infringement is likely hampering innovation. The spirit of the patent system's origins; to enhance and encourage innovation is being bumbled. Unfortunately, the political process of policy evaluation is slow and has not yet adequately addressed the current ongoing problem for small software companies. Some speculate that the markets ability to react is a more viable and option than policy reform to correct the loss of innovative potential. Therefore if firms can find a way to take advantage they can increase their competitiveness. Firms with a sharp eye for acquisition, experience navigating a patent thicket, and investment capital to alleviate licensing requirements or research inertia to jointly develop workarounds can find a plethora of small innovative firms willing to cooperate in order to reap the benefits of joint business operations.

Since some have noted extreme uncertainty with regards to successful new software development (Boudreau, 2011; Zittrain 2006), additional data to support decision-making is needed. Traditional patent data is increasingly used to assist strategic decision-making by large firms, and patent litigation data has been shown to precede market growth in consumer electronics products from the late 1970’s until the early 2000’s. Existing patent-based value indicators and target evaluation frameworks currently do not include patent litigation data, however, further research into the potential use of patent litigation data for strategic information management has been proposed by some scholars and patent data has been validated as an indicator of value in several studies.

The proposal of this paper is to demonstrate a model for using patent litigation data to assist strategic decision-making in software related technologies. The two major frameworks are developed for (1) identifying high-value technological areas, and (2) finding and evaluating potential M&A targets and cooperative partners. This thesis reviews major works to build support; validating several patent indicators such as patent litigation, patent age, forward citations (CI), technology cycle time (TCT), and technological scope for use in strategic patent information management. Three case study scenarios are used to assess the findings provided by the frameworks. The case studies focus on mobile consumer electronics products, intelligent autonomous vehicles, and big-data, however, the frameworks put forth in this study could be modified for other industries.

Chapter 2
Literature Review

2.1 Strategic Management in Hi-Tech Industry

2.1.1 Strategic Importance of Patents in Hi-Tech Industry

The strategic importance of patents in the high-tech industry is directly related to the broader context of technology management. Porter (1985) describes technology strategy as a means to competitive advantage by harnessing R&D, and by utilizing technology along the value-chain. However, technology strategy is also described by Porter as only one element of an overall competitive strategy, and by Hytonen and Jamiro (2008) as only one part of the technology value chain, which is in-turn only one element in the product value chain alongside manufacturing (Figure 2-1).

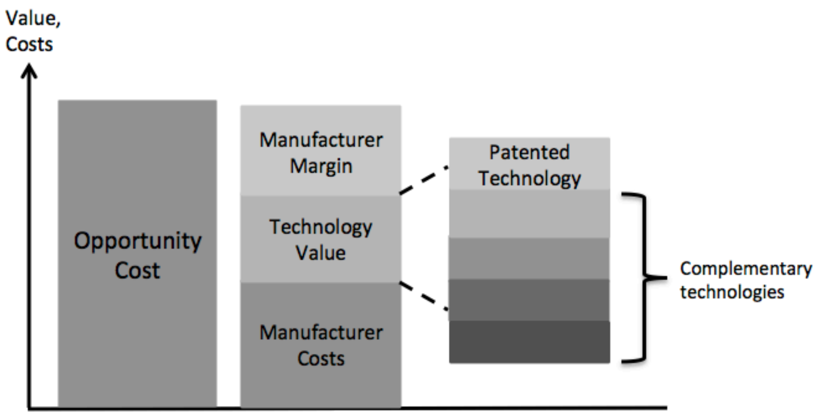

Figure 2-1: Value of patent protection as a fraction of the whole new solution to competitive technology strategy as defined by Hytonen and Jamiro (2008).

Patent management facilitates the ability to profit from the process of technological knowledge development and deployment (Ernst, 2012). With proper planning, patents can reduce uncertainty, reduce risk, and increase profits. Patent management is concerned with: (1) exclusionary rights of patents, and (2) utilization of publicly available information of technological knowledge found in patent information. Both the legal rights, and the information can be leveraged in several ways (Ernst, 2012). The activities associated with (1) leveraging the legal exclusionary functions of patents are known as *'patent protection management'* (PPM). The activities associated with (2) leveraging patent information are known a *'patent information management'* (PIM).

This thesis is primarily concerned with patent information management. PIM methodology includes: (1) evaluating patents and patent applications and the underlying technology, (2) collecting patent data, arranging that data into useful metrics such as technological value, strategic value, and monetary value, and (3) applying the information to strategic management. This type of technology monitoring system is a fundamental part of technology management and allows the timely identification of opportunities and risks (Ernst, 1998). A general framework for the process of PIM is shown in Figure 2-2. In stage 3: Patent Valuation, metric data is collected. These metrics constructed in the third stage of the generalized PIM framework assist technological management in four ways: (1) improving the internal creation of technology by supporting decision making for R&D investment and project selection, (2) improving the use of internal technology by protecting patent rights against infringement, (3) leveraging external technology by identifying potential sources M&A and out-sourcing to acquire technological capabilities, and (4) identifying the external use and production of technology for improving products and forecasting technological change (Ernst, 2012). The frameworks put forth in this paper for utilizing patent litigation data are primarily focused on (3) leveraging external technology by identifying potential targets for cooperative ventures such as M&A, outsourcing, or joint venture. This is achieved by generating reports that identify potential cooperative partners. However, other applications of patent litigation data are considered which are related to: (1) improving internal decision-making support by using patent litigation data to quantitatively identify value in the current technological environment, and (4) identifying external technology for improving products and forecasting by using patent litigation data to assess the current technological environment with the goal of forecasting future change. Although it is possible that patent litigation data may be applicable to (2) protecting rights and infringement, that subject will not be addressed specifically in this study.

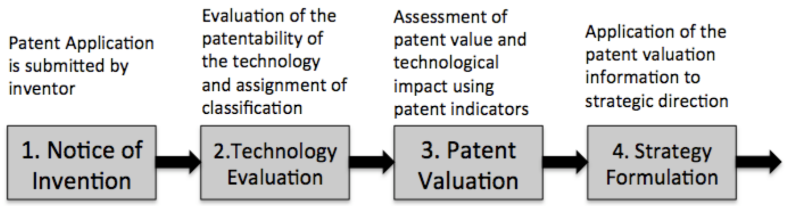

Figure 2-2: Generalized PIM process from submission of patent application to application of information to strategic management.

2.1.2 Validity of Patent Data as a Tool for Valuation

Patents are considered an objective measure of technological information (Ernst, 2003; Wang, 2007), and patents have been used in many cases as an indirect measure of firm value (Pakes and Griliches, 1980; Hall et al., 2005; Harhoff et al., 1999; Aghion et al. 2009; Breitzman & Thomas, 2002), and firm success (Sevilir & Tian, 2011). Data such as patent value indicators are highly valuable as management tools, however, they often need to be carefully selected and refined in order to suit a given firm's needs (Reitzig, 2001). Also, the value can be appraised and data collected using an inexhaustible variety of methods and from several different perspectives. Traditional perspectives taken to patent valuation are cost-, market-, and income-based (Hytonen & Jamiro, 2008; Smith & Parr, 2000). Smith and Parr (2000) consider the value of a patent should be representative of all the future benefits that can be acquired from it. In terms of valuating potential M&A targets, this perspective future economic value makes sense because M&A transactions hope to grow the profitability of a firm. Therefore, forecasting the future growth of markets, and measuring technological impact for estimating the strategic importance of technology should be considered an important part of patent valuation.

Comparing relative technological impact can be used as a means of forecasting the future of technological change. In order to compare relative technological value, patent data indicators are used. Quantitative indicators that use patent citations such as current impact index, (CCI), patent citation index (PCI), and technology cycle time (TCT) are important and valid indicators of technological importance, quality, and impact (Trajtenberg, 1990, 1987; Kayal & Waters, 1999; Hirschey & Richardson, 2001, 2004; Wang, 2007; Galasso, 2011; National Science Foundation, Division of Science

Resources Statistics, 2007; Karki et al., 1998), and citation based patent value indicators are considered potent because of the legal function of patents (Galasso, 2011; Hirschey & Richardson, 2004; Wang, 2007; Hall, et al. 2006). TCT is available at the time of the patent application; however, CCI and PCI cannot be measured until several years after the patent grant has been issued. Naturally, identifying high value patents at the application stage or when they are young allows firms to forecast future technological changes sooner and plan for them better. CCI is method of measuring firm strength, by calculating the ratio of citations of a given firm's patents to all patent citations from a given year, while PCI simply calculates the number of citations an individual patent has received or the average citations per year since its issue date (Wang, 2007). A higher CCI or PCI value indicates higher technological importance (Wang, 2007; Hirschey & Richardson, 2004). TCT measures the average age of a patent's backward citations. If these backward citations are relatively young, the patent is based on a younger underlying technological paradigm. If a group of patents such as a class, subclass, or firm portfolio has relatively low TCT then it represents a faster pace of technological innovation (Breitzman, 2002; Narin, 1998; Wang, 2007; Kayal, 1999; Park et al., 2006a Park et al. 2006b; Judge et al. 1997; Karvonen 2012).

Also, technological scope is considered an important measure of value (Ernst, 2005; Lerner 2012). Technological scope can be measured on the patent level, or firm level. For example, the technological scope of a patent may include the number of classes it has been cited by, or the number of classes it cites. Firms can also be evaluated by the technological scope of their patent portfolios. Firms with wider scope in desirable classes are considered to have relatively high value. PCI, TCT, and technological scope all use patent citations in their formulas. As well, experts believe that indicators show more information when the trends are monitored over time (Ernst, 2005, 1998).

Studies that have validated patent citations as a measurement of patent value include: Harhoff et al. (2008) have shown that the sale price of patents is higher for patents with higher citation counts. Carpenter et al. (1981) showed that patents from IR 100 award winning inventions had citation rates twice as high as other patents. Albert et al. (1999) showed that important patents as identified by industry experts were more highly cited. Deng et al. (1999) showed a correlation between stock market prices and high citation counts, and Narin et al. (1987) showed highly cited patents can predict increased sales and profits for pharmaceutical companies. Hirschey & Richardson (2004) found that measures of patent quality; citation index (CI), non-patent references (NPR) and technology cycle time (TCT) have a positive correlation to stock prices. Maurseth (2001) demonstrated that patents that are cited by other technology fields are renewed more often and for longer periods than patents only cited within their own technological field. This implies that since companies are willing to pay the high renewal price, that these patents are more valuable.

There are also patent value indicators that are not based on patent citations. For example, Non-patent references (NPR) have also been considered a valid measurement of patent value and firm value (Wang, 2007; Cassiman & Veugelers et al., 2007). NPRs show a close link between science and industry (Carpenter and Narin, 1983), and patents with a high number of NPRs are considered to protect a more fundamental or broad technology while patents without NPRs are considered more applied (Cassiman & Veugelers, 2008).

However, as Breitzman (2002) points out "Not every important patent is highly cited, nor is every highly cited patent important", and calls for the development and testing of new techniques for using patent information for strategic management. This supports the claim that patent valuation methods often need to be modified to fit the environment within a specific industry or management application (Reitzig, 2001). Also, the use of more than one indicator is advisable to attain a more reliable indication of value (Wang, 2007; Ernst, 2005). The purpose of my thesis is to fill this void by creating value indicators that use more than one metric to identify value, while also recognizing that modifications would need to be made to the final methodology for specific industries or firms.

Patent Litigation data has also been used as an indicator of patent value in numerous studies concerning policy-making and strategic management. Notable studies regarding citation counts and litigation rates show that highly cited patents are more frequently litigated (Lanjouw and Schankerman, 2001; Allison, 2003; Su et al., 2012). Also, Bessen and Meurer (2008) showed that litigation is a stronger indication of value than citations, and that all else equal a litigated patent is 6 times more valuable on average. Allison, Lemley, and Mason (2003) make the argument clearly that the relationship between value and litigation is bidirectional, meaning that valuable patents are litigated more often and litigated patents are more valuable. The most important evidence regarding the potency of litigation data with regards to patent value is found by Huang & Tang, (2002) who show *definitively* that patent litigation is a '*leading indicator'* of market value in terms of timing and rate of market growth for popular high-tech products. A *leading indicator* is a term used to define a class of economic indicators that forecast the future market growth. More specifically, leading indicators are defined as "changing before the economy as a whole" (Sullivan, 2003). Huang and Tang's study defines measures of patent litigation intensity (PLI) as instances of litigations (docket numbers), and market growth to develop a mathematical formula for market value in dollars of sales. Their results show that litigation incidents have slightly preceded market growth in the PC and cellphone industries since the 1970's. The study from 2002 also remarkably predicted the recession of PC sales growth that has been seen in recent years with startling accuracy. Therefore, if litigation has been shown to precede market growth reliably in hi-tech, then it could be useful in technology forecasting. However, to my awareness, the application of patent litigation data to firm-centric market forecasting has not seen academic attention.

The validation of patent litigation data as an accurate leading indicator of economic growth means that litigation-based indicators have the potential to contribute to strategic valuation of technology. The ability to identify areas of market value with certainty can greatly aid strategic decision-making in the hi-tech strategic planning. Furthermore, combining patent indicators by measuring the age, CCI, PCI, TCT, NPRs, and technological scope of litigated patents creates a more robust and precise validation of technological importance. For example, since the software industry's pace of development is more rapid than other industries (Mann, 2005), identifying valuable patents at the early stages of technological development are especially important. Its safe to reason that a litigated patent which is only one or two years old at the age of their litigation, or has exceptionally high PCI or low TCT is highly likely to represent a high value technological area.

2.1.3 Application of Patent Information in Hi-Tech Management

Cukier (2005) cites pressure to innovate across many industries, as a driving force for increased emphasis on IP strategy, and subsequently, increased patent application activity. This has translated into an accelerating amount of data available for researchers to use in strategic management. Patent data is public information and computer science capabilities allow it to be harnessed. Specifically, database management and greatly enhances the potential use of patent data for strategic management (Ernst, 2005). Modern patent databases provide complex functions for organizing, parsing, and calculating complex patent data indicators. This allows more detailed and thorough analysis strategies to be tailored to individual sectors, or specific firms' interests, and for reports to be generated automatically and periodically. Also, since patent data is available to companies who do not patent, and are not required to patent their own technology, PIM can be useful to support decision-making even for firms that do not apply for patent grants themselves, but rather only use a licensing strategy or trade secrets (Ernst, 2003).

The general consensus among scholars is that patent activity alone does not directly correlate to firm success (Rivette & Kline, 2000, Ernst, 2010). However, if patent totals are weighted according to quality indicators correlation to company performance can be found (Ernst, 2003; Breitzman & Thomas, 2002). Previous empirical research has found that there may only be weak correlation between patenting activities (total patents grants) and firm financial success (profit) (Ernst, 2010; Griliches et al., 1991; Narin et al., 1987; Gilbert, 1990, Levitas & Chi, 2010), and more research is needed to look at the theoretical reasoning behind the relationship of patent information and firm success (Levitas & Chi, 2010). Ernst (2012) suggests that new methods such as investigating managerial strategies could shed new light on the nature of patenting activities that create value. In a regression study conducted by Ernst (2012) the relationship between patent management strategy and multiple indicators of firm performance were probed. The findings indicated that the way a firm manages its patents and licenses, is a more significant indicator of value creation that patent totals alone. The number of patents a firm owns was found to be unrelated to sales growth and profitability. However, a firm's patent protection management, and a firm's patent information management were significantly related to firm profitability. These results indicate that merely producing patents is not an effective strategy towards profitability, but rather strategic management and ad hoc patenting activity is essential to firm success.

Although PIM is not a perfect science, and not an easy task (Rivette and Kline, 2000) it allows companies to get more details about technology and the market. Patent information's use in strategic technology management can have many applications such as: (1) supporting R&D investment decisions, (2) identification and assessment of sources of technological value and competitors, (4) protection of products from competitor copying, (5) M&A target identification and assessment, and (6) identifying in-licensing sources and out-licensing customers (Breitzman et al. 2002, 2002b Ernst, 2012; Stuart, 2000). These strategic activities are considered essential to firm survival by scholars of management science (Ernst, 2003; Rivera, 2000). The role of PIM in these strategic activities is multifaceted. One way is to generate new flows of income by identifying opportunities. For example, identifying an important technology could lead to new product development, or spin off and generate revenue. Also, patent information is used in risk assessment to facilitate decision-making.

Calls by academics have been made to refine the use of patent information and expand the use of patent information to a wider range of competitive intelligence applications such as M&A activities, and identifying undervalued companies. Specifically, patent data for M&A valuation has received much scholarly attention (Reitzig, 2001; Breitzman and Thomas, 2002; Jenkins 2004; Sterne & Laurie, 2007; Wei et al., 2009; Perng 2009; Longsworth, 2007; Malucha 2009; Ernst, 2000, 2003, 2012). This attention was the driving force for selecting the second operational goal of this thesis paper: to identify potential cooperative partners. Knowing that patent litigation can be used to predict market growth in a given technology area, using patent litigation-based metrics to identify technological areas which have high potential for rapid growth could be a significant contribution to PIM and strategic management as a whole. Although Huang & Tang (2003) make no claim that patent litigation instances can forecast market revenue for all areas, or used as a blanket indicator for market growth as a whole, they do show definitively that patent litigation has been a leading market indicator in PC and cellphone sales. This finding forms the basis for identifying potential value in this thesis paper.

2.2 Patent Litigation and Innovation

2.2.1 NPEs and 'Patent Trolls'

'Patent troll' is the pejorative nickname coined in a 1990s *Forbes* article[9], used to describe a subset of what are more formally and neutrally defined as non-practicing entities (NPE) or patent assertion entities (PAE) by the US trade office (Gregory, 2007). Most professionals agree that trolls are a subset of NPEs (Lu, 2012). Some have claimed the difference between *'troll'* and NPE should be based on whether the enforcing entity (troll or NPE) is actively engaged in the development of the technology for which the patent represents (McDonough, 2006; Pohlmann & Opitz, 2009). In that sense, patent trolls only collect and litigate patents for which they had no part in creating, while NPEs do participate in the production of the given technology, but are not involved in the product development or manufacturing process. Another broader definition of trolls is that trolls are only interested in the exclusionary rights, and opportunistically profit from companies and innovators who inadvertently infringe on their IP (Fischer & Henkel 2012; Henkel & Reitzig, 2008; Gregory, 2007). However, not all feel that defining the term 'troll' is a worthwhile endeavor, and reforming patent policy to effectively protect innovative forces should be a higher priority (Gregory, 2007, Feldman & Ewing, 2011). This essay henceforth uses 'NPE' as a neutral term to refer to "firms that rarely or never practice their patents, and instead focus on earning licensing fees" (Shrestha, 2010). Therefore, the focal term 'NPE' is used for firms that do not manufacture, but rather have a business model focused on attaining and asserting patent rights as a broker of IP. NPEs in the context of this paper may or may not be involved in research and development of the patented technology. The term 'troll' will

9 When *Intel* doesn't sue, *Forbes*, 29 March 1993

be defined as a subset of NPEs who use an aggressive or predatory litigation strategy. The rest of this section will mostly focus on NPEs and may only briefly mention trolls.

2.2.2 The NPE Business Model

NPEs generated $29 billion in licensing revenues in 2011, up 400% from $7 billion in 2005 with less than 25% returning towards supporting innovation (Yeh, 2012). While NPEs have arguably been around since the beginning of patents; Thomas Edison himself having been essentially an NPE (Yang, 2012), trolls have emerged more recently due to a fast-paced hi-tech industry, and flourish in the fast-moving software industry where patenting policy has been unclear and patent offices understaffed. Troll business model is simple: place high-pressure on targeted companies to extract the maximum licensing fees possible (Dodson & Luman, 2006). Since NPE's are only interested monetizing exclusionary rights, they will employ two main methods of doing so: (1) licensing fees, (2) damage fees awarded through litigation, and (3) settlements reached during trial.

NPEs build large collections of cheaply obtained patents from bankrupt companies' 'fire-sales' and technology development institutions, then litigate them for their duration of validity. This means that some NPEs often have little invested into the patents themselves and therefore very little is at stake for them compared to their opponent (Gregory, 2007). Also, cross-licensing deals, which are often used to negotiate prices between producing firms, are not part of the NPE strategy and therefore are an impossible strategy for negotiating with NPEs (Pohlmann & Opitz, 2009; Dodson & Luman, 2006). The ability to cross-negotiate with firms for mutually beneficial terms is cohesive to developing an innovative environment, especially in complex technological industries. NPEs leverage their lack of need for in-licensing to get the highest possible price.

Prior to the 2006 decision in the *eBay* case, which ruled that NPEs cannot automatically get injunctions, the threat of injunction against producers had led to excessively opportunistic behavior (Sag & Rohde, 2006) leading to investigations by anti-trust authorities such as in the case of NPE Rambus (Hovenkamp, 2008; Devlin, 2009). Although injunctions are no longer a threat that producing companies need to fear when faced with a lawsuit from an NPE, the number of patent lawsuits filed has doubled during the last decade, while in the 1990s, settlement values increased. Also, the number of settlements of suits before end of trial shows that the power of NPEs has not been quelled by lack of injunction potential (Dodson & Luman, 2006).

NPEs set licensing fees strategically below or at the cost of litigation, and often show fearless tenacity to litigate even at the cost of losing in court. (Yeh, 2012; Dodson & Luman, 2006). Although NPEs Lose 92% of their cases (Yeh, 2012), the cost of litigation is a major drain on producing firms. Accused firms are very likely to settle disputes through licensing due to the higher cost of litigation (Fischer, 2009; Pohlmann & Opitz, 2009; Dodson and Lumen, 2006). These litigation fees can run up to millions of dollars (Merrill et. al, 2005, Bessen and Meurer, 2005). Bessen and Meurer (2005) provide details of average litigation costs as associated with the risk value of a case[10] (Table 2-1).

Risk Value	Litigation Costs (median)
< $1 million	~$ 500,000
$1 million - $25 million	~$2 million
> $25 million	~$4 million

Table 2-1: Litigation costs for patent infringement suits of various risk value (USD).

2.2.3 The Debate on the How NPEs Effect Innovation

The widespread although not unanimous academic opinion is that some NPEs are damaging to the U.S. Patent System (Mazzeo, 2011). The philosophical goal of patent systems is to foster and nurture innovative forces by providing exclusionary rights to firms who innovate (Gregory, 2007). This incentivizes innovation, theoretically, and pushes its pace. The effect of NPEs on innovation is a controversial and much-debated topic for Congress, the press, and public since about 2006 (Yeh, 2012; Lu 2012; Penin, 2012). Both sides have strong points and many reports admit inconclusiveness regarding the comprehensive effect of NPEs on innovation (Yeh, 2012; Lu, 2012). Moreover, it is difficult to assess the effect that NPEs have because of the complex nature of the process of innovation makes it difficult if not impossible to design a framework to evaluate it. The reason that evaluating innovative performance

10 Bessen and Meurer had taken this data from the American Intellectual Property Law Association 2003 Report of the Economic Survey. The current versions of this report can be found at: *http://www.aipla.org/learningcenter/library/books/econsurvey/Pages/default.aspx*

on a national scale is difficult is because; (1) it is difficult to isolate the effect of any one factor when assessing the pace of innovation, (2) innovation happens at different rates in different industries due to the unique nature of various industries.

Also, litigation data is difficult to analyze, despite large bodies of research dedicated to uncovering and clarifying NPE's litigation activities. Chien (2009) finds that only 17 percent of high-tech patent lawsuits in the examined period of study were due to NPEs, closely matching the findings of and Hall & Zeidonis (2003). However, Allison, Lemley, and Walker (2009) find that among the most litigated patents, there are significantly more NPEs doing the litigating, and Lemely and Shapiro found that NPE's filed 30%-40% of all infringement claims in the computing-related industries (Lemely & Shapiro, 2005). The general conclusion that can be drawn from all these studies is that NPEs are about twice as predominant in computing related industries as other industries, and in some cases may be causing harm to the innovative forces within that industry. The main debate of patent trolls is centered on whether the NPEs drain too much of this 'economic incentive' into their own pocket, and create too much uncertainty, thereby preventing investment into innovative actives. The following paragraphs examine the arguments for and against NPEs as catalysts of innovation.

In the pro-NPE camp of thought, there are several convincing arguments. From a free-market perspective, NPEs are market fillers, buying low and selling high, making legitimate business that allows individual inventors to sell their inventions (Yang, 2012). The most fundamental argument is that NPEs promote innovation by assisting inventors find alternative ways to monetize their patents (Yeh, 2012). NPEs may help inventors litigate their patents, or purchase them outright. The assumption here is that small inventors have an important effect on innovation. By ensuring that small inventors are compensated, NPEs can assist market liquidity, efficiency, and monetization alternatives for entrepreneurs, and inventors (Lu, 2012). This creates an efficient market for trade for small inventors (Shrestha, 2010, Tarantino, 2010; Yang, 2012). Even if larger companies would inevitably easily independently discover the contributions of small inventors, the fact that smaller companies are pushing the industry pace supports the notion that they could be spurring innovation. Non-trolling

NPEs theoretically increase R&D investment in tech producers and manufacturers (Penin, 2012). Therefore, their effect could only be considered negative when they are overcompensated, and the resulting financial drain on small producing firms is such that new products cannot reach market. According to Lu (2012), there is no strong evidence that NPEs have been overcompensated. Aside from a few highly publicized cases, NPE overcompensation is "idiosyncratic rather than systematic" (Lu, 2012). Other research reviewed below disagrees with Lu's conclusion that NPEs are not systemically overcompensated.

Following the original theory of spurring innovation of the patent system itself, competition will naturally increase innovation by pushing companies to innovate before their competitors, and better than their competitors. Geradin, (2008) argues that NPE's increase competition, increase innovation, lower downstream prices, increase consumer choice. Large firms are often considered slow moving, while smaller firms' R&D projects are considered more agile, flexible, and specialized. From the perspective of specialized innovation Oxley (1999) (but see also Gans et al., 2002; Geradin, 2008) claims that small upstream firms can specialize superior level skills for narrow processes or products. NPEs market these specialized processes or components allowing them to be integrated in such a way that inventors get paid. One important question however is whether these innovations are really novel, non-obvious, and deserving of a patent. If an innovation is obvious or prior art exists, then small firms should specialize themselves with the competency, but not necessarily expect to be compensated by IP licensing.

Hellman and Puri, (2000), Hall and Ziedonis, (2001), and Mann, (2005) also agree that patents can enable funding for startup companies. As mentioned above, these startups can innovate specialized upstream markets with IP licensing as their primary business model (Geradin, 2008). The products of startup companies may be highly specialized and provide benefits to consumers. Although NPEs are often accused of draining capital from R&D budgets, Anton and Yao (1994) extoll NPE benefits as lower downstream prices, and increased consumer choice. Also, if licensing fees are reasonable, large firms can license from small inventors thereby reducing their own

R&D budgets. Manufacturing is expensive, and has large barrier costs. Becoming an upstream specialist has a lower barrier to entry than becoming a manufacturing firm (Garadin, 2008). An NPE business model thereby allows non-manufacturing firms to participate in the innovation process. It's a safe bet that these specialized upstream firm's participation does indeed affect innovation positively. Additionally, these upstream innovators enable downstream specialists as well (Arora, 1996).

Exceedingly, within the software industry, products do not rely on a highly complex manufacturing process to enable reproduction. Software can easily be created in any PC owner's home. Also, software is not like physical property. Reverse engineering software is simple and can be done in any home with a PC. This means that trade secrets are of little or no value in protecting software IP. Anton and Yao, (1994) have used the idea that IP is not like physical property, it cannot be taken back once shared, to claim that patent protection is needed for innovators to encourage them to share their innovations.

There are also many arguments on the other side of the debate. The arguments that claim NPEs have a negative effect on innovation are outlined below.

The Federal Trade Commission (FTC) suggests NPEs deter innovation by raising costs and risks for companies and investors who actually bring products to the market (Yeh, 2012). This forces producing companies to factor in the probability that NPEs will start to demand royalties. Trolls cause uncertainty for innovators and this uncertainty may lead to royalties far exceeding what innovators would have been willing to pay (Reitzig, 2006). This uncertainty drains resources away from R&D (Dodson & Luman, 2006) and could deter prospective R&D projects and subsequently, products that could potentially benefit consumers. Also, in the case of confrontation by an NPE, firms have to divert funds towards investigating and perhaps litigating. This cost is significant because patent litigation is risky, disruptive and expensive (Yeh, 2012; Dodson & Luman, 2006). The direct costs associated with patent litigation from NPE patent infringement assertions in the US may have been as high as $29 billion for 2011 alone (Bessen and Meurer, 2012). These costs include legal service, licensing fees, and other indirect costs. Other indirect costs measured during Bessen & Meurer's study included:

efforts exerted in legal, managerial, engineering, and science personnel, loss of goodwill, loss of market share, and disruption of innovation. If royalties were fair, the logical choice for firms would be to eliminate risk and uncertainty by licensing. However, NPE's have been accused of asking for royalties "significantly higher than expected" (Barnett, 2006). Pohlman & Opitz, (2009) came to the same conclusion by studying 10 companies. According to the study, NPEs were responsible for excessive licensing fees and inefficient negotiation costs. A report from PricewaterhouseCoopers consulting firm also showed that NPEs received much higher damage awards than producing companies, a trend that has been increasing since before 2001 when there was no significant difference in damage awards (PwC, 2010). Of course, the implication of these excessive costs is that they drain funding away from innovative projects or simply raise uncertainty to the level where some innovative projects are abandoned. In an empirical study, the disruption of innovation effect was investigated in the case of a medical imaging firm (Tucker, 2011). The case study showed decreased sales by the firm who was attacked by an NPE. The decrease in sales was attributed to suppressed product innovation during the period of litigation due to uncertainty.

In another study, a model of R&D investment for a technology supplier and manufacturer by Penin (2012) suggests that aggressive NPE behavior will reduce R&D investment for both the technology developer and manufacturer; however, investment for patent-brokers (a less aggressive form of NPE) always increase R&D investment. The implication of this study is that trollish behavior reduces innovation (read this study again to clarify), however some NPEs also benefit downstream firms.

Trollish NPEs weaponize patents at a strategically calculated opportune time; victims often don't even know that the infringed-upon patents exist (Pohlmann & Opitz, 2009; Dodson & Luman, 2006). By waiting until significant and irreversible investment has been made, aggressive NPEs take advantage of the 'locked-in' position of producing firms who may by that time have limited ability to invent around or abandon the technology. This is also known as the 'problem of notice'. If firms tried to avoid infringement at this late notice period, they would lose future profits, and have to invest more into alternatives. This gives trollish NPEs the ability to extoll excessive licensing fees from victims. Trolls often ask for licensing fees equal to the cost of litigation (Dodson & Luman, 2006). Although paying the licensing fee straight away would remove the risk of infringement, firms may also risk making themselves a target for other trolls (Dodson & Luman, 2006).

To conclude, as mentioned at the beginning of this section, a definitive judgment that NPEs help or harm innovation is impossible. However, a more specific conclusion can be drawn: that some NPEs definitely harm some small firms. By recognizing that NPEs put pressure on small firms, we should also recognize the potential value of cooperative activities with these small firms.

2.3 Software Patent Litigation

2.3.1 Related Patent Policy: Past, Present, and Future

In light of the above-discussed findings that patent trolling, in some cases negatively affects innovation, some policy reform is a reasonable consideration that government bodies should investigate. From a business perspective the policy is important for risk assessment, and planning perspectives. A major concern in reshaping the policy is that it is difficult to exact a change to policy that precisely targets patent trolling but not technology firm's ability to legitimately defend their patents (Penin 2011; Merges 2009). However, many acknowledge strong doubts about the wisdom of protecting software at all (Samuelson, 1990; Chandler, 2000; Computer History Museum, 2011; OECD, 2004; Lemley 2012). Recently, in May 2013 New Zealand moved to abolish software patents altogether[11]. Conversely, Chandler (2000), reasons strongly that although legislative bodies have been slow reacting to changes in the technological industries of software, the competitive nature of software products implies that it requires proprietary protection. Chandler (2000) also finds that in general, software can satisfy requirements set forth in the Patent Act; section 101 for patentable subject matter, section 102 for novelty and utility, and section 103 for obviousness.

11 Lee, T. B. (2013). New Zealand government closes door on software patents. *Ars Technica*. Retrieved May 30, 2013, from http://arstechnica.com/tech-policy/2013/05/new-zealand-government-closes-door-on-software-patents/

Penin (2012) and Chief Judge of the court of appeals, Richard Posner[12] suggest that fewer patents, and tighter requirements of novelty would give patent trolls less ammunition for their ambush.

Lu (2012), Gregory (2007), Lemely (2007), and Merges (2009) all make similar conclusions about the way forward regarding patent policy reform; that instead of trying to identify which NPEs are trolls, efforts should be make to stifle the potential for NPEs to act ‘trollish’. This would effectively involve changing existing policy to reflect the current nature of the patent litigation scene and nature of the software industry itself.

The history of software patent policy and the debate over the patentability of software in general stretches back to the early 1960’s in the US. In the 1960s, the USPTO avoided granting patents to any invention including the calculation made by a computer, but in 1968 formal guidelines for ‘computer related’ inventions were established. However, software patents were not allowed under the guidelines[13]. In *Gottschalk v. Benson*, the Supreme Court held that a mathematical algorithm in computer code was not patentable. It was in the 1970s, that software secured judicial support in the US. Prior to that time, decisions on patenting supported the initial stance that software algorithms were not patentable (Samuelson, 1990). A 1981 Supreme Court Decision further liberalized the patentability of software algorithms in a cases *Diamond v. Diehr16* and *Diamond v. Bradley*; a decision that is still upheld to this day (Merges, 1998). The continuing gauntlet of court battles fought from the 1980s until the present day is outlined in great detail by Chandler (2000).

Graham (2003) recognizes a 1998 Court of Appeals for the Federal Circuit (CAFC) decision to validate a business software patent, which was awarded to *State*

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12 Posner, R. H. (2012, July). Why There Are Too Many Patents in America. *The Atlantic*. Retrieved from http://www.theatlantic.com/business/archive/2012/07/why-there-are-too-many-patents-in-america/259725/

13 Tysver, D. (n.d.). History of Software Patents, from Benson, Flook, and Diehr to Bilski and Prometheus. *BitLaw*. Retrieved March 12, 2013, from http://www.bitlaw.com/software-patent/history.html

Street Bank, as an important shift towards expanded definition of software patents. Business application software patent applications immediately doubled the following year from 1,275 patents in 1998 to 2,600 in 1999 according to Graham (2003) and according to an OECD report software patent grants issued by the USPTO increased to approximately 15% of all patent grant in the year 2000 (OECD, 2004; Bessen & Hunt, 2003). The years leading up to the turn of the millennium also marked a sharp increase in the number of patent applications and grants as a result of many industries adopting the strategic management of IP as part of their technology management strategy (Ernst, 2012; Rivette & Kline 2000). Subsequently, patent litigation activity also skyrocketed. The following chart (Figure 2-3) shows the trends of increasing patent grants awarded and increasing patent litigation from 1976-2011. Patent grants issued have more than doubled in the past twenty years, now approaching almost a quarter of a million per year, while patent litigation instances has risen above 10,000 patents litigated per year.

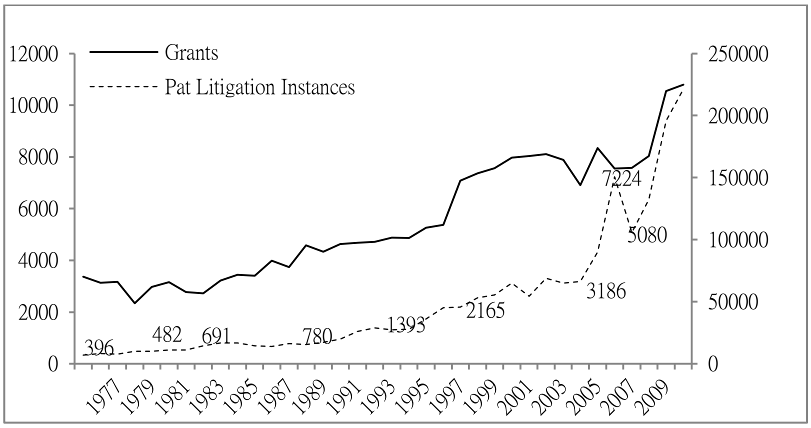


Figure 2-3: Trends of patent grants issued and patent litigation instances (total times any patent was litigated) from 1976 until 2011.

The rocketing number of patent applications in all technological fields had a detrimental effect on the USPTO's ability to review patents properly for novelty, prior art, and non-obviousness. In the spring of 2000, the Business Method Patent Initiative included provisions to: (1) hire more than 500 new patent examiners, specifically specialized in software, (2) triple the number of examiners assigned to UPC 705 for business software methods (3), expand non-patent prior-art search tools and search rules for UPC 705, (4) requiring second examiners for UPC class 705 (Singsangob, 2003; Bessen, 2011; Cohen, 2003). Although the initiative may have hemmed the gross mal-issuance of software patents, it's likely that many questionable patents were still granted.

These mal-issued patents are now a challenge for firms to deal with as NPEs can effectively weaponize them. This has lead to recent patent policy reform a decade or so later known as the 'America Invents Act' (AIA), which was signed into law in November 2011, and became effective in March 2013. The AIA is discussed further below.

The awarding of damages and injunctions has also been a major area for policy reform in the past decade. In 2001, *NTP Inc.*, a small NPE sued *Research In Motion* (*RIM*) and was effectively granted a permanent product injunction against *RIM* and *RIM* was ordered to pay almost $54 million in damages (Shrestha, 2010). This was widely considered outrageous, and almost catastrophic to *RIM's* ability to do business. Then, a major case involving American ecommerce giant *eBay* caused a major shift in future judgments. Post *Mercexchange LLC* v. *eBay Inc.*, NPE's ability to obtain sweeping product injunctions against producing entities deemed to have infringed on their patents was greatly diminished, and that policy still holds today (Dauer and Cleffi, 2007; FTC, 2003; Davis 2007; Mazzeo, 2011). Mazzeo (2011) further notes that post *eBay*, NPEs are not entitled to lost profit damages. This is logical considering NPE's have not means to produce and could not have attained profit; therefore they could not have lost profit. This effectively results in lower average damage awards for NPEs (Mazzeo, 2011).

The America Invents Act (AIA) is a recent legislative initiative under the Obama administration to quell the power of patent trolls to damage producing firms. Much of the AIA specifically addresses the policy problems encountered in the software industry (Graham, 2013). Also, the AIA makes it easier for companies to challenge the validity of patents post-grant and accepts public evidence in the pursuit of invalidating a patent (Graham, 2013). The AIA also bars plaintiffs from joining many defendants into one docket simply because they are accused of infringing on the same patent. Piling many defendants onto one case docket typically saves the litigation expenses for plaintiff and makes it more difficult for defendants to change the location of the suit. This significantly raised the costs of litigation for defendants and may have affected their decisions to settle the suit (Bryant, 2012). With the current restrictions, changing venues is easier for defendants and thus litigation is less costly. This change to limit multiple defendants seems to be specifically aimed at curbing trolls business strategy (Bryant, 2012).

According to the current patent act plaintiffs can be instructed to pay defendants costs of litigation only under "exceptional circumstances" (Yeh, 2012; Chien, 2012). However, if a new bill, which was proposed in 2012, called Saving High-tech Innovators from Egregious Legal Disputes (SHIELD) Act becomes law, then NPEs litigating in the computer hardware and software industries will be held responsible for defendants litigation costs if the court determines that they "did not have a reasonable likelihood of succeeding" in the suit (Yeh, 2012). This bill would be specifically aimed at NPEs and the IT industry, as universities and producing companies would be exempt[14]. This bill would hope to stop frivolous lawsuits from being filed.

Finally, concerning the other possible roads forward in reforming patent policy. Brian Yeh, legislative attorney released a report for congress in 2012 (Yeh, 2012) that extensively reviews the problem of patent trolls in the IT and software industries. Yeh (2012) also reviews other legislative options suggested by commentators. Those proposals include: (1) more IT specific reform such as the SHIELD Act, (2) improving notice by more clearly outlining scope and boundaries of patents, reducing the ability for firms to *'hide'* their patents by filing continuations, (3) reducing leverage, hold-up, and settlement pressure by reducing the damages generally available to NPEs, and shifting more burden of defending the legitimacy of the IP to the plaintiff, (4) escalating costs and diminishing rights over time by invalidating unused patents or reducing their lifespan, and having graduated fees associated with renewing patents as they age, and (5) patent market by forcing the publication of the assignee and licensing information (Yeh, 2012).

14 Worstall, T. (2013). The Shield Act Tries To Kill The Patent Trolls. But Does It Go Far Enough? Forbes. Retrieved June 6, 2013, from http://www.forbes.com/sites/timworstall/2013/03/01/the-shield-act-tries-to-kill-the-patent-trolls-but-does-it-go-far-enough/

2.3.2 Identifying Software Patents

In conducting patent data analysis for a specified technology or industry, an initial challenge lies in identifying a complete set of patents. Some scholars have argued that the currently available classification codes International Patent Classification (IPC), United States Patent Classification (UPC), and Observatoire des Sciences et des Technologies (OST) are insufficient for this task of industrial analysis. In fact, a final report to the WIPO (Schmoch, 2008) warns that the scope of the OST industrial classes is specifically designed for use in international comparison and thus should only be used in this scope. Nonetheless, many studies do use patent classes to identify specific groups of patents, and several methods were considered for this study before a final method was selected.

The type of research being conducted makes a difference regarding the acceptable margin of error when classifying and identifying patents, and methods exist for estimating the margin of error. In this study the need was to identify software patents and litigated software patents. Software patents provide a greater challenge to identify since software itself is often combined with hardware and spans many classifications in both IPC and UPC. A method that is more inclusive, that is, it includes more than software patents is acceptable for this study because any hardware patents included may also be of related technological importance. Also, since the inclusion of UPC classes is not a dependent variable in identifying value means that it is not critical to assessing the accuracy of my thesis' goal. Also, new use of software Therefore, an overly inclusive method would be acceptable not alter the effect of the results. This means that a method of convenience; that is, using only IPC or UPC codes to identify software patents is acceptable. An overly inclusive method is also beneficial to this study because since software is often inseparable from the hardware that it is used on (for example the firmware of wireless microchips) patents for the underlying hardware could also prove useful in this study when characterizing the value indicated by patent litigation. In other words, this study does not need to discriminate patents based on their software 'purity'.

Graham (2003) made an effort to identify software patents by including all patents from 11 UPC subclasses. These subclasses are included in Table 2-2. Since this study is old, and several additions to the IPC system have been made (such as subclass *'G06Q'* for *'Data Processing for Business or Commercial Purposes'*), these specific classes could not be used as they stand. However, Graham's method of examining all patent activities by the six largest US producers of personal computer software between 1984-1995 was considered for use in this study. However, a high amount of diversity of the software technology field means that the top software companies by market capital could not guarantee a scope wide enough to encompass all of today's modern software patenting activity.

G06F	**Electric Digital Data Processing**
/3	Input arrangements for transferring data to be processed into a form capable of being handled by the computer
/5	Methods or arrangements for data conversion without changing the order or content of the data handled
/7	Methods or arrangements for processing data by operating upon the order or content of the data handled
/9	Arrangements for programme control
/11	Error detection; Error correction; Monitoring
/12	Accessing, addressing or allocating within memory systems or architectures
/13	Interconnection of, or transfer of information or other signals be- tween, memories, input/output devices or central processing units
/15	Digital computers in general
G06K	**Recognition of Data; Presentation of Data; Record Carriers; Handling Record Carriers**
/9	Methods or arrangements for reading or recognizing printed or writ- ten characters or for recognizing patterns
/15	Arrangements for producing a permanent visual presentation of the output data
H04L	**Electric Communication Technique**
/9	Arrangements for secret or secure communication

Table 2-2: IPC classes used for identifying software patents by Graham (2003)

Bessen & Hunt (2004) developed two methods for identifying software patents for use in study. The first system was to use only classification codes, while the other was to first read random patents and then classify them according to the definition of software patents defined by Bessen & Hunt (2004). A searching algorithm was then constructed based on the details within those patents. This algorithm resulted in the identification of 130,650 software patents in the USPTO between 1976-1999. The results were then compared against the original random sample of patents and a false positive identification rate of 16%, and false negative identification rate of 22%. Although this method would be sufficient for this study, it is very time consuming, requires ability to distinguish software patents from non-software patents, and reading hundreds of patents. The query algorithm is shown below (Bessen & Hunt, 2004):

> ((‘‘software’’ in specification) OR (‘‘computer’’ AND ‘‘program’’ in specification))
> AND NOT (‘‘chip’’ OR ‘‘semiconductor’’ OR ‘‘bus’’ OR ‘‘circuit’’ OR ‘‘circuitry’’ in title)
> AND NOT (‘‘antigen’’ OR ‘‘antigenic’’ OR ‘‘chromatography’’ in specification)

Another prior study specifically focused on the quality of methods for identifying software patents and used a modified version of the Bessen & Hunt algorithm. After first classifying software patents as a subset of all computer related technology patents, and identifying software patents, that study analyzed the results. The results found that many of the patents were not software (Bergstra & Klint, 2007).

A study by Graham (2013), an advisor to the USPTO, has isolated a group of UPC categories that embody software patents. Graham acknowledges that this method is one of convenience but deems it suitable for his research since it is overly inclusive meaning that some of the patents identified are not software patents. A table of these class codes and descriptions are listed in Appendix A. Although the UPSTO UPC/IPC concordance table[15] was considered for transposing these UPC classes to IPC classes, this course was deemed to be unnecessarily complex in nature since the WIPO expresses that UPC "is recognized as an important patent classification internationally" (WIPO, 2003). Also, an overly-inclusive group of software patents would be acceptable for this research since these extra patents would have a small effect on large scale trends, and also this method is very modern, and proposed by an advisor to the USPTO.

2.3.3 Software Litigation Data

The increase of patent litigation is not spread evenly across all technological classifications. Analyzing probability of litigation for software as defined by the search criteria explained in Chapter 2.2.3, disproportionately increasing litigation is evidenced for software patents (Figure 2-4). Within the software industry, the top ten most

15 UPC to IPC concordance table can be found at:
http://www.uspto.gov/web/patents/classification/

litigated UPC classes since 1990-1999 are included in Table 2-3 and can be compared to the top ten most litigated software classes after 1999 Table 2-4. This comparison shows the dynamic nature of software patent litigation over roughly the past two decades. In the past decade, vehicle, banking, and database technologies have dominated patent suits.

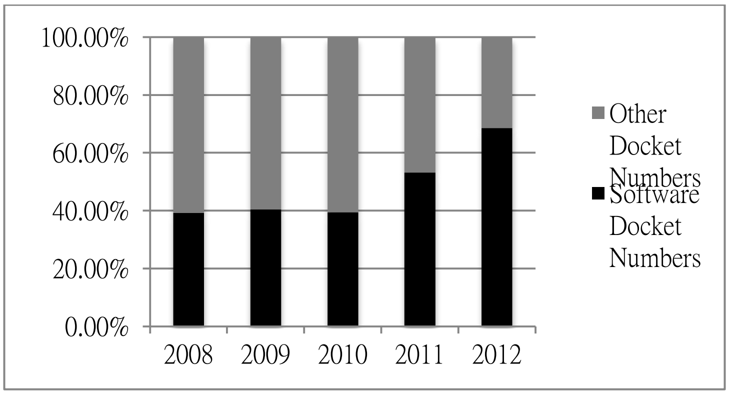


Figure 2-4: Increasingly disproportionate litigation of software patents as percentage of total patent litigation

UPC	Total	Class Title
/379/101.01	42	Telephonic Communication: Audio program distribution
/700/183	38	Data Processing: Preset pattern
/340/566	37	Electrical Communication: Vibration
/318/795	35	Electrical Power Systems: With plural capacitors
/235/462.45	32	Registers: Hand-held
/365/52	29	Static Information: Hardware for Storage Elements
/348/94	28	Television: Position Detection
/340/425.5	26	Electrical Communication: Land Vehicle Alarms
/340/429	22	Responsive to inertia, vibration, or tilt
/370/334	21	Multiplex Communication: Using Multiple Antennas

Table 2-3: Top ten litigated UPC software subclasses from 1990-1999

UPC	Total	Class Title
/701/201	608	Data Processing: Vehicles, Navigation, and Relative Control
/340/994	305	Electrical Communications: Vehicle Arrival Systems
/707/10	274	Database and File Management:
/701/204	250	Data Processing: Vehicles, Navigation, and Relative Control
/235/380	246	Registers: Credit or ID Card Identification
/235/379	207	Registers: Banking Systems
/455/458	200	Communications: Specific Paging Technique
/455/412.1	194	Communications: Message Storage or Retrieval
/705/36R	186	Data Processing: Financial/Business: Portfolio Selection, Planning or

		Analysis
/705/26	183	Data Processing: Financial/Business: Electronic Shopping

Table 2-4: Top ten litigated UPC software subclasses from 2000-2012

This study has previously mentioned the research indicating patent litigation statistics are a leading indicator of market value (Tang & Huang, 2002). While it is presumptive to conclude that the only reason for increased litigation of software patents is due to the increasing market value of software itself, this assumption is at least partially supported by other references to the increasing importance of software in business. While software is becoming an increasingly important part of our household appliances, and everyday devices, the nature of software development, and current legal policies are possibly another cause for the increased litigation. Firstly, the blistering emergence of software patenting seems to have caught the USPTO off guard. Some argue this has allowed patents to be granted which should not have been. Also, a highly controversial and aggressive species of patent licensing entities known as 'patent trolls' have emerged taking the industry by storm with overly broad, possibly invalid. These non-practicing entities (NPEs) build large collections of cheaply obtained patents from bankrupt companies fire-sales and technology development institutions, then litigate them for their duration of validity (Gregory, 2007).

2.3.4 Potential Application of Software Patent Litigation Data

The financial cost of patent litigation is well documented, and as described above, there was a period of time when patents were being issued without proper review for prior art, and novelty, and there is still policy uncertainty about the allowed scope of software patents. Not enough precedent exists to cost effectively ascertain whether a given patent will hold up upon challenge. Since erroneously granted patents have a lifespan of 20 years, the problem of incorrectly issued patents will persist for years to come. It may therefore be worthwhile for firms with experience in patent litigation and an ability to assess the likeliness of getting a patent invalidated to consider litigation rather than licensing in some individual cases. Also, prior knowledge of the chance of litigation and the patents that are being litigated aggressively can give firms a chance to enable precaution methods and reduce risk with information for strategic decision making.

Another application of software litigation data is market growth probability since patent litigation is a leading indicator of economic growth in technology. Also, the loss of innovative force is real. However, since licensing fees are found to be similar for NPEs and regular firms, licensing to acquire the rights needed to produce seems a reasonable strategy if profit levels dictate so. Firms with proficiency navigating patent thickets can navigate around the software patent trolling and uncertainty more effectively than small companies without IP management experience. Considering all these elements, it stands to reason that large firms with experience in IP management strategy, litigation, and related risk analysis are in a position where they may potentially benefit through the leveraging of their IP competencies. This could be accomplished through mutually beneficial relationships such as direct outsourcing of IP management capabilities, or through more traditional forms of cooperative ventures such as M&A, joint venture, or open development.

Litigation data can also be used to identify technological areas that have borne and have high likelihood to grow market-value, as well as more detailed information such as the names of firms that have those capabilities. Identifying firms with valuable technological capabilities could lead to one of several types of cooperative relationships such as joint ventures, outsourcing, M&A, or their product lines could be evaluated for market entry potential and competition.

2.4 Collaborative Growth Ventures in Software and High-Tech

2.4.1 Collaborative Growth Ventures in Hi-tech

'Strategic alliance' (SA) is a term, which has been used to refer to a wide variety of inter-firm relationships (Osborn and Hegedoorn, 1997). SAs are cooperative relationships between firms in which the firms maintain their autonomy, identify, and self-control (Duysters & de Man, 2005). Various types of relationships that are considered SAs for the purposes of this essay include: joint ventures, outsourcing, in-licensing, out-licensing, and collective research organizations (Schilling, 2010). The other major type of collaborative growth venture (CGV) is merger and acquisition (M&A). In M&As, companies combine together to form one company with hopes of creating a beneficial and profitable synergy, or 1 + 1 = 3 result (Malucha, 2009). In

some cases the resulting combination is relatively equal balance between the two companies (merger) and some cases one company absorbs and takes control of the other (acquisition). There are many purposes for M&A, which will be discussed later in this section, however, recent research clearly points to knowledge and capability acquisition as being a reason of growing importance (Duysters & de Man, 2005). M&A is a critical firm activity for large hi-tech firms (Sterne, 2007), and a common way to work towards corporate strategic goals, and expand into new technological territories (Gaughan 2005). The following paragraphs will discuss some commonly accepted ways of categorizing and thinking about M&A.

M&A integration can be classified into three major types: vertical, horizontal and conglomerate (Duysters & de Man, 2005, Kedia et al., 2011, Malucha, 2009). '*Vertically integrated*' M&A is defined as combining two companies, which occupy distinct positions along the value chain. In other words, a vertical integration M&A happens between two companies in a supplier/customer relationship. Some examples of vertical M&A include; the combination of a manufacturer and a raw material producer, or a manufacturer and a distributor. '*Horizontally integrated*' M&A refers to the combination of peer companies who are in direct competition with each other, and therefore at least partially occupy the same strata along the supply chain and product category. Examples of horizontal integration M&A include: an oil producer combining with another domestic or foreign oil producer, or a retail store combining with another retail store.

Also important to note in an overview of corporate M&A is that M&A trends of high-activity, also known as '*waves'* are a noticeable phenomenon documented by extensive research (Park at al., 2010, Rau & Stouraitis, 2007), and described as a "complex adaptive system for self-organized corporate ecology" (Park et al., 2010). Waves of M&A are important indicators of the current state of the industry as firms adapt to the changing competitive environment. This is true because when a given technology or sector becomes mature, the strategic benefits associated with the adoption increase. The simultaneous adoption of the given technology creates recognizable increases in M&A data such as deal volume and deal value. Observing the patterns of deal volume, and deal value for specific sectors can subjectively depict technological changes within an industry. Therefore, corporate level officials should take careful notice of M&A waves occurring in related industries as indications of important technological change.

In this paper, SA and M&A are, at times, analyzed separately for their unique qualities and benefits, and at times combined and considered together as 'Collaborative Growth Ventures' (CGV). In the results section of this paper, large groups of potential CGV targets are evaluated according to a set of metric criteria. In that analysis framework, all firms are treated equally without consideration of the potential type of integration with the firm being used for the scenario. However, knowing about types of M&A integration, and the associated benefits for each, helped in designing the framework and selecting the metrics. For example when setting a search scope for potential horizontally integrated M&As, a given firm and its competitor's patent grants can be analyzed and important patent classes can be isolated for inclusion. Similarly, if the desired M&A integration type is vertical then patent classes specifically apply to that technological area can be selected for inclusion. The goal is to devise a scope, which will catch all potential CGV targets. This study a takes a broad approach in attempting to catch all horizontal and vertical targets.

2.4.2 The Current Wave of M&A in Software and Hi-Tech

Recent years have seen an unprecedented increase in the overall value and volume of M&A transactions (Duysters & de Mann 2005), and the mid-2000s were particularly a boon for software M&A activity (Gao & Iyer, 2006; Park at al., 2010). For example, the number of Web-analytics companies decreased from 90 to 10 during the period of 1999-2005 (Park, 2009). Technology M&A activity continues to outpace other industries in M&A deal volume as it has for the past decade (PwC, 2012). In total there were 12,750 M&A transactions in 2011 globally, and the technology, media, and telecommunications sector (TMT sector) was the most active globally. In the US, there were 1,138 TMT sector M&A deals in 2011 (Mergermarkets, 2012). The maturing software industry, and the constant drive for innovation is a major reason for hi-tech M&A deal volume (Gao & Iyer, 2006; Duysters & de Man, 2005). Within hi-tech, software application M&A deal volume outnumbered other hi-tech sectors in 2011 (PwC, 2012), and the other leading sectors were also software intensive such as IT services, and Internet. Table 2-5 shows the deal volume and value data for leading sectors of hi-tech M&A in 2010 and 2011 (PwC, 2012). Despite an overall slowing rate of change in hi-tech, companies still need to constantly assess and redirect their strategic direction due to the typically fast-paced nature of changes in the high-tech market.

Sector	Number of Deals		Total Value (US Billions)	
	2010	2011	2010	2011
Software	96	93	$28.248	$40.77
IT Services	95	51	$24.718	$19.286
Internet	80	71	$13.07	$22.896
Hardware	74	53	$33.475	$17.101
Semiconductor	45	40	$7.6	$25.059

Table 2-5: PricewaterCooper global M&A report data for M&A deal volume and value in 2011 & 2012. These totals exclude undisclosed deals and deals <$15 million USD.

The strategic transformational changes, which are currently characterizing the software industry, are evident in the M&A activity. Cloud computing, security, big data, mobile payment technologies, social networking, and online gaming are the biggest evolutionary technologies and are expected to lead strategic acquisitions in the coming years (PwC, 2012).

Also, the goal of finding potential CGV targets for Taiwan companies seems highly justifiable, in light of Asian conglomerate’s recent blistering expansion (Hirt et al., 2012). According to some estimates, Chinese, Indian, and Korean conglomerates expanded their revenues by well over 10% per year (20% in the case of India and China). About 50% of this growth was largely driven by expansion into business areas that were unrelated to the parent companies previous operations, while approximately 30% of the growth was value chain expansion and 20% category expansion. An example from Chinese company Tencent is their expansion of instant messaging software from personal to corporate service (Hirt et al., 2012). These statistics underscore the fact that expansion into new specialized competencies should be an essential growth strategy for Taiwanese firms in order to compete with other Asian firms.

2.4.3 Benefits of CGV in Hi-Tech

M&A is a critical firm activity (Sterne, 2007), a common way to work towards corporate strategic goals, and expand into new technological territories (Gaughan 2005). There is an abundance of research, which outlines the potential benefits that push firms to engage in M&A activity. This section will review a portion of that research and finally compile a list of reasons for perusing M&A deals, and the benefits associated with each reason.

Studies by Pautler (2003) indicate value creation from acquisitions is related to economy of scale benefits to economic performance of the company while Capron (1999) suggests that the potential to create synergies and develop new products is another driving force of merger. In fact, many scholars have identified similar lists of aims and motives for considering M&A activity. For example: according to Brage & Eckerstom (2008) the major reasons for perusing M&A identified are: (1) efficiency in entering a new market, (2) expanding product line or distribution ability, (3) obtaining knowledge and skillsets, (4) transforming corporate identity or strategic direction, (5) economy of scale and risk distribution associated with developing new technology, (6) acquiring brand loyalty or customer base (Brage & Eckerstom, 2008). Schilling, (2010) identifies the benefits of M&A as: (1) technology capability and knowledge transfer, (2) capability complementation, (3) economy of scale, (4) time saving, (5) cost cutting, and (6) risk aversion. A similar list by Leger (2009) includes (1) economy of scale, (2) economy of scope, (3) market growth, and (4) acquisition of competencies, while Malucha (2009) also adds (1) eliminating severe competition by acquiring competitors, (2) tax benefits accrued by transferring accumulated losses, and (3) financial incentives such as employing cash surplus, increasing and debt capacity.

Also, another driver of M&A; network externalities are playing an increasing role in business strategy and the economy and are a driver of M&A as well (Doluca, 2012). Network externalities, otherwise known as network effects are defined as the benefits reaped by having more consumers or users of the same product (Economides, 1996; Katz and Shapiro, 1985). Especially in horizontal M&A, network externalities can be created when peer firms join together, thereby fusing their individual user-bases into one pool. Network effects can also to apply not only to products, but also to product platforms such as software operative systems (Economides, 2001). This concept is known as virtual networks and applies to new mobile platforms like iOS, and Android, as well as to traditional OSs such as Windows, and OS X and even database or codec standards. Virtual networks enable benefits to platform producers, application producers, and customers. These benefits are recognized as having virtuously cyclic nature, or in other words building inertia as they grow.

There are many trade-offs to consider when choosing a model of CGV, which will greatly impact the benefits that can be reaped with regards to innovative capacity. While some CGV strategies require long periods of time to implement, others such as licensing and outsourcing can provide quicker implementation and rewards. The extent to which a firm wants to leverage another firms existing capabilities is also a key factor determining which form of collaboration is appropriate. M&A, joint ventures, outsourcing, and licensing can allow greater access to other firm's competencies; however, these alliances offer varying degrees of ability to internalize these competencies. For example, outsourcing does not offer any opportunity to develop new internal competencies, while M&A, and joint ventures offer higher degrees of opportunity to develop new competencies within the firm. However a major difference between M&A and SA is that M&A offers more opportunity to access an outside competencies due the to the inherent level of control that M&A provides to the acquiring firm (Schilling, 2010). It has been noted that in a SA, the participating firms may chose not to offer complete access to their competencies for fear of giving the opportunistic competitor too much (Duysters & de Man, 2005; Schilling, 2010). The following table (Table 2-6) outlines some trade-offs between different forms of CGV development on the next page.

	Speed	Control	Develops New Competencies	Access Outside Competencies
Solo Development	LOW	HIGH	YES	NONE
Strategic Alliances	VARIES	LOW	YES	SOME
Joint Ventures	LOW	SHARED	YES	YES
Licensing In	HIGH	HIGH	SOME	YES
Outsourcing	HIGH	HIGH	NO	YES
M&A	LOW	HIGH	YES	YES

Table 2-6: Trade-offs for various forms of CGV development (adapted from Schilling, 2010)

Firm size is a major factor that pre-determines the potential rewards that CGV can offer (Schilling, 2010, p.164; Gynawali, 2009 & 2011). In relationships between firms of different size, small firms can access larger firms' resources and capital, while larger firms may want to access small firms specialized knowledge or capabilities (Schilling, 2010). Industry leading firms may cooperate with their large competitors in order to enforce standard setting with hopes of dominating the industry market share and reaping the benefits of network effects, to induce radical changes that can leave smaller firms behind, or to combine technologies into new products at better prices for the consumer (Gynawali, 2011). On the other hand, cooperation for smaller firms may be critical to creating economy of scale, economy of R&D scope, as well as try to develop or participate in technological standards development (Gynawali, 2009, Gomes-Casseres, 1997)

In terms of generating technological innovation through CGV, SA and M&A can help generate new technologies and products that would not have been possible without the partnership, or it can develop technologies much faster or at a lower cost than would be possible by the firms independently, while at the same time sharing best-practices that may continue to help the firms in the future (Duysters & de Man, 2005; Gerpott, 1995). Also, the tacit nature of knowledge makes it difficult and expensive to transfer knowledge, making CGV a more attractive alternative for acquiring technological knowledge (Larsson et al. 1998, Shilling 2010). Finally, although SAs have a slightly lower failure rate than M&As, there is no inherent theoretical advantage of one over the other and therefore making the better choice needs to be done case by case (Duysters & de Man, 2005)

2.4.4 Success Factors of CGV in High-tech

Of course if the intended benefits of CGVs are to come to fruition, they must be successful. Numerous studies have been focused on identifying factors that make CGV relationships successful and what factors cause failures. Most of these studies are focused specifically on M&A and therefore most of the literature reviews in this paper focus on M&A. There is some indication success rates of CGVs remain poor at about 50% (Duysters & de Man, 2005; Saari, 2007) although appropriate definitions of success, and methods of measuring success are often debated. Perhaps the most common method of measuring success of M&A deals is an economic approach of measuring the stock market reaction, subsequent profits, or market capitalization growth. However, some efforts have also been made to identify unique factors that contribute to M&A success for the various types of M&A (horizontal, vertical, and conglomerate) as well as within specific industries, or with regards to achieving specific benefits.

A study by Mialon (2011) specifically attempts to analyze whether M&A or SA is more successful way to increase profits when companies plan to bundle their product with other complementary products in order to force competitors out of the market. The definitions used in that study match the definitions of M&A and SA outlined in the first sections of this chapter. In that study, Mialon found that in general, SA was a better choice since competitor firms can counter-merge, or form counter-alliances to neutralize blocking benefits of an M&A deal. (Read this paper again and improve this review)

Also, firms need to evaluate the complementarity of a target before committing to a CGV because 'strategic fit' is an important success factor (Wang and Zajac, 2007; Chakrabarti et al., 2005; Colman, 2008). Strategic fit between companies can be analyzed based on organization, social elements such as management style, corporate culture, or national culture, size, technological competencies, or technological relatedness to the acquiring firm. In this paper we are mostly concerned with identifying targets with technological complementarity such as technological relatedness, knowledge and competency fit, and potential to create innovative product combinations. Pehresson (2006) finds that technological relatedness has a strong positive performance effect on M&A. Keeping in mind that Asian conglomerate companies are largely entering into new business areas, these new business areas may have close technological relatedness to the firms other product areas.

In terms of the size and nature of the firms involved in M&A transactions, Cloodt et al. (2006) conducted a statistical analysis study of M&A for hi-tech firms. The results showed support for their hypothesis that the size of the acquired knowledge base had a significantly negative impact on the acquiring firms performance post-acquisition indicating that large acquisitions can overshadow the acquiring firm, possibly drawing attention away from it. Secondly, Cloodt et al.'s (2006) hypothesis that acquired firms' knowledge base should overlap the existing technological knowledge of the acquiring firm, yet also include technological diversity was shown to also be true. Cloodt's findings support previous M&A management research that balance of technological complementarity is an important factor in M&A success and support the previously discussed notion that large firm should seeks smaller firms for CGV.

2.4.5 Software Specific Issues in CGV

Corporate spending on software is becoming increasingly critical, and now supports nearly every aspect of business according to *McKinsey Quarterly* (2013), making up 60% of total investments. The benefits include front-end benefits such as new product and communication channels, as well as back-end benefits like greater automation, standardization, and integration (Sarrrazin et al., 2013), and the current wave of M&A in hi-tech places a large spotlight on software (PwC, 2012). Some examples of how the application of software is evolving business are: front-end software that provides a greater access to vital customer data collected through apps and customer communication, and the emergence of big data systems on the back-end that allows data to be utilized to its full potential. Additionally, software that can enhance the performance of your product such as operating systems and application software is not only limited to PCs, notebooks, and mobile devices. Incorporating software capabilities into products that traditionally do not include software such as the emergence of the intelligent automobile industry, smart appliances and security systems are also emerging battlefield that is largely software dependent (Zittrain, 2006).

The software market has reached a mature stage in latter half of the past decade (Leger, 2009; Gao & Iyer, 2006), which is a possible reason for its increasing importance and integration into business strategy. Mature technologies are more profitable and viable to adopt (Kauffman and Li, 2005), and examples of high-profile software acquisitions by large firms are abundant today. This means the software technological paradigm is ripe for CGV, and more firms need to be scanning the environment for potential partners.

There are several benefits of CGV specific to the software industry. Network effects are particularly potent in software application development (Boudreau, 2011), and are thought to create a vicious cycle of attracting more users and more developers to a platform. Boudreau (2011) also points to the infinite product space available due to the nature of software products (Stoneman, 2010 from Boudreau). In terms of the financial risk of software M&A, Leger (2009) concluded that in the short-term, financial market reactions seem to ignore the characteristics of software product portfolios. Perhaps this is due to the inability for speculators to assess the potential synergy between software companies since although it is a ripening technological industry; there is still much uncertainty. Therefore extremely negative market reaction to expanding a software product line is unlikely.

Also, as discussed in the previous chapter, patent litigation, and uncertainty caused by patent policy issues is thought to significantly raise transaction costs (OECD, 2004). Firms with experience navigating these patent thickets have an easier time to deal with those associated costs (Cockburn & MacGarvie, 2011). This means that larger firms with prior IP management experience have a valuable competency to offer smaller companies. In terms of CGV, this is a likely source of synergy. With respect to small firms that are under the duress of litigation, this IP experience could in some cases make the difference between success of the small firm and failure. For this reason, large firms should carefully look at CGV opportunities where they can leverage their IP management capabilities. Also, it's important to note that a lack of patents does not imply lack of technological capabilities as small firms may have several other strategies for dealing with information management such as open source, trade secrets, copyright, or licencing (Cockburn & MacGarvie, 2011).

There are also some unique challenges and risks associated with CGV in software. In the long-term, a business combination's software CGV success is closely connected to software related attributes associated with network effects such as complementarity and compatibility of acquirer and target products (Leger, 2009).
This makes entry into these areas much easier, as evidenced by the large number of small mobile app and software companies that are emerging today. Leger (2009) found that the software compatibility was most vital long-term factor to software M&A success, while complementarity was also indicated positively. This study was done by studying the 60 highest-value software acquisition combinations of public firms in SIC 7373 and 7372, and by identifying the operational variables (acquisition of competencies, economies of scale, economies of scope, market growth, software compatibility and software complementarity) from reliable business and financial news sources. The importance of this finding is in the evidence that network externalities can be shown to have a significantly positive effect on software M&A success.

The term 'software stacks' is an architectural framework for software products and refers to the horizontal layers of software components (Figure 2-5). The products within a stack can be substituted for each other and products from different firms may be characterized by their complementarity or compatibility (Gao and Iyer, 2006). Several bodies of research have identified the success factors of M&As with regard to product placement within the software stack.

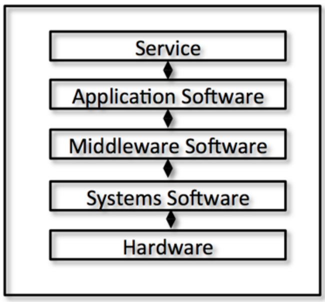


Figure 2-5: 'Software stacks' architectural framework for the horizontal relationships between various components of software products (Gao and Iyer, 2006)

Gao & Iyer (2006) determined that M&A deals involving firms from different layers of the software stack improves the success in terms of financial returns. SIC codes where used to classify companies into layers of the stack. Models using both three-layer stack and five-layer stack were compared, with the five-layer stack producing even greater abnormal returns for both acquirers and targets. The theory supporting this improved performance is the creation of the network effects of complementarity and compatibility, which were discussed in previous chapters.

2.4.6 Potential Contribution of Patent Data to CGV Targeting

Several general stages of M&A were described by Sterne (2007); (1) growth strategy formulation, (2) target selection, (3) opening negotiation, (4) due diligence, (5) final negotiation, and (6) post-closing integration. Sterne (2007) also emphasized that more attention to IP and technological capabilities should be paid during the early stages of M&A assessment rather that waiting until later stages (Sterne, 2007). As the number of corporate-level chief IP officers (CIPO) increases today, the CIPO involvement in M&A will also increase.

During the first stage of M&A described above (1) growth strategy formulation, the CIPO should attend to how IP fits into the firm's intended approach to growth. IP will continue to be a strong driver of revenue, positioning strategy, and growth in the future. Also, M&A is a common way for firms to achieve strategic goals (Gaughan, 2005). Assessment of competitor IP portfolios and forecasting the future of technological innovation allows powerful direction setting strategy such as, (1) risk assessments, (2) entry-barrier creation, (3) cross-licensing strategies, and (4) R&D

planning. Patent litigation data can provide important market information by accurately pinpointing focal technologies. Highly litigated areas show market development, and also strong will to protect IP rights. Reports detailing the most litigated IP areas on a annual and monthly basis can be used as a foundation for tapping key strategic information. In the second stage; for target selection, IP has surprisingly traditionally not played an important role considering some knowledge-based industries where 90% or more of a firm's market cap is related to IP and knowledge assets (Sterne, 2007). Also, in the due diligence stage, firms can use traditional patent information, and patent litigation information to support decision-making, negotiation strategy, and risk management. In graphing synergy maps for the future intentions post-acquisition, traditional patent data and patent litigation data can highlight the high-value areas, and help forecast the alignment of the future 'fit' between the companies involved. Considering the proposal that IP play a more important role in M&A targeting and due-diligence assessment, the fact that patenting firms were shown to have a higher deal value and higher deal value per assess value than non-patenting acquired firms, but, that non-patenting firms are more profitable as indicated by increase of total profits over total assets prior to acquisition (Grimpe & Hussinger, 2007) could play an important role in determining who to target. In this study, patent litigation data allows firms who are not patent holders, but who have been accused of infringing patented technologies to be identified. Also, these firms could not be identified by using only patent data as a targeting tool, however, these firms have technological capabilities associated with the patent they are accused of infringing and some degree of market success. It's possible that licensing for the rights to the patents being litigated, or work around technologies could further impact profitability and success.

Breitzman et al. also (2002a, 2002b) report that patent analysis can be used for several aspects of M&A and indicate benefits for increased use of patent information in targeting and due-diligence stages. Proposed uses for patent data are include; (1) targeting firms for M&A, (2) conducting due-diligence decision making assessments, (3) assessing a target firm's technological capabilities, and (4) market-valuation of target firm assets (Brieitzman et al., 2002a, 2002b). The following table (Table 2-7) shows an existing framework for assessing firms using traditional patent indicators as metrics.

The criteria put forth by Brietzmen et al. (2002) are: (1) No. of Patents, (2) recent patents, (3) high impact patents, (4) links to science, (5) emerging technology. The number of criteria met is then summed as an overall pass or fail rating for each firm. This model was designed for a specific industry; however, the framework presented by Brietzman et al (2002) is used as the model framework for creating a method to valuate potential CGV targets for the scenarios in this paper. In methods and data chapter of this paper, an explanation of appending patent litigation data to the Brietzman et al. model is explained in detail.

Indicator Name	**Definition**
No. of Patents	More than one US patent
Recent Patents	One patent granted 2010-2012
High-Impact Patents	> 1 patent in top citation quintile
Links to Science	Average of 5 non patent references per patent
Emerging Technology	Patent combining iontophoresis with other technologies
Overall	Meets criteria in at least three areas

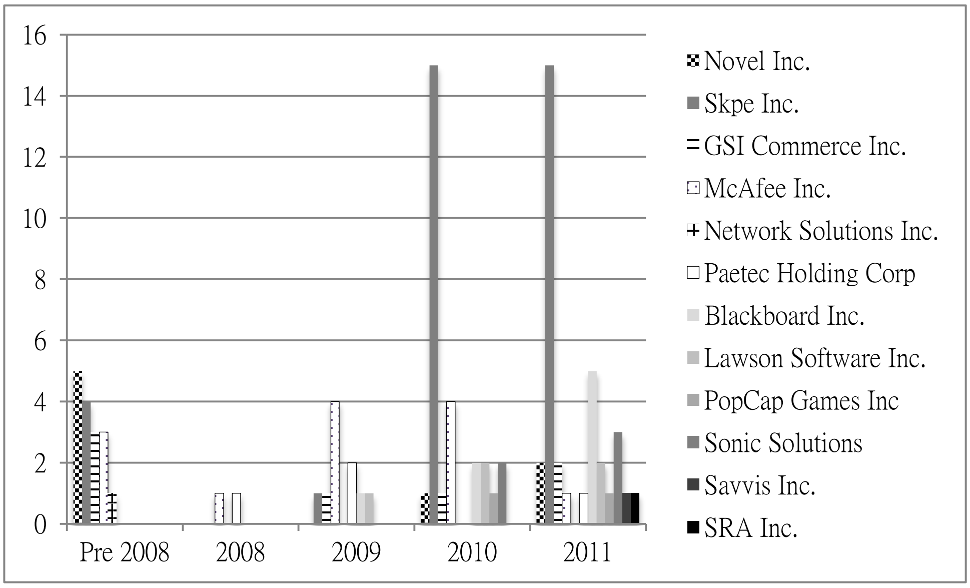
Table 2-7: List of criteria used as metrics in Breitzmen et al.'s framework for assessing potential M&A targets

Finally, two short preliminary verification studies were done to test whether patent litigation data had likely potential to contribute to M&A targeting. In the first test, a list of 682 partnerships and acquisitions for 7 major hi-tech software companies was compiled from online data. The defendants from the patent litigation dataset collected for this study were cross-referenced against this list of 682 companies. It was found that 72 (10.6%) of them had been the defendant in a patent infringement case prior to their partnership or acquisition. In another test, the acquired firms from the top 5 acquisitions by value for the sectors of software applications, IT services, and Internet (15 firms in total) were cross-referenced against defendant names from the patent litigation database. In this test, 12 of the 15 (80%) firms were found to have had infringement suits brought against them prior to acquisition. The list of those firms and a chart showing the timing of acquired firm's litigations can be found in Table 2-8, and Figure 2-6 below.

Target	Buyer	Price	Acquisition Date	Litigated
Top 5 Software Deals				
Autonomy Corporation	Hewlett-Packard Company	11.36 Billion	10/3/2011	N
McAfee Inc.	Intel Corp.	7.6 Billion	2/28/2011	Y
Novel Inc.	Attachemate Corp.	2.2 Billion	4/27/2011	Y
Lawson Software Inc	Golden Gate Captial Information	1.89 Billion	7/6/2011	Y
Blackboard Inc	Providence Equity LLC	1.79 Billion	10/4/2011	Y
Top 5 Internet Deals				
Skype	Microsoft Corp.	8.5 Billion	10/13/2011	Y
GSI Commerce	eBay Inc.	2.4 Billion	6/17/2011	Y
PopCap Games Inc	Electronic Arts, Inc.	1.33 Billion	8/12/2011	Y
Network Solutions Inc	Web.com Group Inc.	756 Million	10/27/2011	Y
Sonic Solutions	Rovi Corp.	742 Million	2/17/2011	Y
Top 5 IT Deals				
Emdeon Inc	Blackstone Group LP	3 Billion	11/2/2011	N
SAVVIS Inc	CenturyLink Inc.	2.84 Billion	7/15/2011	Y
PAETEC Holding Corp	Windstream Corp.	2.3 Billion	12/1/2011	Y
SRA International Inc	Providence Equity LLC	1.79 Billion	7/20/2011	Y
Terremark Worldwide Inc	Verizon Inc.	1.52 Billion	4/8/2011	N

Table 2-8: PwC Top Software, Internet, and IT industry M&A deals 2011 (PwC, 2012). 80% of these firms were found to have faced patent infringement litigation prior to their acquisition.

Figure 2-6: Pre-acquisition litigations for the targets in top 15 software related M&A deals of 2011 by valu



Chapter 3
Problem Definition

3.1 Review of Assumptions

Before stating the problem proposed in this thesis, a short review will reexamine the previously made assumptions. These assumptions are: (1) the innovation cycle of hi-tech is slowing and firms need to find new ways to maintain competitiveness including entering new technological fields. Software innovation has maintained an above average pace of development and is entering into a mature phase making it a vital area in which to expand. (2) Regardless of whether or not 'patent trolls' or NPEs are considered to have a positive or negative impact on innovation, they are a strategic obstacle for many hi-tech firms, especially so for smaller companies with less resources dedicated to IP management. An opportunity exists for larger firms with access to more resources and experience in IP management to cooperate with these smaller firms, in exchange receiving access to specialized technological knowledge and competencies. (3) Patent litigation data is a potential source of leading knowledge about value creation in US hi-tech markets. By identifying high value industrial sectors and potential partners who have developed profitable products firms can better plan for the future. Patent litigation data can contribute to decision-making and supplement other established IP metrics for evaluating technology and targets. (4) CGV activity provides many benefits, which are critical to firm success in the changing technology environment. Various factors, and integration types affect the achievable benefits and must be evaluated on a case-by-case, and target-by-target basis.

3.2 Problem Definition

The problem proposed by this research thesis is as follows: How can patent litigation data be sourced and organized together with other types of information, leveraging it to provide: (1) information about the high value technological software sectors for use in strategic decision-making and forecasting, and (2) identification and evaluation of potential CGV targets suitable to a given firm based on the current patenting activities of that given firm and its competitors. This problem will be solved by designing frameworks for each of these two goals. These frameworks will attempt to use previously validated indicators of patent value such as patent age, TCT, CI, and scope in order to create a heatmap-like dataset in order to view potential market value. Scenarios have been used to demonstrate the way in which a firm may want to use this framework. The data results of each framework were analyzed for statistically significant anomalies, which would indicate a significant level of value. For example, patents that were very young and had been litigated were assumed to have significantly higher market value because of the nature of patent litigation being very expensive. Further more, other patent values were taken into consideration such as low TCT, high CI, and NPRs.

3.3 Proposed Use of Patent Litigation Data

The proposal for solving this problem is to create a report consisting of two frameworks. Both use UPC classes related to a firm's strategic direction, and patent litigation data as well as other patent value metrics. The report is called the Firm Centric Identification of Value (FCIV) report. The goal of (1) the first report (FCIV-TA) was to identify high market value areas and the goal of (2) the second report (FCIV-CP) was to identify CGV targets. The following section follows the reasoning used when forming the frameworks of these reports.

In general, litigated patents are shown to have a higher value than non-litigated patents when considering metrics (Su, 2012; Lanjouw and Schankerman, 2001; Alison, 2003), and empirical assessment (Harhoff at al., 2003; Bessen, 2008). As well, litigation is a leading indicator of economic growth (Huang & Tang, 2003). Therefore, when firms search for technologies and competencies as potential future strategic directions, data reports from litigated patents can provide strong evidence of value. Annual industry reports, that show which UPC class and subclasses are most litigated, can provide insight into current market value of technological areas.

Although USPTO patent classes and subclasses are complex and products often combine components across many classes and subclasses, R&D managers have detailed knowledge about the importance of these classes to their firm's strategy. Therefore, using UPC classes and subclasses is suitable for reports directed at CTO's, CIPO's, IP mangers, and R&D managers. UPC software classes that are important to a firm need to be identified in order to focus the FCIV reports appropriately. Therefore, some consideration about how to identify relavant patent classes for a firm is required. Basically, a combination of identifying patent subclasses that a firm is actively patenting in as well as the subclasses that its competitors are actively patenting in can provided an acceptable method for isolating relevant subclasses to include in the FCIV reports. This has described the method of obtaining an initial list of relevant valuable software patents

The report frameworks also used previously validated indicators of patent value such as patent age, TCT, CI, and scope in order to create a heatmap-like dataset of value. The cumulative value as defined by ranking the selected patent indicator based metrics was applied to the relevant USPTO UPC subclasses. The cumulative scores calculated for the UPC subclasses were also be used to characterize some classes as emerging, fast-moving, or high impact. Scenarios have been used to demonstrate the way in which a firm may want to use this framework. For example, patents that were very young and had been litigated were assumed to identify higher market value because litigated patents are unmistakably an indication of high value due to the nature of patent litigation being very expensive.

In order to evaluate the ability of these reports to identify high-value areas, and potential CGV targets, three scenarios were devised to test the number and quality of the targets identified. The goal of the reports is to present data of potential economic growth areas to a management team in order to aid strategic decision-making. The goal was to select scenarios that also represented the technologies that are currently relevant. These scenarios are as follows: (1) HTC mobile consumer electronics, (2) Luxgen Intelligent Automobiles, (3) Big Data. The goal of the reports

Chapter 4
Methods and Data

4.1 Framework for Identifying Value Using Litigation Data

The following report-building framework (Figure 4-1) shows the workflow for combining the information from Thompson Reuters' Westlaw Litalert with USPTO patent data in order to create a Report Generation Database, which was then used for the generation of Firm Centric Identification of Value (FCIV) reports. The FCIV report framework, including a description of each indicator used, and a rationale for its use is included in Chapter 4.3.

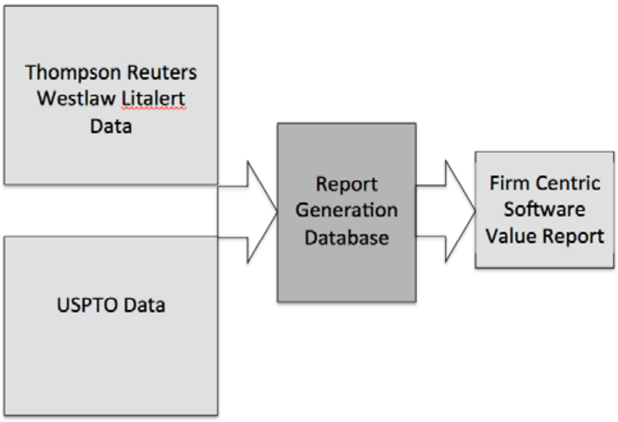


Figure 4-1: Framework for building annual reports by combining Thompson Reuters' Westlaw LitAlert Data and NBER's USPTO patent data

In order to build a schematic plan for the Report Generation Database, important characteristics for patent value analysis were identified from an existing body of research, which uses expert interviews by Su et al. (2012) for the study of patent litigation probability. These important fields are as follows: (1) Patent Number, (2) Application Year, (3) Issue Year, (4) No. of Assignee, (5) No. of Assignee Countries, (6) No. of Inventors, (7) No. of Inventor Countries, (8) No. of Patent References, (9) No. of Patent Citations Received, (10) No. of IPCs, (11) No. of UPCs, (12) No. of Claims, (13) No. of Non-Patent References, 14) No. of Foreign References. The fields available in Westlaw Litalert records are as follows: (1) Document Type, (2) Title, (3) Patent Number(s), (4) Patent Type, (5) Class Number, (6) Class Type, (7) Inventor, (8) Assignee(s), (9) Plaintiff(s), (10), Defendant(s), (11) Court, (12) Docket Number, (13) Filing Date, (14) Subsequent Action Details, and (15) Notes. Important fields were selected from the Litalert data and integrated with USPTO patent data, considering the fields indicated by Su et al. (2012). Finally, the names of defendant(s), and patent number(s), filing date, and docket number were extracted from the Litalert reports as important variables for use in this study. Two data tables were generated from the Litalert records. Those two tables were (1) The Litalert Patent Numbers Table, and (2) The Litlaert Defendant Table. Also, a third table containing a complete set of UPSTO patents was required for generating and appending indicators such as CCI, PCI, TCT, NPRs, UPC, etc. The USPTO Patent Indicator Data Table included the following fields: (1) patent number (2) patent TCT, (3) forward citation count, (4) non-patent citation count, (5) patent issue date, (6) assignee, and (7) US classification. These three tables comprise the Report Generation Database. The diagram outlining the basic framework of the table is available below (Figure 4-2), and technical procedures for obtaining the data in these three tables is described below in Chapter 4.2.

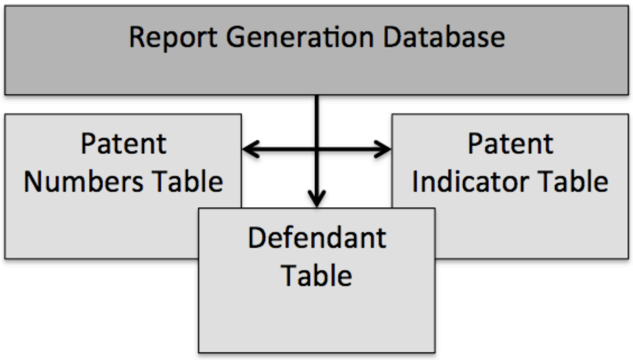


Figure 4-2: Framework for the tables included in the Report Generation Database

4.2 Obtaining the Required Data

To obtain the data required for this study, USPTO and patent litigation data was obtained and constructed into several data tables described above in section 6.1. Computer science techniques were essential to this process. Patent litigation data was obtained through the NCHU library access to Thompson Reuters Westlaw Litalert online database. The Litalert data was downloaded in several separate text files comprising all the patent litigation records from 1976-2012. These records were parsed using two separate parsing software applications. The parsing software applications were verified for accuracy using a test file and that verification and related data are available in Appendix B. The data was shown to have been extracted with 100%

accuracy. The records were parsed into two separate tables and small samples of those tables are included in the appendix of Appendix C, Tables C-1 & C-2. These tables contained data for; (1) The Litalert Patent Number Table containing each instance of litigation for each patent number in each reported filing, including filing dates, and docket numbers, and (2) The Litalert Defendant Table containing defendant names for each reported filing, including filing dates and docket numbers. Basic USPTO data was provided by access to a database used for previous research by Su et al. (2012). The USPTO Patent Indicator Data Table was created using SQL scripts to calculate the important indicators for each patent as mentioned above in section 7.1. An example of the table is shown in Appendix C Table C-3.

Organizing the tables in this manner allows cross-referencing by docket numbers in order to rejoin the Litalert Patent Number Table, and the Defendant Table. For example, this allows identification of all patents involved in litigation for any given defendant by querying for a defendant name, identifying a list of docket numbers, and then searching for patent numbers using those docket numbers (Appendix C, Table C-4). Similarly, docket numbers for a given patent could be identified and queried in the defendants table in order to find all defendants litigated for infringement of that particular patent (Appendix C, Table C-5).

4.3 Firm Centric Identification of Value Report

FCIV reports are designed to be relative to a given firm's strategic position, and FCIV reports should identify value from a given firm's perspective. Using relevant patent classes is a reliable and useful means for firm analysis (Ernst, 2005). FCIV reports must identify key UPC classes and subclasses for a firm by identifying UPC classes they are actively patenting in, UPC classes that they are considering to patent in or developing products that contain technology from, and UPC classes from their competitor's patenting activity. Those considerations, and the rationales for their inclusion are outlined in Table 4-1. There are many processes for selecting relevant subclasses, and in the end, different methods can be used depending on a given scenario. In the scenarios of this paper, some assumptions and decisions were made to narrow the subclasses included in each scenario. Although these decisions were deemed to be suitable and effective, direct contact with R&D managers could have lead to a more concise group of classes being selected for inclusion in each scenario.

FCIV reports identify: (1) economic value and it's potential for growth in a group of subclasses, and (2) CGV targets by creating lists of defendants and assessing those defendants according to a set list of value-based criteria. FCIV-TA Report identifies potentially high economic growth technological areas, and FCIV-CP Report focuses on defendant assessment for CGV targeting. Identified targets and UPC subclasses passing a higher cumulative number of criteria are considered to be stronger firms. The set of metric criteria used for the CGV target evaluation consists of both (1) criteria used by Breitzman & Thomas (2002b) to evaluate potential M&A targets and (2) additional criteria utilizing patent litigation data. These patent value indicators used in the FCIV reports were validated previously.

The indicators were selected based on the considerations for using patent information as a tool for strategic management assessment as outlined in Chapter 2.1, and the considerations for evaluating potential CGV target outlined in Chapter 2.4. The framework for the FCIV shows the overall picture of how these elements are combined (Figure 4-3).

Table 4-1: Identifying classes that comprise a firm's strategic interests

Code	Description	Significance
C1	Classes a firm currently patents in	Knowing the litigation conditions for specific components, and products related to a firms current activity allows smaller strategic modifications to R&D activities and decision making support
C2	Classes of interest to a firm based on current product assessment	Firms don't always patent in all classes embodies by their product portfolio. Knowing litigation conditions allows identification of potential cooperative partners, identifies value trends, and allows decision making support
C3	Classes of interest to a firm based on potential future directions	Firms have several means to identify potential future technology development and product development. Classes identified by other means can be included to gain additional decision making support
C4	Classes of competitors or cooperative partners patenting activity	Firms must often react to changes in competitor activity. Analysis of competitor litigation helps indicate value in competitor technology

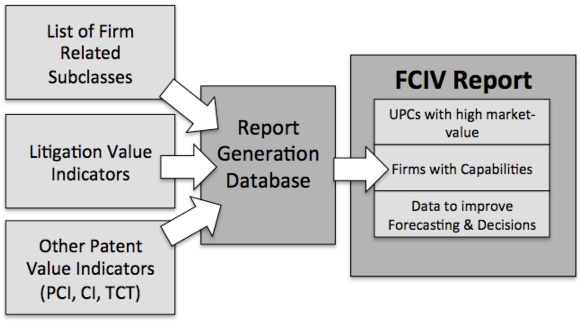


Figure 4-3: framework for combining litigation, and other patent value indicators with list of relevant subclasses into a FCIV report

In FCIV-TA Report the focus was on identifying potential economically high-value technological areas (HVTA) from within a given group of relevant UPC classes. Indicators were selected that could identify the most highly litigated UPC classes, and identify of those litigated areas, which had the lowest average age, lowest average TCT, and highest average CI; as well as identify 5-year litigation trends in those classes. The following table (Table 4-2) lists the indicators selected for FCIV-TA Report and includes definitions, and descriptions of the significance of the indicators.

Table 4-2: Description of Indicators for FCIV-TA Report

Code	**Indicator Name**	**Definition**	**Significance**
TA-F1	Most litigated subclasses	Active subclasses *ac*, competitor subclasses *cc*, current product subclasses *pc*, and future direction subclasses *fc*, with most patent litigations (PL) for current year (PL_{ac}, PL_{cc}, PL_{pc}, PL_{fc},), and share of subclasses (PL_c/PL_T).	Most litigated classes can indicate high market value for the technologies encompassed by those classes. This is because patent litigation is a leading economic indicator.
TA-F2	Lowest average age	Youngest average patent age (A) for subclass *c* of all litigated patents for a given year (A_{PLc}) .	Litigated Patents with very low age can indicate (1) fast development to market transition for that technological area or (2) high expectation of future value.
TA-F3	Lowest average TCT	Subclasses *c* with lowest average litigated patent TCT (LTCT) ($LTCT_c$). TCT is the average age of the references within a patent.	Low TCT can indicate a fast pace of technological development in that technological area.
TA-F4	Highest average CCI	Subclasses *c* with highest average patent citations per patent (LCCI) ($LCCI_c$). CCI is the number of forward citations received by a patent.	CCI is an indicator of technological impact. High CCI means that a patent has been referred to more often implying that it has a greater impact on future technologies.
TA-F5	Litigation trends for key subclasses	PL per year *y* of key patent subclass *c* for past five years (PL_{cy}).	Litigation trends provide emergence and decline of litigation within certain classes. This can help identify if an area is becoming important or its importance is declining.

In order to make a final assessment of the value, the top ten UPCs from each of the indicators TA-F1-TA-F4 are taken. The significance of being in the top-ten list for multiple metrics detailed below in Figure 4-4. The cumulative number of top-ten lists that a UPC makes is totaled and finally summarized. The cumulative number of top-ten list appearances with respect to the metrics TA-F1-TA-F4 were used to identify which classes have exceptionally high value (Appendix F). Also, the classes themselves were grouped together according to their titles to form clusters of UPCs, which represent separate technological areas. After statistically significant technologies were identified, they were listed along with a rationale for their inclusion in the results summaries for each scenario.

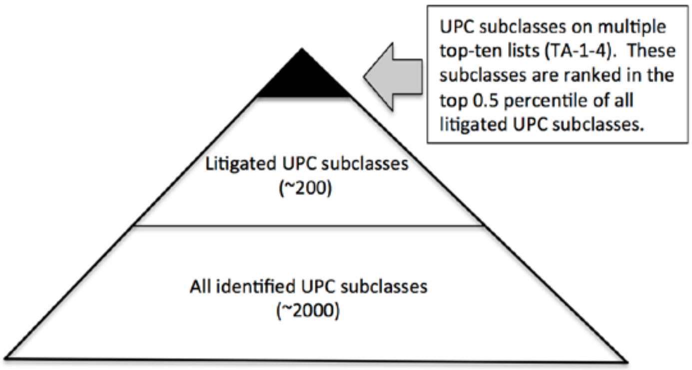


Figure 4-4: The significance of ranking top-ten on multiple metric lists (TA-1-4)

In FCIV-CP Report, identified defendants were compared against each other, and assessed for suitability as a CGV target. Table 4-3 shows the criteria used by Breitzman & Thomas (2002b) for comparing potential M&A targets for electronic drug delivery technology using patent data as support metrics. Because the criteria for the "emerging technology" metric were specifically related to electronic drug delivery, it was excluded. Additional metrics that take advantage of patent litigation data were appended to the Breitzman & Thomas's metrics (Table 4-4). These additional metrics combine the widely accepted traditional patent value metrics such as patent age, CI, and TCT, and technological scope with litigation data.

Table 4-3: Model for examining companies' suitability as M&A target by using patent portfolios

Code	Indicator Name	Definition
FD1	No. of Patents	More than one US patent
FD2	Recent Patents	One patent granted in past two years (2011-2013)
FD3	High-Impact Patents	> 1 patent in top citation quintile
FD4	Links to Science	Average of 5 non patent references per patent
---	Emerging Technology	Patent combining iontophoresis with other technologies
FD9	Overall	Meets criteria in at least three areas

Table 4-4: Additional value indicators using litigation data

Code	Indicator Name	Definition
FD5	Young Patent	Has been litigated for infringement of at least one patent <5 years old)
FD6	Low TCT	Has been litigated for patent with TCT <3
FD7	High Impact	Has been litigated for a patent with CI > the UPC subclass average
FD8	Multiple Subclasses	Has been litigated in more than one selected UPC subclass

In the previous sections the benefits of cooperative relationships between small firms under the pressure of litigation and larger firms with extensive IP management capabilities was discussed. Although FCIV-CP Report firms were valued by comparing their cumulative performance in all metrics, even firms that only meet the criteria of a few, or even one metric may have substantial CGV value. Being accused of infringing a young patent, or patent with low TCT both may indicate that a firm has capabilities that are emerging technology and/or has developed a product with significant market value. Being accused of infringement of a high PCI patent could imply that a firm has capabilities that are high-impact, and litigation in multiple UPC classes indicates a firm's capabilities span multiple technological areas of importance. Also, small firms often develop highly specialized technologies even firms without large valuable patent portfolios may represent significantly high value as a CGV target, depending on the complementarity of the technological capabilities of the firm, the product comparison, and the nature of the integration (vertically integrated, horizontally integrated) CGV target, especially. For example a small firm that could be vertically integrated with a larger firm could be a valuable acquisition if they produce a component that is an important part of the acquirer's value chain.

In order to identify and rank this second group of potential CGV targets, FCIV-CP Report also includes another set of criteria calculating the number of firms that meet a second framework. This second framework uses the same metrics outlined in Table 4-3 and 4-4, but a subset of firms were isolated. The goal of this second criteria framework is to identify firms that have been accused of infringing a highly valuable patent, but do not have extensive patenting experience themselves. This subset of identified firms, denoted high-litigation-value low-patenting-value (HLVLPV) firms were identified and calculated as total number and percentage of all firms identified. The criteria for HLVLPV firms were as follows: scoring cumulative total of 75% or more of the litigation criteria, but limited to scoring a cumulative total of 50% or less of the patent grant criteria. By setting the criteria for HLVLPV firms in this way, firms who have extremely high level of patenting-activity are eliminated, and firms with less patenting experience, and thus probably less IP management experience are isolated. The firms scoring less on the patenting-activity specific criteria are more likely to be on the smaller end of the firm-size scale and also have less experience with complex IP management and legal defense. These smaller firms will probably be more eager to benefit from CGV with other firms, especially ones that can offer extensive experience with strategic IP management capabilities such as: patent litigation defense strategy, strategic IP licensing, and strategic R&D planning. Also, these smaller HLVLPV firms may benefit extensively from CGVs through creating economies of scale, reducing development times, or network effects.

A summary of the four data parts included in FCIV-CP Report including definitions and description of the significance are outlined in Table 4-5 below.

Table 4-5: Description of Indicators for FCIV-CP Report

Code	Indicator Name	Definition	Significance
CP-F1	Cumulative criteria summary	No. of firms *f* passing cumulative total of criteria (CCr).	This data shows the total number and percentage of high, med, and low value targets that were identified using the FCIV report framework (FD1-FD8).
CP-F2	Percentage of firms passing each criteria	% of firms *f* passing each separate criteria (Cr).	This data chart shows the percentage of firms passing each criteria (FD1-FD8).
CP-F3	Highest-valued targets	Firms meeting a cumulative total of 7 or more of all 8 criteria set forth in the FCIV-CP firm assessment.	This list of firms shows the most highly valued candidates for CGV from the list of target firms identified (FD1-FD8).
CP-F4	HLVLPV targets	Firms meeting at least 3 out of the 4 litigation-based criteria (FD5-FD8), and 2/4 or less of the patent-grant based criteria (FD1-FD4).	This list of firms isolates the CGV targets that have been accused of infringing highly valuable patents, but do not have a robust patenting activity. These candidates represent potentially highly beneficial CGV partnerships, and would benefit most from CGV partnerships.

To review, the steps involved in building the FCIV reports are as follows: (1) compile a list of highly important subclasses related to a given firm's strategic activities, (2) use the identified UPC classes to search the Report Generation Database for patent numbers, and defendant names, (3) append data from the USPTO Patent Indicator Data Table, and (4) compile the FCIV-TA and FCIV-CP reports.

4.4 Example Scenarios Selected from Taiwan Hi-Tech Industry

In the example scenarios, patent activity of several firms have been analyzed and the strategic IP related interests of several technological perspectives have been undertaken. The methods used for identifying patent classes that are of strategic interest are detailed above in Table 4-1 (Codes C1-C4).

4.4.1 Scenario A: HTC Mobile Consumer Electronics

Mobile devices such as smartphones and tablets rely heavily on software for their functionality. Operating systems, such as iOS and various Android flavors uniquely characterize the functionality and effectively the distinguishing features of the device. Proprietary software features are an important differentiating feature that mobile device makers use to gain competitive advantage in the marketplace. For example, HTC's new phone *'One'* has new camera software with advanced features and a new upgraded interface for Android OS[16]. This shows that HTC has invested in strategy to develop software features to differentiate their phones in the marketplace. In fact, other mobile device-makers also heavily rely on proprietary software to differentiate their product in the marketplace. For example Apple uses proprietary operating system (iOS) and Blackberry has developed a reputation for advanced security features[17, 18], which had initially gained Blackberry corporate and military

16 CNN Money reports on the HTC *'One'*. Three paragraphs are dedicated to hardware, while eleven paragraphs are dedicated to reviewing the software capabilities. (Feb 19 2013). http://money.cnn.com/2013/02/19/technology/mobile/htc-one-android-smartphone/index.html

17 RIM (now called Blackberry) has excellent penetration in to corporate business clients. http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/9033921/BlackBerrys-problems-began-with-Apples-success.html. (Jan 2012).

18 RIM offers encryption built into apps for corporate security: http://bits.blogs.nytimes.com/2012/05/11/security-rim-3lm-good/ (May 11, 2012)

market-share in the early days of smartphones. More recently, Facebook has released a new customized version of Android, which has been released on an HTC phone[19].

Selecting patent classes to include in the search for high value technological areas and CGV targets was done in two parts separately. First, the active classes that HTC has obtained patents in was collected and analyzed as HTC active classes. Secondly, competitor classes for HTC were collected and analyzed as HTC competitor classes. Apple, Nokia, and Research in Motion (now called Blackberrry) were selected as competitors when identifying UPC subclasses for inclusion. In retrospect, a different group of companies could have perhaps produced better results with respect to the strategic interests of HTC, however these competitors were deemed important for this study. Since producing these reports is simple, they are repeatable for infinite possible configurations of UPC classes. These competitors were selected because of the fact that while other large players exist in the in the mobile electronics industry, these other large players such as Samsung, Motorola, Google, all have other major revenue streams coming from something other than a mobile brand. For example, Samsung has major shipping, appliance, and semiconductor revenue streams, while Google's revenue comes almost entirely from advertising. These firms hi-tech patenting activity could have been carefully collected. A more broad perspective to the competition of HTC would possibly be suitable, but this scope was selected in order to focus on hi-tech patents directly associated with HTC. Essentially, this was also offset by compiling both an active patenting class report and a competitor class report.

Appendix C, Table C-1 shows the active and competitor patent subclasses identified as being highly important to HTC. In total, 74 UPC subclasses were included for the HTC active class reports (21 of which had litigated patents) and 595 UPC subclasses (217 of which had litigated patents) were included for the HTC competitor class reports.

19 Facebook releases its own version of Android on HTC. http://bits.blogs.nytimes.com/2013/03/29/facebook-to-introduce-its-own-flavor-of-android-for-smartphones/ (March 29, 2012)

4.4.2 Scenario B: Luxgen Intelligent Vehicles

Scenario B is an imagined scenario where Taiwanese car manufacturer Luxgen has decided to look for CGV targets to develop automotive technologies with the goal of developing innovative intelligent vehicle technologies. This scenario was selected for a few reasons. Firstly, the fact that autonomous vehicles have been licensed for testing in two US states to date, and that Google's Sergey Brin has publically predicted that autonomous vehicles will be ready for market in 5 years[20] indicates that technological innovation and development is very active in this industry. Secondly, litigation data shows the top two litigated software UPC classes for 2012 are related to transportation technology (Table 4-6). This litigation trend indicates that technological innovation in the intelligent transportation industry is high-value at this time. The final justification for selecting this scenario is that Luxgen; a new Taiwanese independent auto brand is seeking to grow and add market share in Taiwan and abroad[21]. Luxgen is owned by parent company Yulon Motors.

The patenting activities of the top ten biggest global auto-manufacturers[22] were used to identify the subclasses to be included in the search for litigation data and the building of FCIV reports. A example of their patenting activity is shown in Figure 4-5. The patent grants from these top global automakers were sorted into UPC subclasses and all subclasses with less than 5 total patent grants were eliminated. Initially, 2,149 subclasses were identified as shown in Appendix C, Table C-2. 80 of those subclasses had litigated patents.

20 Sergey Brin predicted that autonomous vehicle technology will be reality in 5 years: http://www.computerworld.com/s/article/9231707/Self_driving_cars_a_reality_for_39_ordinary_people_39_within_5_years_says_Google_39_s_Sergey_Brin (Sept 25, 2012)

21 Luxgen Website: Debut of LUXGEN in MIAS, the New Intelligent Auto Force in Russia. http://www.luxgen-motor.com/Message/MessageDetail?ContentID=ea110fa7-bce7-4268-8c3c-f60da0ec9243&actionName=News

22 Top global auto-makers were identified from within Forbes Global 2000 list. http://www.forbes.com/global2000/list/

Table 4-6: Top ten most litigated UPC subclasses by total no. of docket numbers. The top two subclasses are related to intelligent vehicle technology.

Rank	UPC	Title
1	/701/201	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: NAVIGATION: Determination of travel data based on the start point and destination point
2	/340/994	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: Vehicle's arrival or expected arrival at remote location along route indicated at that remote location (e.g., bus arrival systems)
3	/235/380	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS: Credit or identification card systems
4	/370/449	MULTIPLEX COMMUNICATIONS: CHANNEL ASSIGNMENT TECHNIQUES: Polling
5	/235/379	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS: Banking systems
6	/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
7	/702/182	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Performance or efficiency evaluation
8	/705/65	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including intelligent token (e.g., electronic purse)
9	/715/810	DATA PROCESSING: PRESENTATION OR PROCESSING OF DOCUMENT, OR INTERFACE: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Menu or selectable iconic array (e.g., palette)
10	/709/219	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server

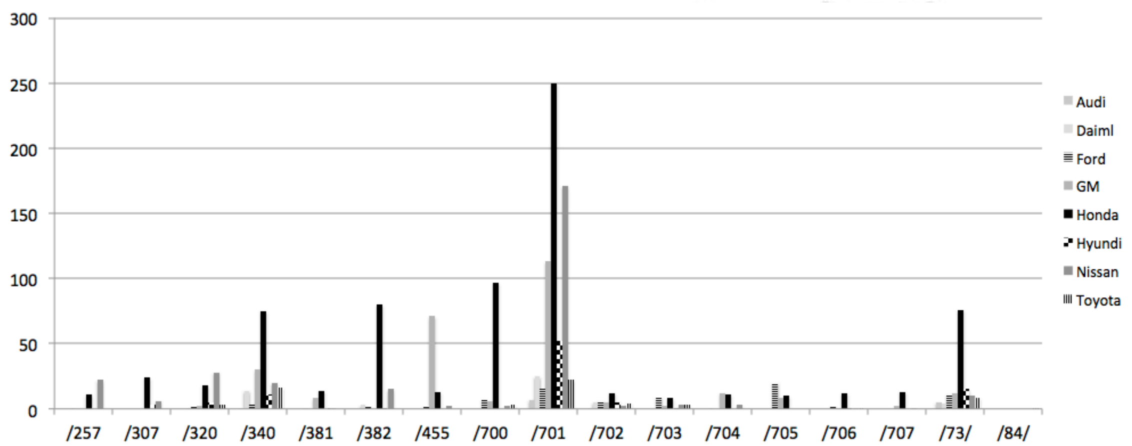


Figure 4-5: Patenting activity in software UPCs for largest global auto manufacturers.

4.4.3 Scenario C: Big Data

Everyday, billions of bytes of data are created, and that figure will unquestionably continue to rise in the near future. The challenges involved in structuring, storing, accessing, and analyzing this data is known in the business world as ‘big data’. Big data is considered an important business trend by the top global business-consulting firms, and an important focus of large IT high-tech firms in recent years. Also, Big Data has been named as a leading area of high-tech M&A in 2012 (PwC, 2012).

Firstly, the problem of which patent classes should be included in our search criteria for 'Big Data' was addressed. Two steps were used to identify what patent classes would be included. Firstly, the articles from Forbes[23,24], Eweek.com[25], and Fastcompany.com[26] were used to identify the some big data companies. In total 35 firms were identified. After an initial analysis of these firms, a few were eliminated due to the fact that their operations and product lines were extremely diverse and would definitely include high numbers of patents unrelated to big data. The eliminated firms were IBM, HP, Amazon, and Oracle. The remaining 31 companies' product lines are more focused on big data and therefore their patenting activity as a whole should more accurately reflect the main patenting areas of big data. The patenting activity was collected and sorted according to the UPC classes and subclasses. Initially, 17 UPC classes, including 421 UPC subclasses were identified. Table 4-7 below shows the total number of patent grants collected in each UPC class. Appendix C, Table C-3 shows the UPCs finally selected for inclusion. It should be noted that finally, after reviewing the classification titles themselves and patent grant totals, the several classes were selected for complete inclusion. The classes selected for complete inclusion were (1) /707, (2) /715, (3) /709, (4) 705. This makes the total number of subclasses higher than it would appear when looking at Appendix C, Table C-3 because several classes have been fully included. In total, 1177 subclasses were included in the Big Data scenario search, and 200 of those subclasses were found to have litigated patents within them.

23 Forbes. Top Ten Big Data Pure-Plays: http://www.forbes.com/sites/gilpress/2013/02/22/top-ten-big-data-pure-plays/
24 Forbes. Top Ten Most Funded Big Data Startups: http://www.forbes.com/sites/gilpress/2013/03/18/top-10-most-funded-big-data-startups/
25 EWeek.com. Top 12 Big Data Companies Creating Buzz on the Social Web: http://www.eweek.com/database/slideshows/top-12-big-data-companies-creating-market-buzz-on-the-social-web/
26 Fastcompany.com. World's Top 10 Most Innovative Companies in Big Data: http://www.fastcompany.com/most-innovative-companies/2013/industry/big-data

Table 4-7: UPC classes and grant totals results for identification of big data UPC classes for inclusion (classes were selected for total inclusion)*

UPC Class	No. of Grants	UPC Class Title
/707*	632	DATABASE AND FILE MANAGEMENT OR DATA STRUCTURE
/715*	222	DATA PROCESSING PRESENTATION PROCESSING OF DOCUMENT
/709*	214	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS
/705*	154	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT
/713	40	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING
/714	39	ERROR DETECTION/CORRECTION AND FAULT DETECTION/RECOVERY
/235	31	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS
/340	27	COMMUNICATIONS ELECTRICAL
/370	18	MULTIPLEX COMMUNICATIONS
/345	17	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS
/702	15	MEASURING CALIBRATING TESTING
/455	12	TELECOMMUNICATIONS
/382	11	IMAGE ANALYSIS
/380	9	CRYPTOGRAPHY
/379	4	TELEPHONIC COMMUNICATIONS
/710	4	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT

Chapter 5

Results

In this chapter, the contents of the FCIV reports are analyzed for their effectiveness by their ability to identify firm centric high-value areas, and strong CGV targets. The FCIV-TA reports' effectiveness was measured by their ability to produce results showing that some technology classes are noticeably and significantly more valuable than other technology classes. Firstly, value was defined as being a litigated patent and having passed another secondary patent value indicator (age, TCT, CI, scope). Secondly, technology classes were measured as clusters of UPC subclasses that are related to each other. For example, several clusters of technology classes were found related to cryptography, database management, graphics processing, etc. These technology clusters were grouped by reading the title of the UPC classes identified in the selected metrics top ten lists. The value indicated by these reports should be validated and verified by experts such as technology forecasters, Chief technology Officers (CTOs), CIPOs and professional technology managers. However, the reports themselves were able to identify significant variations in detected value among groups of UPC subclasses, and subsequently technology cluster areas.

Assessing the reports was done in a few ways. One way, (1) was by counting how many FCIV-TA metrics were passed by each UPC subclass. In each scenario, numerous UPC subclasses were included in the initial scenario definition. To recall, the HTC scenario included 74 (21 litigated) subclasses in the active subclass reports and 595 (200 litigated) subclasses in the competitor subclass reports. The Luxgen scenario included 2,149 (80 litigated) competitor subclasses, and the Big Data scenario had 1,177 (200 litigated) included subclasses. Therefore, any subclass appearing on a single, let alone multiple top ten lists (TA-1-TA-4) has achieved indication of significant value. That is because appearing in a top ten list of UPCs on the FCIV-TA puts that UPC in approximately the top percentile as measured by that value indicator. According to the results from Huang & Tang (2002) the PC industry patent litigation grew at a statistically similar rate to the sales in the PC industry and subscribers within the mobile phone industry throughout the 80's and 90's. Since that time litigation intensity has significantly increased. These reports are of value considering that (1) the patents were litigated which shows measure of value, and (2) the patents additional indicators (age, TCT, CI, patent scope) are considered objective measure of value from a certain perspective.

Cumulative total number of FCIV-TA metrics passed can indicate if some UPC classes are of significantly higher value than others and those UPC classes can be grouped together based on the type of underlying technology they protect. Again, value is being measured by at least two perspectives at all times (patent litigation, and one of the other FCIV-TA metrics). If some classes are high-ranking on more than half of the metrics, they could be identified as having high-value according to at least a combination of three patent value metrics (patent litigation, and two of age, TCT, CI, and scope), which identifies high-value technological areas, and the FCIV-CP report which identifies potential

The tables produced to analyze the results of the FCIV reports can be found in the Appendix F of this paper. It was found that the FCIV reports did produce a valuable result in terms of (1) identifying high-value technological areas related to a given firm's strategic interests, and (2) identifying defendants that represent firm-specific strong CGV targets and HLVLPV CGV targets.

5.1 FCIV Report Analysis – Scenario A: HTC

FCIV TA Report was conducted separately for both HTC active and HTC competitor classes. Significant differences were noticed between the two reports. The reason is because HTC's patenting activity is limited to a small portion of the total number of UPC classes identified as important to smartphone devices in this study. Therefore the ranking system of counting cumulative appearences on top ten lists was not be as sensitive because few UPCs were included. Irrespective of the differences between the two reports, there were several results that were significant. For example, for HTC active classes, UPC subclass *'/345/173'* for *'Touch Panel Graphics Processing'* had 350% more docket numbers in 2012 showing that it was by far more significant than other HTC active classes (Appendix E, Figure E-1). The implication of more docket numbers is that there is much more money being spent on litigation in that subclass, and the technology that those patent protect is expected to continue to be of high-value if patent litigation precedes market growth. While it may be already well established within the HTC R&D management thinking that*"Touch Panel Graphics Processing"* is a significantly important technological area, a high level of litigation is important evidence when considering further development in that technological area. The 5 year litigation trends for HTC active classes also shows that this same graphics processing subclass, *'/345/173'* has far outpaced all other classes in terms of litigation during the past 5 years. Also, upon analysis of HTC active classes' cumulative total of appearances on the top 10 lists for FCIV-TA Report criteria, more than 50% (7 out of 13) of the UPC subclasses with more than one appearance were related to *graphics processing* or *image analysis* (Appendix F, Table F-1). Of the remaining 6 UPC subclasses with cumulative total of more than one, 30% (4 out of 13) were related to telecommunications.

For HTC competitor class analysis, all but one (87.5%) of the subclasses appearing on more than one top 10 list of value indication were related to multi-computer data transferring. 6 out of those 7 classes, which were related to multi-computer data transferring were from UPC class *'/709'*, while one was from UPC class *'/713'*. This is strong evidence that several UPC classes in *'/709'* have high likelihood of being an economically important technology classes in the mobile phone industry. That's not to say that other UPC subclasses are not more important, only that future economic growth has been implied by the litigation data. Upon examining 5-year litigation trends for the top 20 increasing HTC competitor classes several other technological areas show meteoric rises in litigation. Those technological areas include: cryptography (3 of 20 top increasing subclasses), database management (3 of 20), computer conferencing and messaging (2 of 20), and credit card and remote shopping (2 of 20).

Finally, after grouping the UPC subclasses of related technologies, the most important technological areas for HTC as identified by patent litigation data is listed below including a rationale for its inclusion (Table 5-1).

Table 5-1: Most important technological areas for HTC as identified by patent litigation data.

Technological Areas	Characteristics	Rationale
Multi-computer data transfer and communication	• High market value • Emerging • Fast moving • Technologically Important	• These classes dominated all top areas of the HTC competitor classes.
Graphics Processing & Touch Panel	• High market value • Emerging • Fast moving • Technologically Important	• Most litigated active class by 350% • Representing about 50% of top classes identi fied by value indicators
Cryptography	• Increasing litigation • Fast moving • Technologically important	• 25% of the top 20 classes by most increasing litigation • 3 of the lowest TCT competitor classes were related to cryptography • The highest CCI competitor class
Database Management	• High market value • Increasing litigation • Emerging	• 10% of the top 20 classes by most increasing litigation • Among the top active and competitor classes with lowest age of litigated patents
Computer Conferencing & Messaging	• Increasing litigation	• 10% of the top 20 classes by most increasing litigation
Credit card & Remote Shopping	• Increasing litigation	• 10% of the top 20 classes by most increasing litigation

In total 860 firms were initially identified using 2012 Litalert data in search of CGV targets for HTC. 66 (7.8%) of these targets were identified as having exceptionally high-value (having cumulative score of 7 or 8), and 203 (23.6%) of the targets were identified as having HLVLPV value. In total, 269 (31.3%) firms were identified as potentially valuable CGV targets.

The charts and firm lists for HTC FCIV-CP can be found in Appendix E. Upon investigation of the list of strong CGV targets, many of HTC's competitors were found. Apple, Research In Motion, Google, LG, Amazon, Samsung, Toshiba, Sony, Sanyo, Asustek, Nokia, Acer, HP, Dell, and Microsoft were all identified as very strong CGV targets, and all of them also produce mobile devices comparable to HTC. However, several other types of firm were identified within the class of strong CGV targets, representing possible vertical and conglomerate integrations were identified such as banks, automakers, telecoms, chipmakers, logistics companies, and Internet commerce companies. Firms from these other industries may have incentives to collaborate on the technologies that are mutually important to HTC.

5.2 FCIV Report Analysis – Scenario B: Luxgen Intelligent Vechicles

In the Luxgen Scenario, the FCIV reports were only compiled for competitor classes combined. Upon analysis of the FCIV-TA Report, two UPC subclasses had significantly higher count of docket numbers. Those classes were: (1) UPC *'/701/201: Determination of travel data, based on start point and end point'* and (2) *'/705/35: Vehicle's arrival or expected arrival at remote location along route indicated at that remote location'* (Appendix E, Figure E-13 and Table E-13). The 5-year trend reports that these UPC have been the highest litigated subclasses included in Scenario B consistently over the past 5 years. Also, of UPC subclasses that had been in the top 10 lists for multiple FCIV-TA Report value metrics (Appendix F, Tables F-5 & F-6), 6 such UPC subclasses were identified comprising 3 distinct technological areas. Those areas are: (1) vehicle position indication for controlling a vehicle, (2) business processing using cryptography and (3) telecommunications. The following table summarizes the technology areas identified as high-value (Table 5-2).

Table 5-2: Most important technological areas for Luxgen as identified by patent litigation data.

Technological Areas	Characteristics	Rationale
Vehicle navigation and control	• High market value • Increasing litigation • Emerging • Fast moving • Technologically Important	• The two most highly litigated subclasses • Representing about 50% of all top classes tha t appeared in high value lists
Cryptography in business processes	• High market value • Emerging • Fast moving • Technologically Important	• 2 of 9 classes that appeared in multiple value lists
Telecommunications	• High market value • Increasing litigation • Emerging • Fast moving • Technologically Important	• 2 of 9 classes that appeared in multiple value lists • 4 classes that appeared in top 10 value lists.

In total 136 firms were initially identified in the search for CGV targets. 20 (14.7%) of these targets were identified as having exceptionally strong, having passed a cumulative total of 7 or 8 of the metric criteria. Also, 18 (13.2%) of the targets were identified as having HLVLPV value. This means that in total, 38 (30%) of the firms were identified as potentially high-value CGV targets. Upon analysis of the high-value CGV targets, 4 major automakers were identified: BMW, General Motors, Hyundai, and Toyota. Several other major electronics manufacturers were also identified as high-value CGV targets including: LG, Sony, Samsung, and Toshiba, General Electric, and

Kyocera. Also, several consumer electronics producers were identified including: Dell, Acer, HTC, Lenovo and Pantech Wireless.

5.3 FCIV Report Analysis – Scenario C: Big Data

In Scenario C for Big Data, several technological areas were identified as being high value after analyzing the results of the FCIV-TA report (Appendix E). After a total of 1177 UPC subclasses (200 litigated) were compared with each other, a cumulative total of 6 subclasses had appeared on multiple top-ten lists. All 6 of those subclasses were top-ten in 2 out of 4 of the metrics TA-1-TA-4. This puts them in a very high percentile of value. Looking at the 5-year trends showed that of these 6 high-value subclasses, 4 of them experienced meteoric rise in litigation within the past three or so years. The technological areas identified when grouping the multiple top ten list UPCs into clusters includes: (1) cryptography, (2) document and data presentation and GUI, (3) banking and shopping, (4) data transferring, and (5) database efficiency and structure. A table listing the technologies and outlining the rational is included below (Table 5-3).

Table 5-3: Most important technological areas for Big Data as identified by patent litigation data.

Technological Areas	Characteristics	Rationale
Cryptography	• High market value • Increasing litigation • Fast moving • Technologically Important	• 3 of 17 of the most increasingly litigated subclasses • One of the classes which appeared in multiple top 10 value lists • Several additional classes that appear in the top 10 lists (7 of 40)
Document and data presentation and GUI	• Emerging • Fast moving	• 2 of 9 classes that appeared in multiple value lists • 5 of 10 of the lowest average TCT classes • 6 of 10 of the lowest average age classes
Banking and shopping	• High market value • Increasing litigation • Technologically Important	• 4 of 17 of the most increasingly litigated subclasses • 3 of 10 of the highest average CCI classes
Data transfer	• High market Value • Increasing litigation	• 4 of 10 of top classes by docket numbers • 5 of 17 of the most increasingly litigated subclasses
Database structure and efficiency	• Increasing litigation	• 3 of 10 of the most increasingly litigated subclasses

In total 1122 firms were initially identified in the search for CGV targets. 74 (6.8%) of these targets were identified as having exceptionally strong, having passed a cumulative total of 7 or 8 of the metric criteria. Also, 234 (20.8%) of the targets were identified as having HLVLPV value. This means that in total, 308 (27.4%) firms were identified as potentially valuable CGV targets. Upon inspection is was also noted that the exceptionally high-value CGV targets consisted exclusively of large firms, many of whom are recognized as competitors in the big data movement. Those firms included: Amazon, Apple, Google, Cisco, Oracle, Microsoft, Sprint, AT&T, Ebay, SAS institute, Wal-Mart, Huawei, etc. The complete list is found in Appendix E, Table 26. The firms identified by the reports also represented a broad mixture of industries as well as potential merger types (conglomerate, horizontal and vertical mergers).

Chapter 6

Conclusions

6.1 Conclusion

The FCIV-TA reports demonstrated ability to identify classes of software technology that have seen increased litigation particularly in the past few years. In all scenarios, some UPC subclasses stood out as having a significantly higher proportion of docket numbers. Since litigation has been strongly validated as being an indicator of market value, and indirectly validated as being an indicator of technological value with respect to litigated patents having higher CI, it can be assumed that these UPCs with noticeably more docket numbers, and UPCs with trends of increasing docket numbers are of higher economic value. Not only that, but identifying UPC classes with litigated patents that are young, low TCT, or high CI, also identifies areas of significant strategic value. This concept makes a contribution to the science of patent information management by using litigation data to support other patent indicators. The use of litigation data allows a more focused perspective on the future market of technology because of its strong correlation with economic growth (Huang & Tang, 2003). This study centers in on the identification of value by first using litigation data to hone in on technologies with high likelihood of economic growth, and then uses other secondary indictors, to identify: (1) fast development (TCT), (2) high-market value (age), (3) high technological impact (CI), and connection to science (NPR). By satisfying a combination of criteria for both litigation and a second value indicator, a stronger and more reliable indication of value is produced.

Also, firms that have been involved in patent litigation in specific technological areas were identified and evaluated. These firm names were collected analyzed for their potential value as determined by a frame-worked patent portfolio assessment (FCIV-CP). This frame-worked assessment collected target names and then compiled assessments using patent indicator values. The targets were identified having been litigated within a certain set of USPTO subclasses that were deemed to be related to a firm’s strategic interests. This was done in concordance with the indicator-based assessment frameworks presented by Earnst (2003) and Britzman (2002) and under the premise presented by Tang & Huang (2002) that patent litigation is a leading economic indicator. Also, the results were parsed in certain ways to isolate firms who are likely to have particular characteristics such as likely having little R&D experience but having high profits. These firms were denoted as *'high litigation value low patent value'* (HLVLPV) targets. For all lists in the FCIV-CP reports, many competitors, and potential horizontal and vertical cooperative partners were identified. The fact that these firms had been affected by patent litigation indicates that some part of their technology-based sales is becoming more important economically (Huang & Tang, 2002).

Since software technology is considered to have reached a mature phase, it would reason to assert that now is the time for Taiwan high-tech companies to conduct closer assessment of their opportunities hunt valuable software CGV opportunities. Asian conglomerates will no doubt continue to expand through M&A, thereby receiving the benefits associated with network effects, economy of scale, and knowledge spillover. Taiwanese high-tech companies should also closely examine the whole spectrum of opportunities available for CGV enhanced growth similarly to what we have recently seen with the partnerships between HTC and Facebook and Hon-Hai and Mozilla.

Although the majority of firms identified in this study are not Taiwanese, and hence operate within foreign business customs and values, Taiwan companies should also seek to further their ability to cooperate and invest in foreign SMEs for the benefits associated with growth, new markets opportunities, fresh ideas, and change-provoking experience. Software firms under the duress of litigation represent an attractive target. They are likely to benefit significantly from investment capital, legal advice, and a IP management strategy, while large high-tech firms often possess those increasingly vital assets. The ability to navigate a patent thicket, while a nightmarish proposition to a relatively small software SME, is an becoming an streamlined competency of high-tech firms with experience in semiconductors, LED, consumer electronics, design and manufacturing such as the ones located here in Taiwan.

6.2 Limitations of This Study

Many limitations were encountered while conducting this study. The limitation that had the biggest impact on the results of the study was the limitation of knowledge about a given firm's strategic direction, and expected future direction. This makes it difficult to determine the true value priorities of the firm in each scenario. While this study was aimed at producing information to support decision-making, deeper knowledge with regards to the strategic priorities of the firms involved in the scenario would have been useful to more accurately identify a set of UPC classes that could comprise the strategic interests of a firm. Also, without the strategic interests of the firm clearly in mind, it is difficult to truly assess the value attributed to each technology area or potential CGV target. However, the nature of the reports is to make an assessment that is as near to being objective as possible. On the other hand, if these reports were to be actually used by a firm, they could be easily and immediately modified to focus on any subset of UPC classes or subclasses or indicators desired by the R&D manager or CIPO.

6.3 Contributions

The contributions of this research is mainly in the vein of providing a framework for large hi-tech firms to identify static snapshots of economic value in relevant technological areas, short term trends of litigation in relevant technological areas, and assessment of software companies who are potential CGV partners. Before this research, no framework for the application of patent litigation data for the purpose of technological forecasting or firm identification existed in academic writing. Previous evidence (Huang & Tang, 2003) showing that patent litigation is a leading indicator of economic value could be further validated if the results of this thesis could be subjected to expert review. Expert opinions and economic data must be used in order to verify the findings of patent indicators and frameworks for gathering metrics may need to be adapted to specific strategic perspectives (Rivette & Kline, 2000; Ernst, 2005; Reitzig, 2001). Also, value-creating firms in specific technological areas were identified and ranked by modifying an existing M&A target assessment framework from Brietzman & Thomas (2002). The identified firms are being sued for technology that has definitively produced value, and perhaps joint legal, technological, or licensing strategies could be mutually beneficial.

6.4 Suggestions for Further Research

The topic of using patent litigation data for the purpose of strategic information management in high-tech is still a largely unexplored niche in academia. Huang & Tang (2003) make a strong case that it can be used to indicate market growth in broad consumer electronics markets. This paper attempts to develop a metric analysis on technological areas, and potential partners that can use patent litigation data to forecast technology market growth. Although patent litigation has been validated as an indicator of market value and litigated patents have been shown to have higher-value with respect to forward citations, more research into this area is clearly called for. It would be appropriate to have the results of these frameworks assessed by experts. The age profile of litigated patents within a given technological area may also have potential for identifying paradigm shifts and assessing the pace of technological development. Also, the integration of patent litigation data with traditional patent indicators may other possible benefits in addition to supplementing CGC target assessments.

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APPENDIX

Contents **Page**

Tables **Page**

Appendix A

Software UPC Classes

Table A-1: UPC Classes used for identifying software patents as taken from Graham (2013).

Class	Subclasses	Class	Subclass
29	026000-065000, 560000-566400, 650000- 650000	378	004000-020000, 210000-901000
73	455000-487000, 570000-669000	379	067100-088280, 188000-337000
84	600000-746000	380	
235		381	
236		382	
244	003100-003300, 014000	385	
250		386	
257		396	028000, 048000-304000, 310000-321000, 373000-386000, 406000-410000, 421000, 449000-501000, 505000-510000, 529000-533000, 563000
307		398	
315		438	009000, 689000-698000, 704000-757000
318	700000-832000	455	
320		463	001000-047000, 048000-069000
323		473	065000, 070000, 136000, 140000-141000, 151000-156000, 407000
324		482	001000-009000, 051000-053000, 057000-065000, 069000-070000, 112000-113000
326		600	001000-015000, 019000-041000, 300000-406000, 407000-480000, 481000-507000, 529000-595000, 920000-921000
327		606	001000-052000, 163000-164000
330		623	024000-026000
331		700	
340	850000-870440	701	
340	002100-010600, 825000-825980	702	
340	286010-693900, 901000-999000	703	001000-010000, 011000-012000, 013000-999000
340	815400-815730, 815740- 815920	704	
341	020000-035000, 173000-192000	705	
341	001000-017000, 050000-172000, 200000-899000	706	
342	001000-465000	707	
343		708	
345	001100-215000, 418000-428000, 440000-472300, 473000-475000, 501000-517000, 518000-689000, 690000-698000, 699000	709	
348		710	
353		711	
355		712	
356	002000-003000, 004090- 004100, 006000-027000, 030000-139000, 140000, 142000-151000, 153000-900000	713	
358	001100-003320, 260000-517000,	714	001000-100000, 699000-824000

	518000-540000		
359	326000-332000	715	
361	001000-270000, 437000	716	
363		717	
365		718	
367	001000-008000, 009000, 010000-013000, 014000-080000, 081000-085000, 086000, 087000-092000, 093000-094000, 095000- 191000, 197000-199000, 900000-910000, 911000-912000	719	
368		725	
369	001000-032000, 043000-054000, 058000-062000, 064000, 069000-070000, 083000-095000, 097000, 100000-126000, 128000-152000, 174000-175000, 275100-276000, 300000	726	
370		901	
374		902	
375			

Appendix B

Data Verification for Litalert Parser

To verify the accuracy of the Litalert Data Parsing software a verification study was conducted. The data was extracted the data with 100% accuracy, and therefore the only errors from the data would be the errors made during data entry.

Two methods were used to verify the accuracy of the data using an exported document file from Thompson Reuter's Westlaw Litalert database accessed through the NCHU library website. All patent litigation records from the first week of 2012 were exported for the test. Although the number of documents was known, this could not be used to verify the extracted data because many documents contained multiple patent numbers, plaintiff names, and defendant names and so the number of records created by the parsing software differed. Therefore, the data was verified manually by checking the first ten Litalert documents against the records created by each of the three parsing programs; patent number parser, defendant parser, and plaintiff parser. Secondly, the last record from the Litlalert document was compared to the last records created by the parsing software programs in order to verify that the document was parsed until the end of file. The end of file records were 100% accurate.

After verification of the test file; extracted data files from the USPTO Litalert record dataset to be used in this study were also parsed using the software and imported into MS SQL Server where duplicate records were removed. The docket code, filing date, and the other pertaining columns (patent number, defendant name, and plaintiff name) were used to identify identical records. The resulting datasets contained 95,484 incidents of patent litigation involving 39,633 patents, 105,386 incidents of defendant involvement in a litigation suit, and 72,648 incidents of plaintiff involvement in a litigation suit.

The results of this extracted dataset can be further verified by comparing it to existing published records from other scholars. For example, searching the dbo.measure2011_new shows that 31,992 patents were identified as litigated by the end of 2011. Since the new Litalert extractor includes 8505 records for 2012, the data samples are very similar.

Parser Verification Records and Documents

Table B-1: The verified first ten records for the Litalert patent number parsing program

PatentNumber	DocketCode	DocketNumber	FilingDate
D495726	21200072	2:12CV00072	01/06/2012
D563779	21200072	2:12CV00072	01/06/2012
D508063	21200072	2:12CV00072	01/06/2012
D613437	21200072	2:12CV00072	01/06/2012
5576951	61200006	6:12CV00006	01/06/2012
6289319	61200006	6:12CV00006	01/06/2012
7010508	61200006	6:12CV00006	01/06/2012
6351736	11200015	1:12CV00015	01/06/2012
7627975	21200124	2:12CV00124	01/06/2012
6128617	21200003	2:12CV00003	01/06/2012
D639064	21200040	2:12CV00040	01/06/2012
5940510	41200006	4:12CV00006	01/06/2012
5949880	41200006	4:12CV00006	01/06/2012
6105013	41200006	4:12CV00006	01/06/2012
6237095	41200006	4:12CV00006	01/06/2012
7181430	51200040	5:12CV00040	01/06/2012
7216106	51200040	5:12CV00040	01/06/2012
7386511	51200040	5:12CV00040	01/06/2012
7440924	51200040	5:12CV00040	01/06/2012
7624071	51200040	5:12CV00040	01/06/2012
6799994	11200101	1:12CV00101	01/06/2012
6023708	31200060	3:12CV00060	01/06/2012
6085192	31200060	3:12CV00060	01/06/2012
6151606	31200060	3:12CV00060	01/06/2012
6708221	31200060	3:12CV00060	01/06/2012
LAST RECORD IN FILE:			
6102206	01200003	0:12CV00003	01/03/2012

Table B-2: The verified first ten records for the Litalert plaintiff name-parsing program

PlaintiffName	UPCClassCode	DocketCode	DocketNumber	FilingDate
CARSON OPTICAL INC	D16/135000	21200072	2:12CV00072	
LEADING EXTREME OPTIMIST INDUSTRIES LTD	D16/135000	21200072	2:12CV00072	
LANDMARK TECHNOLOGY LLC	705/000000	61200006	6:12CV00006	01/06/2012
MOBILE TRANSFORMATION LLC	705/014046	11200015	1:12CV00015	01/06/2012
PROTOTYPE PRODUCTIONS INC	042/084000	21200124	2:12CV00124	01/06/2012
PROTOTYPE PRODUCTIONS	042/084000	21200124	2:12CV00124	01/06/2012
SELECT RETRIEVAL LLC	707/100000	21200003	2:12CV00003	01/06/2012
KIVA DESIGNS INC	D03/301000	21200040	2:12CV00040	01/06/2012
INTEGRATED PRODUCTS INC	705/065000	41200006	4:12CV00006	01/06/2012

DIEBOLD INCORPORATED	705/045000	51200040	5:12CV00040	01/06/2012
TELEFONIX INC	439/501000	11200101	1:12CV00101	01/06/2012
VANGUARD PRODUCTS GROUP INC	439/501000	11200101	1:12CV00101	01/06/2012
VISTO CORPORATION	707/203000	31200060	3:12CV00060	01/06/2012
GOOD TECHNOLOGY	707/203000	31200060	3:12CV00060	01/06/2012
LAST RECORD IN FILE:				
CARDINAL IG COMPANY	206/454000	01200003	0:12CV00003	01/03/2012

Table B-3: The verified first ten records for the Litalert defendant name-parsing program

Defendant Name	**UPCClassCode**	**DocketCode**	**DocketNumber**	**FilingDate**
JO-ANN STORES INC	D16/135000	21200072	2:12CV00072	
ZUMIEZ INC	705/000000	61200006	6:12CV00006	01/06/2012
WETPAINT.COM INC	705/014046	11200015	1:12CV00015	01/06/2012
RESET INC	042/084000	21200124	2:12CV00124	01/06/2012
LL BEAN INC	707/100000	21200003	2:12CV00003	01/06/2012
VF OUTDOOR INC	D03/301000	21200040	2:12CV00040	01/06/2012
CAPITAL ONE FINANCIAL CORPORATION	705/065000	41200006	4:12CV00006	01/06/2012
PPS DATA LLC	705/045000	51200040	5:12CV00040	01/06/2012
SHOPGUARD USA	439/501000	11200101	1:12CV00101	01/06/2012
SHOPGUARD SYSTEMS LIMITED	439/501000	11200101	1:12CV00101	01/06/2012
FIXMO U.S. INC	707/203000	31200060	3:12CV00060	01/06/2012
LAST RECORD IN FILE:				
CLEARY, OWEN	206/454000	1200003	0:12CV00003	01/03/2012
WAKEFIELD EQUIPMENT	206/454000	1200003	0:12CV00003	01/03/2012

Litalert Test File Record:

Document Type: Patent
Title: Magnifier
Patent Number: US D495726 (20040907)
Patent Type: Design
Class Number: D16/135000
Class Type: Photography and optical equipment
Inventor: Yip, Gin Fai - North Point, Hong Kong; Yip, Bryan - Kowloon, Hong Kong
Assignee(s): Leading Extreme Optimist Industries Ltd - Chai Wan, HONG KONG
Plaintiff: CARSON OPTICAL INC; LEADING EXTREME OPTIMIST INDUSTRIES LTD
Defendant: JO-ANN STORES INC
Court: NY, Eastern Dist
Docket Number: 2:12CV00072
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: Cause - 35 USC 145 - complaint - PATENT INFRINGEMENT
Notes: none
Other Patents: US D563779;US D508063;US D613437
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-18, 2012 WL 104792 (Derwent)

LitAlert

Document Type: Patent
Title: Automated sales and services system
Patent Number: US 5576951 (19961119)
Patent Type: Utility
Class Number: 705/000000
Class Type: Data processing: financial, business practice, management or cost/price determination
Inventor: Lockwood, Lawrence B - La Jolla, CA
Assignee(s): Not assigned
Plaintiff: LANDMARK TECHNOLOGY LLC
Defendant: ZUMIEZ INC
Court: TX, Eastern Dist
Docket Number: 6:12CV00006
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: Cause - 35 USC 271 - complaint for PATENT INFRINGEMENT
Notes: none
Other Patents: US 6289319;US 7010508
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-19, 2012 WL 104793 (Derwent)

LitAlert

Document Type: Patent
Title: System and method for displaying advertisements with played data
Patent Number: US 6351736 (20020226)
Patent Type: Utility

Class Number: 705/014046
Class Type: data processing; financial, business practice, management or cost/price determination
Inventor: Weisberg, Tomer - Caesarea, Israel; Baz, Etay - Haifa, Israel; Harush, Assaf Ben - Haifa, Israel; Cohen, Lior - Haifa, Israel
Assignee(s): not assigned
Plaintiff: MOBILE TRANSFORMATION LLC
Defendant: WETPAINT.COM INC
Court: DE
Docket Number: 1:12CV00015
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: cause - 35 USC 271 - complaint for PATENT INFRINGEMENT
Notes: none
Other Patents: none
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-20, 2012 WL 104794 (Derwent)

LitAlert

Document Type: Patent
Title: Electrified handguard
Patent Number: US 7627975 (20091208)

Patent Type: Utility
Class Number: 042/084000
Class Type: firearms
Inventor: Hines, Steve - Tijeras, NM
Assignee(s): not assigned
Plaintiff: PROTOTYPE PRODUCTIONS INC; PROTOTYPE PRODUCTIONS
Defendant: RESET INC
Court: CA, Central Dist
Docket Number: 2:12CV00124
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: cause - 35 USC 271 - complaint for PATENT INFRINGEMENT
Notes: none
Other Patents: none
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-21, 2012 WL 104795 (Derwent)

LitAlert

Document Type: Patent
Title: Data display software with actions and links integrated with information
Patent Number: US 6128617 (20001003)
Patent Type: Utility
Class Number: 707/100000
Class Type: data processing: database and file management or data structures
Inventor: Lowry, David D - Medford, OR
Assignee(s): Lowry Software Incorporated - Medford, OR
Plaintiff: SELECT RETRIEVAL LLC
Defendant: LL BEAN INC
Court: ME

Docket Number: 2:12CV00003
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: cause - 35 USC 145 - complaint for PATENT INFRINGEMENT
Notes: none
Other Patents: none
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-29, 2012 WL 104802 (Derwent)

LitAlert

Document Type: Patent
Title: Expandable/compressible packing box
Patent Number: US D639064 (20110607)
Patent Type: Design
Class Number: D03/301000
Class Type: travel goods and personal belongings
Inventor: Raible, Margaret M - Benicia, CA
Assignee(s): not assigned
Plaintiff: KIVA DESIGNS INC
Defendant: VF OUTDOOR INC
Court: CA, Eastern Dist
Docket Number: 2:12CV00040

Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: cause - 35 USC 271 - COMPLAINT FOR PATENT INFRINGEMENT
Notes: none
Other Patents: none
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-30, 2012 WL 104803 (Derwent)

LitAlert

Document Type: Patent
Title: Transfer of valuable information between a secure module and another module
Patent Number: US 5940510 (19990817)
Patent Type: Utility
Class Number: 705/065000
Class Type: data processing: financial, business practice, management or cost/price determination
Inventor: Curry, Stephen M - Dallas, TX; Loomis, Donald W - Coppell, TX; Bolan, Michael L - Dallas, TX
Assignee(s): Dallas Semiconductor Corporation - Dallas, TX
Plaintiff: INTEGRATED PRODUCTS INC
Defendant: CAPITAL ONE FINANCIAL CORPORATION
Court: TX, Eastern Dist
Docket Number: 4:12CV00006
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: cause - 35 USC 271 - COMPLAINT FOR PATENT INFRINGEMENT
Notes: none
Other Patents: US 5949880;US 6105013;US 6237095
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-32, 2012 WL 104806 (Derwent)

LitAlert

Document Type: Patent
Title: Method and system for processing financial instrument deposits physically remote from a financial institution
Patent Number: US 7181430 (20070220)
Patent Type: Utility
Class Number: 705/045000
Class Type: Data processing: financial, business practice, management or cost/price determination
Inventor: Buchanan, Danne L - Sandy, UT; Titus, William Ronald - Fruit Heights, UT
Assignee(s): Netdeposit Inc - Salt Lake City, UT
Plaintiff: DIEBOLD INCORPORATED
Defendant: PPS DATA LLC
Court: OH, Northern Dist
Docket Number: 5:12CV00040
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: CAUSE - 28 USC 2201 - COMPLAINT FOR DECLARATORY JUDGMENT
Notes: none

Other Patents: US 7216106;US 7386511;US 7440924;US 7624071
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-33, 2012 WL 104807 (Derwent)

LitAlert

Document Type: Patent
Title: Cord management apparatus and method
Patent Number: US 6799994 (20041005)
Patent Type: Utility
Class Number: 439/501000
Class Type: Electrical connectors
Inventor: Burke, Paul C - Lake Forest, IL
Assignee(s): Telefonix Inc - Waukegan, IL
Plaintiff: TELEFONIX INC; VANGUARD PRODUCTS GROUP INC
Defendant: SHOPGUARD USA; SHOPGUARD SYSTEMS LIMITED
Court: IL, Northern Dist
Docket Number: 1:12CV00101
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: cause - 35 USC 271 - complaint for PATENT INFRINGEMENT
Notes: none
Other Patents: none
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LitAlert P2012-02-35, 2012 WL 104809 (Derwent)

LitAlert

Document Type: Patent
Title: System and method for using global translator to synchronize workspace elements across a network
Patent Number: US 6023708 (20000208)
Patent Type: Utility
Class Number: 707/203000
Class Type: Data processing: database and file management, data structures or document processing
Inventor: Mendez, Daniel J - Mountain View, CA; Riggins, Mark D - San Jose, CA; Wagle, Prasad - Santa Clara, CA; Ying, Christine C - Foster City, CA
Assignee(s): Visto Corporation - Mountain View, CA
Plaintiff: VISTO CORPORATION; GOOD TECHNOLOGY
Defendant: FIXMO U.S. INC
Court: TX, Northern Dist
Docket Number: 3:12CV00060
Filing Date: 01/06/2012
Subsequent Action: 01/06/2012
Action Taken: CAUSE - 15 USC 1126 - COMPLAINT FOR PATENT INFRINGEMENT
Notes: none
Other Patents: US 6085192;US 6151606;US 6708221;US 7039679
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

LAST RECORD IN FILE:

LitAlert

Document Type: Patent
Title: Packaging for panels, e.g. glass panels
Patent Number: US 6102206 (20000815)
Patent Type: Utility
Class Number: 206/454000
Class Type: special receptacle or package
Inventor: Pride, Thomas E - Spring Green, WI
Assignee(s): Cardinal IG Company - Minnetonka, MN
Plaintiff: CARDINAL IG COMPANY
Defendant: CLEARY, OWEN; WAKEFIELD EQUIPMENT
Court: MN
Docket Number: 0:12CV00003
Filing Date: 01/03/2012
Subsequent Action: 02/23/2012
Action Taken: NOTICE OF VOLUNTARY DISMISSAL BY CARDINAL IG COMPANY
Notes: none
Other Patents: none
Other Trademarks: none
See LitAlert No: none

END OF DOCUMENT

Appendix C

Report Generation Database Table Samples

Table C-1: The Litalert Patent Number Table (LitAlertPatNum) containing each instance of litigation for each patent number from all Litalert Records, including filing dates, and docket numbers.

Patent Number	Docket Number	Filing Date
6604435	5:12CV00208	2012-03-05
6605038	1:12CV00133	2012-02-02
6605760	5:12CV06046	2012-06-12
6605761	5:12CV06046	2012-06-12
6606581	1:12CV05662	2012-07-18
6606953	1:12CV00016	2012-01-30
6607097	1:12CV00464	2012-04-13
6607097	1:12CV02745	2012-04-13
6607473	1:12CV00174	2012-08-20
6608332	4:12CV11758	2012-04-19

Table C-2: The Litalert Defendant Table containing plaintiff names for each reported filing, including filing dates, and docket numbers.

Defendant Name	Docket Number	Filing Date
10ZIG TECHNOLOGY INC	8:12CV01711	2012-10-05
123RF LTD	6:12CV00093	2012-02-27
1STRADARDETECTOR	1:12CV00066	2012-02-13
360 SOURCING	1:12CV05106	2012-06-29
4 MOBILE TECHNOLOGIES S.A.	2:12CV00976	2012-06-06
6WAVES LLC	3:12CV00501	2012-02-28
A2 HOSTING INC	1:12CV00081	2012-02-22
A9 INNOVATIONS LLC	1:12CV00768	2012-06-18
ABB LTD	3:12CV00380	2012-07-13
ABBOTT MOLECULAR INC	1:12CV00274	2012-03-06

Table C-3: The LitAlert Extended Data Table including appended data from the USPTO database.

Patent Number	TCT	CI	Age	Filing Date	Issued Date	UPC Class	UPC Subclass
4345315	4.77778	128	30	2012-08-03	1982-08-17	364	900000
4470044	4.6	47	28	2012-11-28	1984-09-04	340	755000
4482535	4.25	8	28	2012-06-21	1984-11-13	424	49000
4546382	3.55556	253	27	2012-08-03	1985-10-08	358	84000
4557720	6.28571	3	27	2012-02-21	1985-12-10	604	1000
4567359	4.33333	371	26	2012-08-27	1986-01-28	235	381000
4621972	9.66667	19	26	2012-04-23	1986-11-11	414	477000
4692245	3	38	25	2012-05-03	1987-09-08	210	232000
4740890	4.07143	310	24	2012-08-03	1988-04-26	364	200000
4813056	5.84615	102	20	2012-09-14	1989-03-14	375	27000

Table C-4: The Litalert Table patent number and docket number results for 2012 and defendant 'Hon-Hai'.

Patent Number	Docket Number	Title
6057812	2:12CV00309	Image display apparatus which both receives video information and outputs information about itself
6247090	2:12CV00309	Display apparatus enabled to control communicatability with an external computer using identification information
6639588	2:12CV00309	Image display apparatus
7089342	2:12CV00309	Method enabling display unit to bi-directionally communicate with video source
7475180	2:12CV00309	Display unit with communication controller and memory for storing identification number for identifying display unit
6585540	3:12CV00194	Shielded microelectronic connector assembly and method of manufacturing
6962511	3:12CV00194	Advanced microelectronic connector assembly and method of manufacturing
7241181	3:12CV00194	Universal connector assembly and method of manufacturing
7367851	3:12CV00194	Universal connector assembly and method of manufacturing
7661994	3:12CV00194	Universal connector assembly and method of manufacturing
7786009	3:12CV00194	Universal connector assembly and method of manufacturing
7959473	3:12CV00194	Universal connector assembly and method of manufacturing

Table C-5: The Defendant Name Table Results for patent number '6057812'.

Defendant Name	Docket Number
INPRO	2:11CV00224
LITE-ON TECHNOLOGY CORP	2:11CV00224
MONDIS TECHNOLOGY LTD	2:12CV00309
TATUNG CO	2:11CV00224
TPV TECHNOLOGY LTD	2:11CV00224
AOC INTL	2:11CV00224
HITACHI LTD	3:10CV01579
HON HAI PRECISION INDUSTRY CO LTD	2:12CV00309
MONDIS TECHNOLOGY LTD	3:10CV01578

Appendix D

Tables of UPC Classes Identified in Each Scenario

Table D-1: Initial identification of UPC software classes related to Scenario A: HTC mobile consumer electronics based on competitor analysis and patenting activity.

Strategic Interest	Classes Identified (ordered by number of patents)	Notes
C1: Classes of currently held patents	/343/702, /345/422, /345/426, /455/5754, /345/531, /345/582, /345/613, /348/373, /348/375, /345/506, /343/700MS, /345/168, /455/575.4, /713/300, /455/5753, /370/328, /382/166, /382/232, /345/557, /455/566, /455/569.1, /455/575.3, /345/558, /382/233, /382/253, /455/2262, /455/436, /455/564, /370/331, /370/349, /370/350, /370/470, /379/330, /381/107, /381/374, /381/74, /713/320, /455/575.7, /455/5751, /702/190, /702/92, /707/705, /708/706, /710/14, /710/301, /710/35, /710/5, /712/22, /345/173, /345/204, /345/419, /345/421, /250/221, /345/156, /345/519, /345/428, /345/543, /345/545, /345/552, /345/556, /348/447, /348/699, /363/146, /370/206, /370/231, /370/313, /345/690, /345/87, /348/14.02, /348/333.05, /345/587, /345/589, /345/603, /345/605	57 software patents (of 86 total patents) were found assigned to *'HTC Corporation'*. 50 software patents were found to be owned by HTC's acquisition S3 Graphics Inc.
C2: Classes of interest to your company based on current product assessment	None	Inside R&D knowledge greater than their current patenting activity cannot be obtained
C3: Classes of interest to your company based on potential future directions	Unknown	Inside R&D knowledge greater than their current patenting activity cannot be obtained
C4: Classes of competitors or cooperative partners patenting activity	/343/702, /370/338, /345/173, /370/331, /709/206, /455/466, /370/328, /370/329, /455/436, /455/566, /455/522, /455/456.1, /455/450, /370/352, /343/700MS, /455/41.2, /455/550.1, /370/335, /345/169, /455/414.1, /455/575.1, /709/227, /455/411, /455/574, /455/418, /341/22, /370/230, /370/401, /455/412.1, /370/252, /345/168, /455/552.1, /370/342, /455/410, /345/156, /455/67.11, /370/235, /455/419, /455/445, /709/203, /455/557, /455/433, /455/435.1, /455/567, /713/300, /709/223, /455/406, /455/558, /455/437, /455/423, /370/389, /370/347, /375/295, /709/230, /455/434, /709/217, /455/562.1, /370/349, /370/337, /709/219, /375/148, /375/267, /710/105, /370/465, /455/453, /375/346, /370/392, /709/224, /370/229, /455/432.1, /709/220, /375/316, /455/556.1, /455/561, /375/260, /380/270, /455/435.2, /375/150, /700/94, /370/350, /375/297, /370/310, /455/69, /710/305, /713/320, /370/466, /370/311, /370/468, /345/473, /455/63.1, /455/553.1, /704/9, /455/404.1, /709/238, /714/748, /715/744, /707/3, /704/500, /370/332, /370/330, /710/8, /455/90.3, /715/234, /375/350, /345/467, /455/518, /715/723, /707/10, /345/589, /455/422.1, /455/452.1, /707/101, /455/502, /709/231, /345/619, /713/1, /345/629, /345/157, /455/458, /320/106, /709/228, /709/246, /345/660, /455/403, /704/219, /455/446, /455/127.1, /715/769, /455/126, /380/247, /713/2, /455/442, /375/222, /375/341, /370/312, /370/236, /455/517, /455/509, /455/426.1, /455/417, /370/469, /370/394, /715/764, /370/231, /710/104, /713/168, /455/76, /455/405, /455/101, /375/343, /715/716, /715/810, /726/4, /375/130, /375/347, /719/328, /370/503, /370/336, /382/232, /455/415, /455/575.3, /713/323, /704/275, /345/163, /709/229, /455/456.3, /709/225, /709/207, /707/104.1, /382/187, /375/240.03, /382/167, /375/354, /455/575.8, /705/26, /455/452.2, /718/100, /455/564, /713/176, /345/102, /370/254, /455/569.1, /455/4121, /709/204, /709/248, /710/22, /455/456.2, /341/67, /719/318, /379/219, /375/296, /715/727, /710/113, /455/425, /375/147, /375/340, /455/4141, /370/345, /711/103, /375/240.16, /370/318, /709/221, /713/100, /713/193, /709/245, /710/52, /713/156, /235/492, /380/277, /709/232, /455/575.4, /710/107, /707/100, /704/226, /455/115.1, /455/456.5, /455/573, /341/143, /455/572, /715/835, /715/863, /704/260, /370/216, /455/412.2, /707/1, /370/238, /342/357.12, /455/519, /345/604, /455/11.1, /370/208, /713/324, /726/26, /455/5501, /707/102, /370/395.1, /370/210, /345/545, /368/10, /455/4561, /455/414.4, /455/78, /455/90.1, /715/236, /345/419, /707/203, /707/5, /715/830, /370/203, /375/299, /711/118, /715/784, /455/439, /455/3.06,	Competitors considered for this scenario were: *Apple* (12,269 patents), *Nokia* (10,009 patents), *Research in Motion* (1,949), because they are the largest companies are appropriately focused on mobile handsets. 12,269 patents were collected in total from these competitors spanning 2800 UPC subclasses. Only subclasses with > 5 total patents (595 subclasses) were included.

	/710/301, /380/28, /345/506, /320/107, /715/838, /715/788, /714/758, /455/414.2, /455/424, /713/340, /709/250, /320/114, /345/684, /455/525, /715/765, /358/1.9, /330/254, /370/230.1, /455/4352, /345/211, /370/280, /715/762, /704/207, /713/153, /455/226.2, /375/219, /345/184, /455/67.14, /382/239, /375/259, /715/210, /455/560, /455/114.3, /382/166, /235/451, /345/601, /704/223, /455/413, /715/205, /714/776, /379/229, /382/162, /382/254, /707/610, /320/128, /707/103R, /704/201, /715/856, /717/168, /375/240.01, /375/344, /455/234.1, /707/201, /709/247, /345/522, /370/467, /715/864, /717/107, /714/4, /715/201, /455/432.3, /455/441, /709/236, /704/255, /707/621, /375/231, /370/353, /235/380, /331/16, /715/781, /345/441, /370/462, /370/348, /455/515, /715/202, /714/752, /715/763, /710/5, /455/438, /455/255, /375/240, /370/356, /709/218, /707/4, /379/230, /340/572.1, /330/149, /345/426, /345/600, /375/376, /370/232, /455/407, /715/773, /710/303, /709/201, /704/8, /713/310, /455/4321, /382/189, /370/474, /320/134, /715/815, /375/132, /345/568, /358/1.11, /341/23, /379/201.01, /710/307, /705/51, /707/2, /717/100, /713/189, /714/786, /382/238, /375/240.23, /331/17, /345/440, /455/296, /455/73, /715/203, /370/343, /370/395.2, /330/302, /455/551, /382/305, /375/356, /713/400, /713/500, /711/170, /707/802, /382/124, /704/233, /711/141, /455/4351, /345/581, /370/255, /370/315, /341/144, /714/704, /726/5, /717/170, /719/313, /715/848, /341/51, /370/412, /370/334, /375/233, /375/265, /455/416, /707/706, /455/41.1, /455/277.2, /713/171, /702/63, /320/132, /341/20, /715/833, /455/114.2, /455/88, /701/200, /235/375, /343/895, /341/176, /715/816, /710/240, /455/226.1, /375/257, /705/67, /714/755, /375/240.2, /715/758, /235/472.01, /345/204, /375/224, /370/310.1, /370/354, /370/218, /455/435.3, /455/457, /382/275, /704/270.1, /710/67, /707/204, /717/174, /726/27, /707/654, /704/1, /382/268, /455/127.2, /330/136, /715/854, /718/104, /719/331, /726/13, /345/611, /345/421, /382/154, /455/5751, /712/225, /713/166, /711/159, /709/222, /455/4562, /455/569.2, /701/209, /370/341, /370/390, /370/408, /341/50, /719/329, /718/107, /348/14.08, /345/593, /370/320, /370/516, /370/410, /370/431, /370/441, /701/213, /455/5561, /375/348, /711/163, /709/235, /713/181, /714/718, /709/226, /707/804, /455/444, /455/343.4, /455/404.2, /702/186, /704/222, /345/648, /370/351, /370/428, /370/333, /370/521, /345/158, /726/29, /717/124, /330/151, /341/58, /342/367, /345/167, /375/144, /455/412, /455/455, /455/67.13, /455/563, /704/10, /709/205, /704/258, /713/401, /713/155, /711/202, /715/853, /715/780, /704/503, /455/68, /455/575.5, /455/67.16, /379/221.01, /455/440, /455/420, /370/395.6, /375/345, /345/161, /715/804, /712/300, /713/187, /715/823, /370/477, /375/225, /370/400, /358/1.15, /324/538, /327/291, /715/238, /715/708, /711/154, /710/316, /710/56, /713/322, /703/27, /704/220, /710/15, /380/46, /455/503, /455/3.01, /455/313, /455/443, /713/169, /713/170, /715/862, /342/357.15, /345/174, /330/51, /370/395.42, /370/241, /370/260, /375/149, /370/473, /345/422, /455/512, /455/5754, /707/741, /379/202.01, /715/799, /713/600, /714/38, /714/751, /342/357.02, /345/175, /235/382, /330/285, /375/229, /370/324, /702/188, /455/554.2, /704/270, /707/781, /709/233, /455/301, /455/323, /455/168.1, /455/421, /455/4221, /455/570, /382/260, /704/267, /455/4122, /382/276, /375/240.12, /370/437, /370/395.64, /370/242, /343/841, /345/469, /257/686, /715/779, /715/786,	

Table D-2: Initial identification of UPC software classes related to Scenario B: Luxgen Intelligent Vehicles based on competitor analysis of the top global automakers.

Strategic Interest	**Classes Identified (ordered by number of patents)**	**Notes**
C1: Classes of currently held patents	Unknown	
C2: Classes of interest to your company based on current product assessment	Unknown	Inside R&D knowledge greater than their current patenting activity could not be obtained
C3: Classes of interest to your company based on potential future directions	Unknown	Inside knowledge of Luxgen's future plans could not be obtained
C4: Classes of competitors or cooperative partners patenting activity	/701/41, /701/70, /701/96, /701/1, /701/51, /701/22, /701/37, /701/45, /701/93, /701/103, /701/36, /701/301, /701/29, /701/54, /382/104, /343/713, /701/102, /700/245, /320/132, /307/10.1, /701/114, /701/104, /340/438, /342/70, /701/42, /382/103, /340/435, /701/209, /701/67, /701/110, /701/200, /701/55, /340/436, /701/33, /340/576, /701/111, /381/86, /701/208, /701/108, /340/439, /73/114.32, /73/862.333, /340/461, /701/210, /701/79, /73/146, /236/49.3, /701/117, /320/104, /701/48, /701/101, /73/23.31, /340/425.5, /701/112, /701/72, /701/207, /29/897.2, /701/69, /701/213, /701/35, /701/71, /318/801, /340/442, /73/49.7, /703/2, /701/105, /701/97, /701/38, /701/78, /315/77, /73/115.02, /315/82, /73/204.26, /307/10.2, /701/61, /320/101, /705/26, /29/623.1, /701/49, /73/861.22, /701/85, /701/123, /701/60, /340/458, /701/84, /701/113, /704/275, /73/114.74, /701/74, /29/623.5, /318/811, /701/66, /701/201, /29/596, /73/304C, /324/173, /701/62, /29/890, /343/715, /701/30, /29/421.1, /340/5.62, /701/109, /704/233, /340/903, /701/58, /701/76, /701/115, /340/457, /29/890.039, /701/53, /257/77, /236/34.5, /343/903, /701/80, /701/43, /324/426, /700/253, /29/235, /29/888.09, /703/8, /701/82, /320/123, /701/59, /340/905, /340/572.1, /324/207.21, /382/118, /348/148, /73/146.5, /345/7, /701/68, /320/118, /73/114.36, /73/114.33, /73/114.16, /701/56, /323/282, /318/701, /340/431, /340/450.3, /381/71.9, /701/211, /73/114.05, /324/174, /73/114.71, /73/35.03, /340/575, /455/418, /324/166, /236/13, /340/5.72, /701/99, /701/34, /320/116, /324/207.25, /73/114.72, /307/10.5, /363/98, /73/114.73, /73/35.05, /340/460, /318/807, /320/150, /701/28, /73/23.32, /73/114.37, /29/888.01, /701/86, /73/114.02, /363/41, /73/114.04, /382/106, /73/114.68, /700/279, /73/114.49, /340/457.1, /320/134, /703/1, /701/87, /73/514.32, /701/300, /340/5.64, /307/10.3, /701/95, /705/28, /343/712, /73/114.39, /701/202, /340/932.2, /340/901, /701/2, /73/669, /73/317, /73/114.21, /382/152, /343/700MS, /700/97, /701/31, /29/559, /29/598, /320/107, /340/988, /29/894.1, /701/65, /700/100, /73/147, /29/407.01, /73/313, /455/419, /73/114.26, /29/612, /73/114.35, /324/427, /29/602.1, /73/1.06, /701/212, /702/184, /73/114.52, /29/888.061, /702/183, /73/861.05, /381/71.12, /29/281.1, /702/167, /704/270, /340/457.4, /340/447, /29/458, /29/840, /702/63, /315/83, /257/192, /29/889.2, /315/84, /73/118.01, /455/456.1, /73/23.2, /29/450, /257/260, /29/890.043, /73/204.21, /73/35.09, /73/114.01, /318/700, /29/726, /340/459, /73/114.75, /705/11, /701/57, /250/338.1, /73/35.11, /29/2, /455/161.3, /340/441, /714/23, /356/4.01, /29/434, /701/89, /700/182, /705/7, /73/862.331, /455/414.1, /705/35, /345/184, /700/255, /340/479, /29/451, /455/420, /340/620, /29/402.08, /361/42, /702/165, /257/342, /382/154, /714/55, /455/411, /324/522, /345/173, /342/389, /701/106, /701/75, /73/862.044, /73/114.28, /73/724, /29/430, /370/438, /340/995.14	UPC subclasses with more than 5 patents from all the auto-manufacturing firms. Only 3 classes and 18 subclasses were finally selected for inclusion in the final reports.

Table D-3: Initial identification of UPC software classes related to Scenario C: Big Data based on competitor analysis of the top big data related companies.

Consideration for Classes	**Classes Identified (ordered by number of patents)**	**Notes**
C1: Classes of currently held patents	None	none
C2: Classes of interest to your company based on current product assessment	None	none
C3: Classes of interest to your company based on potential future directions	None	none
C4: Classes of competitors or cooperative partners patenting activity	All subclasses from : /707, /715, /709, /705 Additional subclasses: /714/798, /714/769, /714/763, /714/758, /714/747, /714/57, /714/49, /714/48, /714/46, /714/45, /714/43, /714/31, /714/26, /714/25, /714/2, /714/18, /714/16, /714/15, /714/100, /714/1, /713/400, /713/330, /713/194, /713/193, /713/192, /713/187, /713/185, /713/182, /713/181, /713/176, /713/175, /713/172, /713/170, /713/168, /713/167, /713/156, /713/153, /713/151, /713/150, /713/100, /713/1, /710/52, /710/15, /710/104, /702/79, /702/193, /702/189, /702/188, /702/186, /702/184, /702/182, /702/150, /702/123, /702/122, /455/66.1, /455/566, /455/552.1, /455/550.1, /455/456.1, /455/450, /455/419, /455/417, /455/416, /455/410, /382/230, /382/225, /382/187, /382/181, /382/177, /382/160, /382/115, /380/46, /380/37, /380/33, /380/30, /380/28, /380/277, /380/255, /379/88.12, /379/266.1, /379/265.09, /379/201.04, /370/465, /370/395.42, /370/395.21, /370/395.2, /370/392, /370/388, /370/352, /370/260, /370/256, /370/254, /370/252, /370/241, /370/235, /370/230.1, /370/230, /370/225, /358/1.18, /358/1.15, /358/1.14, /345/629, /345/581, /345/473, /345/443, /345/440, /345/427, /345/418, /345/163, /345/156, /340/995.23, /340/628, /340/572.4, /340/572.1, /340/568.1, /340/539.22, /340/539.11, /340/525, /340/522, /340/517, /340/511, /340/501, /235/494, /235/492, /235/472.02, /235/451, /235/386, /235/385, /235/383, /235/382, /235/380	The following firms were included in the search for big data UPCs: Splunk, Opera Solutions, Mu Sigma, Palantir, Cloudera, Actian, 1010data, 10gen, Alteryx, Guavus, Teradata, DataSift, SAP, Hortonworks, Quid, Kaggle, ZestFinance, Apixio, Datameer, BlueKai, Gnip, RetailNext, Recommind, MuSigma, Opera Solutions, ParAccel, Talend, GoodData, DataXu, DataStax. In total 1177 UPC subclasses were included in the Scenario C search.

Appendix E

FCIV Reports for Three Scenarios

Scenario A: HTC

TA Report
UPC Subclass Value Identification Report

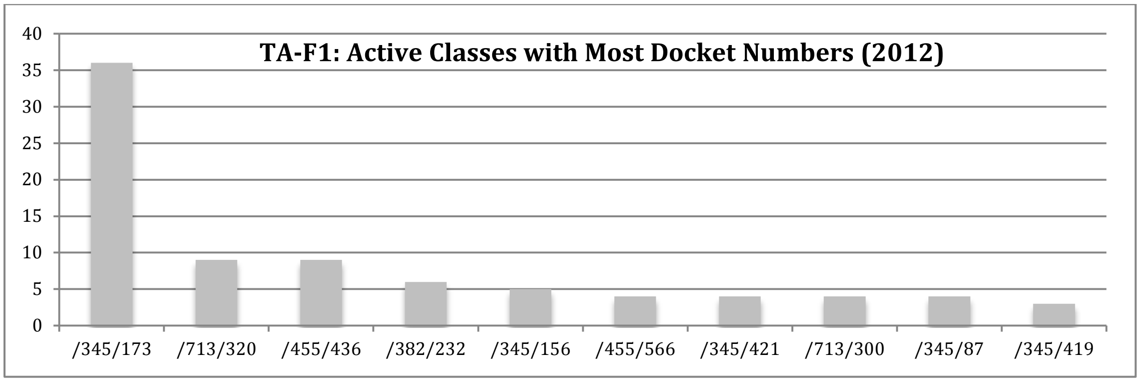

Figure E-1: Scenario A (HTC) TA-F1: Active subclasses with most docket numbers (2012).

Table E-1: Scenario A (HTC) TA-F1: Titles of active subclasses with most docket numbers (2012).

UPC	Title
/345/173	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE: Touch panel
/713/320	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL: Power conservation
/455/436	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Handoff
/382/232	IMAGE ANALYSIS: IMAGE COMPRESSION OR CODING: IMAGE COMPRESSION OR CODING
/345/156	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE:
/455/566	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Having display
/345/421	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Hidden line/surface determining
/713/300	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL:
/345/87	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: PLURAL PHYSICAL DISPLAY ELEMENT CONTROL SYSTEM (E.G., NON-CRT): Liquid crystal display elements (LCD)
/345/419	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Three-dimension

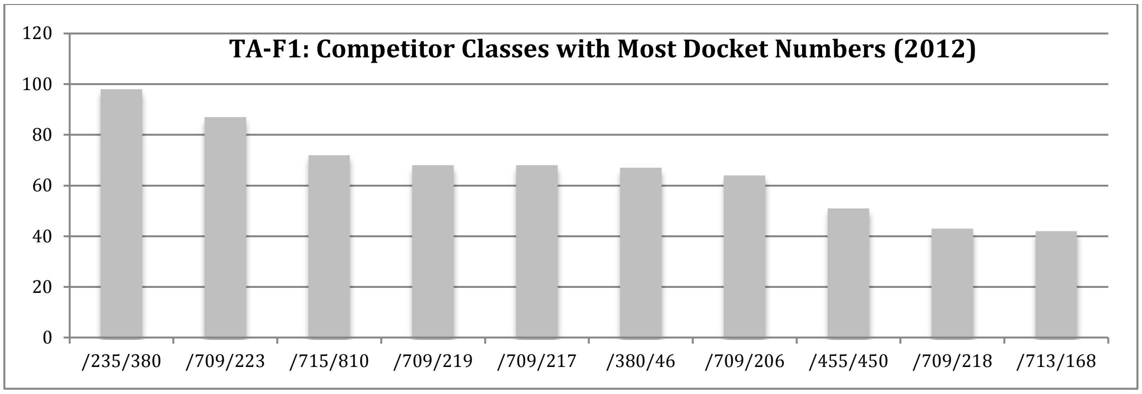

Figure E-2: Scenario A (HTC) TA-F1: Competitor subclasses with most docket numbers (2012).

Table E-2: Scenario A (HTC) TA-F1: Titles of competitor subclasses with most docket numbers (2012).

UPC	Title
/235/380	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS: Credit or identification card systems
/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING
/715/810	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Menu or selectable iconic array (e.g., palette)
/709/219	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server
/709/217	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/380/46	CRYPTOGRAPHY: KEY MANAGEMENT: Nonlinear (e.g., pseudorandom)
/709/206	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Demand based messaging
/455/450	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Channel allocation
/709/218	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Using interconnected networks
/713/168	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular communication authentication technique

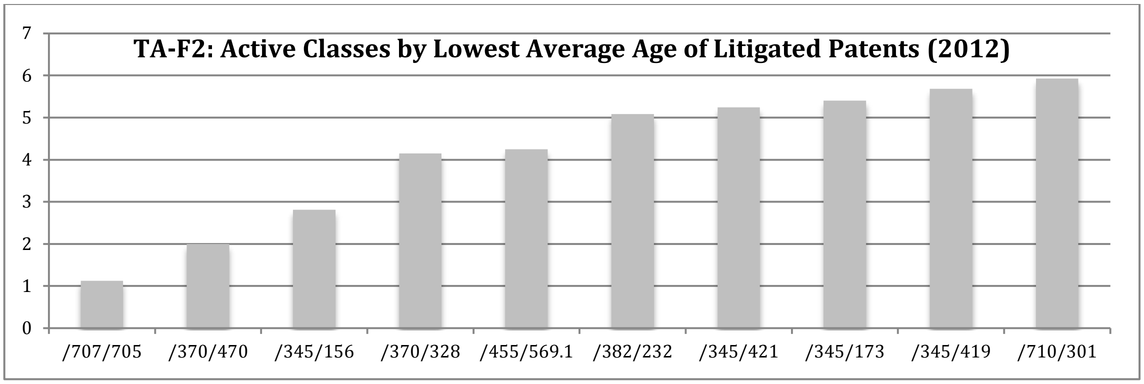

Figure E-3: Scenario A (HTC) TA-F2: Active subclasses with lowest average age of litigated patents (2012).

Table E-3: Scenario A (HTC) TA-F2: Titles of active subclasses with lowest average age of litigated patents (2012).

UPC	Title
/707/705	DATABASE AND FILE MANAGEMENT OR DATA STRUCTURE: DATABASE AND FILE ACCESS
/370/470	MULTIPLEX COMMUNICATIONS: CHANNEL ASSIGNMENT TECHNIQUES: Frame length
/345/156	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE
/370/328	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Having a plurality of contiguous regions served by respective fixed stations
/455/569.1	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Hands-free or loudspeaking arrangement
/382/232	IMAGE ANALYSIS: IMAGE COMPRESSION OR CODING: IMAGE COMPRESSION OR CODING
/345/421	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Hidden line/surface determining
/345/173	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE: Touch panel
/345/419	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Three-dimension
/710/301	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT: INTRASYSTEM CONNECTION (E.G., BUS AND BUS TRANSACTION PROCESSING): Card insertion

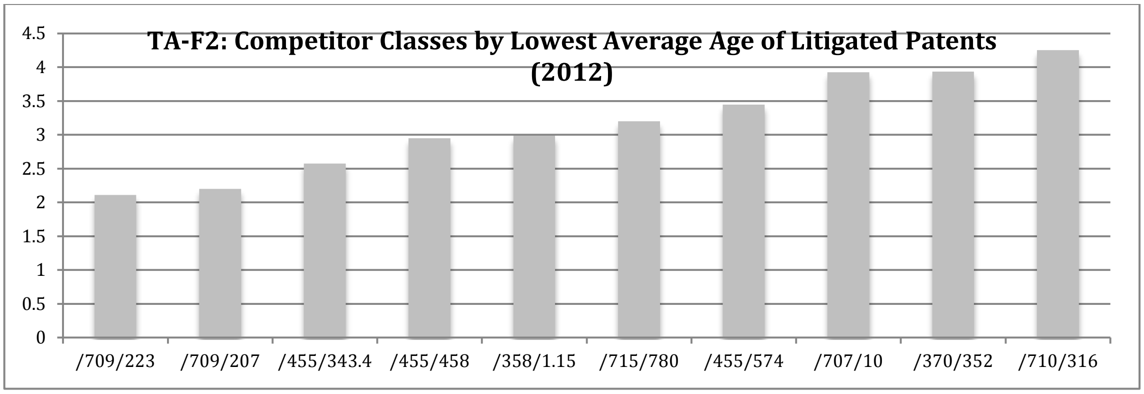

Figure E-4: Scenario A (HTC) TA-F2: Competitor subclasses with lowest average age of litigated patents (2012).

Table E-4: Scenario A (HTC) TA-F2: Titles of competitor subclasses with lowest average age of litigated patents (2012).

UPC	Title
/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING
/709/207	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Priority based messaging
/455/343.4	TELECOMMUNICATIONS: UHF and VHF: Based on schedule information
/455/458	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Specific paging technique
/358/1.15	FACSIMILE AND STATIC PRESENTATION PROCESSING: STATIC PRESENTATION PROCESSING (E.G., PROCESSING DATA FOR PRINTER, ETC.): Communication
/715/780	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Entry field (e.g., text entry field)
/455/574	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Power conservation
/707/10	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES: DATABASE SCHEMA OR DATA STRUCTURE: Distributed or remote access
/370/352	MULTIPLEX COMMUNICATIONS: PATHFINDING OR ROUTING: Combined circuit switching and packet switching
/710/316	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT: INTRASYSTEM CONNECTION (E.G., BUS AND BUS TRANSACTION PROCESSING): Path selecting switch

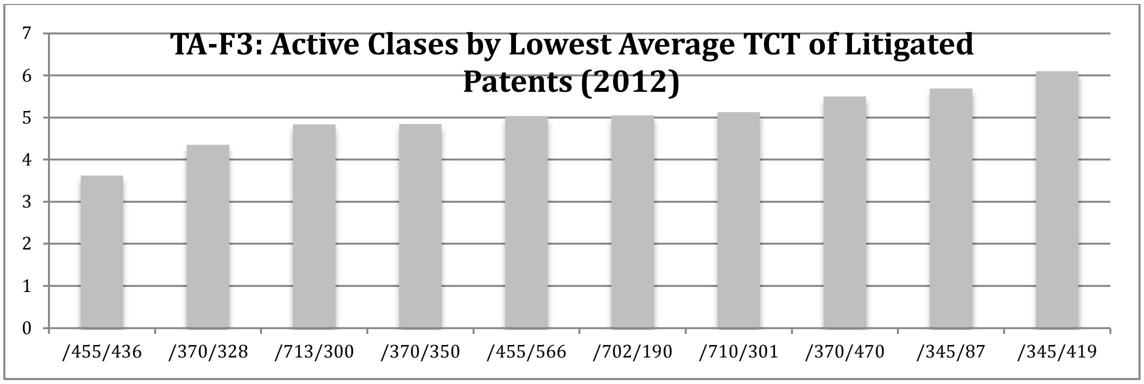

Figure E-5: Scenario A (HTC) TA-F3: Active subclasses with lowest average TCT of litigated patents (2012).

Table E-5: Scenario A (HTC) TA-F3: Titles of active subclasses with lowest average TCT of litigated patents (2012).

UPC	Title
/455/436	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Handoff
/370/328	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Having a plurality of contiguous regions served by respective fixed stations
/713/300	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL:
/370/350	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Synchronization
/455/566	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Having display
/702/190	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Signal extraction or separation (e.g., filtering)
/710/301	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT: INTRASYSTEM CONNECTION (E.G., BUS AND BUS TRANSACTION PROCESSING): Card insertion
/370/470	MULTIPLEX COMMUNICATIONS: CHANNEL ASSIGNMENT TECHNIQUES: Frame length
/345/87	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: PLURAL PHYSICAL DISPLAY ELEMENT CONTROL SYSTEM (E.G., NON-CRT): Liquid crystal display elements (LCD)
/345/419	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Three-dimension

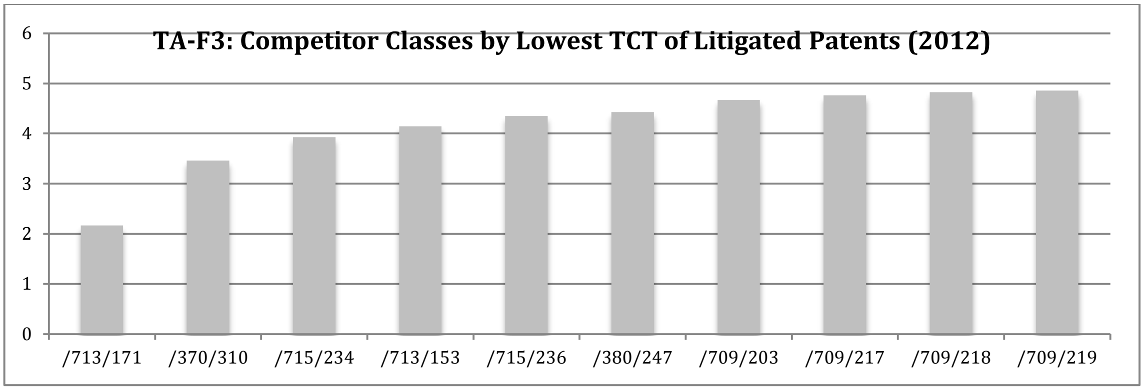

Figure E-6: Scenario A (HTC) TA-F3: Competitor subclasses with lowest average TCT of litigated patents (2012).

Table E-6: Scenario A (HTC) TA-F3: Titles of competitor subclasses with lowest average TCT of litigated patents (2012).

UPC	Title
/713/171	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Having key exchange
/370/310	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE:
/715/234	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Structured document (e.g., HTML, SGML, ODA, CDA, etc.)
/713/153	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/715/236	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Stylesheet based markup language transformation/translation (e.g., to a published format using stylesheet, etc.)
/380/247	CRYPTOGRAPHY: CELLULAR TELEPHONE CRYPTOGRAPHIC AUTHENTICATION:
/709/203	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: DISTRIBUTED DATA PROCESSING: Client/server
/709/217	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/709/218	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Using interconnected networks
/709/219	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server

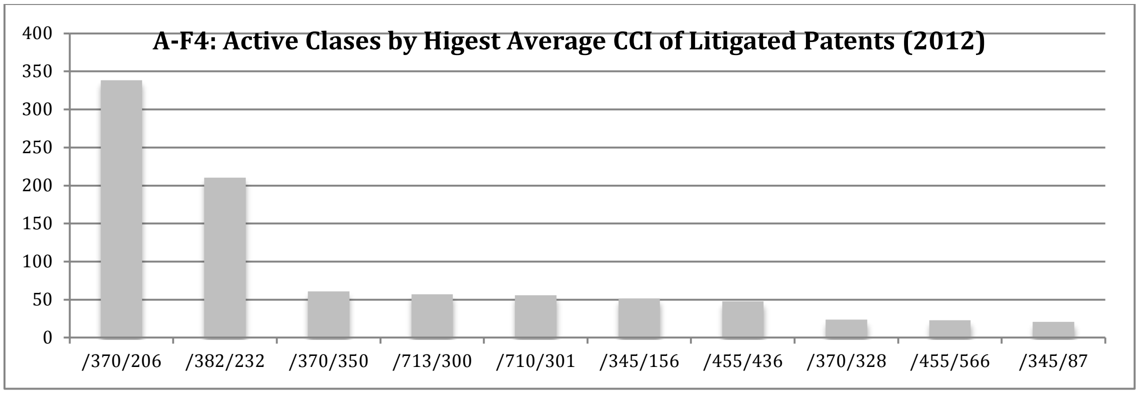

Figure E-7: Scenario A (HTC) TA-F4: Active subclasses with highest average CCI of litigated patents (2012).

Table E-7: Scenario A (HTC) TA-F4: Titles of active subclasses with highest average CCI of litigated patents (2012).

UPC	Title
/370/206	MULTIPLEX COMMUNICATIONS: GENERALIZED ORTHOGONAL OR SPECIAL MATHEMATICAL TECHNIQUES: Quadrature carriers
/382/232	IMAGE ANALYSIS: IMAGE COMPRESSION OR CODING: IMAGE COMPRESSION OR CODING
/370/350	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Synchronization
/713/300	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL:
/710/301	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT: INTRASYSTEM CONNECTION (E.G., BUS AND BUS TRANSACTION PROCESSING): Card insertion
/345/156	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE:
/455/436	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Handoff
/370/328	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Having a plurality of contiguous regions served by respective fixed stations
/455/566	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Having display
/345/87	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: PLURAL PHYSICAL DISPLAY ELEMENT CONTROL SYSTEM (E.G., NON-CRT): Liquid crystal display elements (LCD)

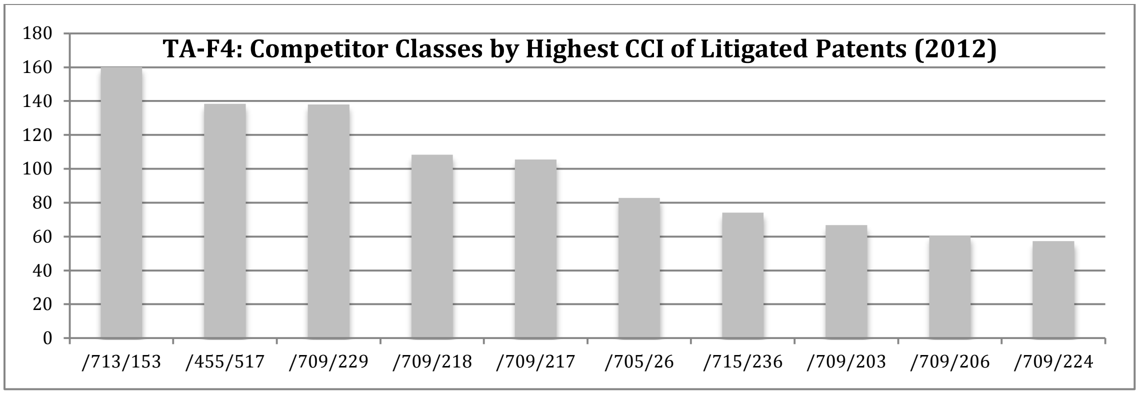

Figure E-8: Scenario A (HTC) TA-F4: Competitor subclasses with highest average CCI of litigated patents (2012).

Table E-8: Scenario A (HTC) TA-F4: Titles of competitor subclasses with highest average CCI of litigated patents (2012).

UPC	Title
/713/153	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/455/517	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SEPARATE STATIONS: To or from mobile station
/709/229	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER-TO-COMPUTER SESSION/CONNECTION ESTABLISHING: Network resources access controlling
/709/218	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Using interconnected networks
/709/217	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/715/236	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Stylesheet based markup language transformation/translation (e.g., to a published format using stylesheet, etc.)
/709/203	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: DISTRIBUTED DATA PROCESSING: Client/server
/709/206	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Demand based messaging
/709/224	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING: Computer network monitoring

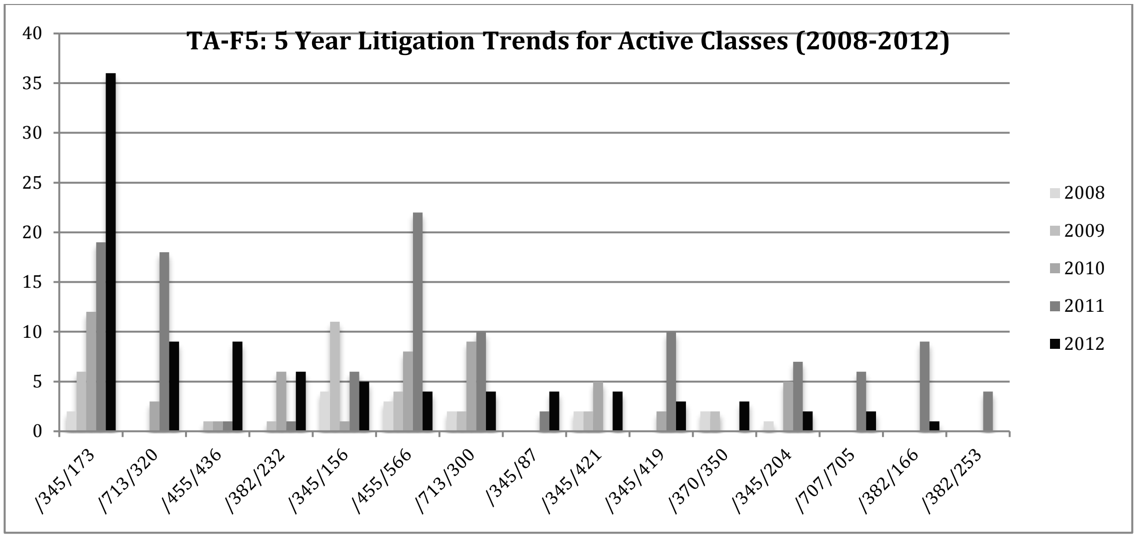

Figure E-9: Scenario A (HTC) TA-F5: Active subclasses' 5-year litigation trends (2008-2012).

Table E-9: Scenario A (HTC) TA-F5: Titles of active subclasses' 5-year litigation trends (2008-2012).

UPC	Title
/345/173	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE: Touch panel
/713/320	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL: Power conservation
/455/436	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Handoff
/382/232	IMAGE ANALYSIS: IMAGE COMPRESSION OR CODING: IMAGE COMPRESSION OR CODING
/345/156	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE:
/455/566	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Having display
/713/300	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL:
/345/87	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: PLURAL PHYSICAL DISPLAY ELEMENT CONTROL SYSTEM (E.G., NON-CRT): Liquid crystal display elements (LCD)
/345/421	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Hidden line/surface determining
/345/419	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Three-dimension
/370/350	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Synchronization
/345/204	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY DRIVING CONTROL CIRCUITRY:
/707/705	DATABASE AND FILE MANAGEMENT OR DATA STRUCTURE: DATABASE AND FILE ACCESS:
/382/166	IMAGE ANALYSIS: COLOR IMAGE PROCESSING: Compression of color images
/382/253	IMAGE ANALYSIS: IMAGE COMPRESSION OR CODING: Vector quantization

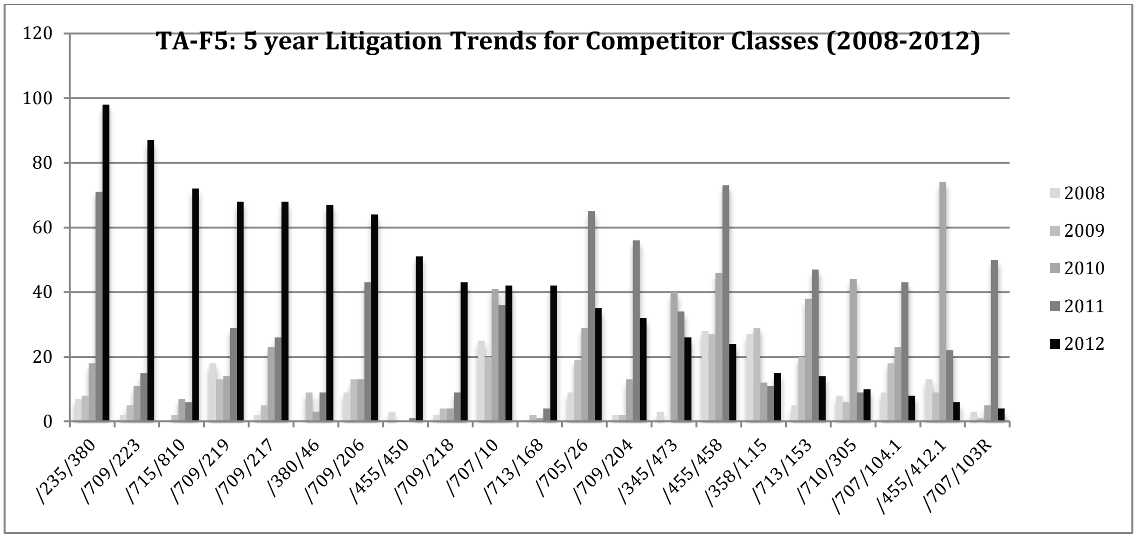

Figure E-10: Scenario A (HTC) TA-F5: Active subclasses' 5-year litigation trends (2008-2012).

Table E-10: Scenario A (HTC) TA-F5: Titles of active sub classes' 5-year litigation trends (2008-2012).

UPC	Title
/358/1.15	FACSIMILE AND STATIC PRESENTATION PROCESSING: STATIC PRESENTATION PROCESSING (E.G., PROCESSING DATA FOR PRINTER, ETC.): Communication
/455/458	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Specific paging technique
/707/10	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES: DATABASE SCHEMA OR DATA STRUCTURE: Distributed or remote access
/713/153	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/707/104.1	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES: DATABASE SCHEMA OR DATA STRUCTURE: Application of database or data structure (e.g., distributed, multimedia, image)
/709/219	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server
/709/206	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Demand based messaging
/455/412.1	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Message storage or retrieval
/380/46	CRYPTOGRAPHY: KEY MANAGEMENT: Nonlinear (e.g., pseudorandom)
/235/380	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS: Credit or identification card systems
/710/305	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT: INTRASYSTEM CONNECTION (E.G., BUS AND BUS TRANSACTION PROCESSING): Bus interface architecture
/709/217	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
/709/218	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Using interconnected networks
/709/204	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING:
/715/810	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Menu or selectable iconic array (e.g., palette)
/713/168	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular communication authentication technique
/707/103R	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES: DATABASE SCHEMA OR DATA STRUCTUREL: Object-oriented database structure
/345/473	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Animation
/455/450	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Channel allocation

CP Report
CGV Target Analysis Report

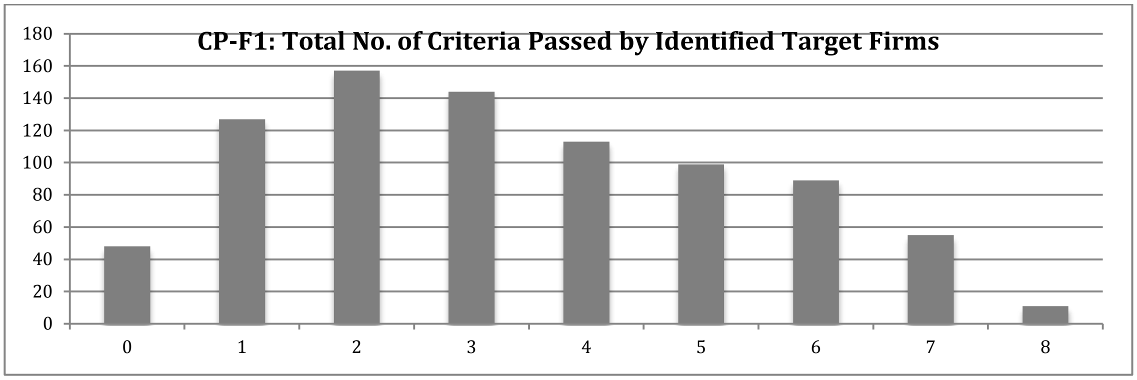

Figure E-11: Scenario A (HTC) CP-F1: The total number FCIV-CP Report metric criteria passed by identified target CGV firms.

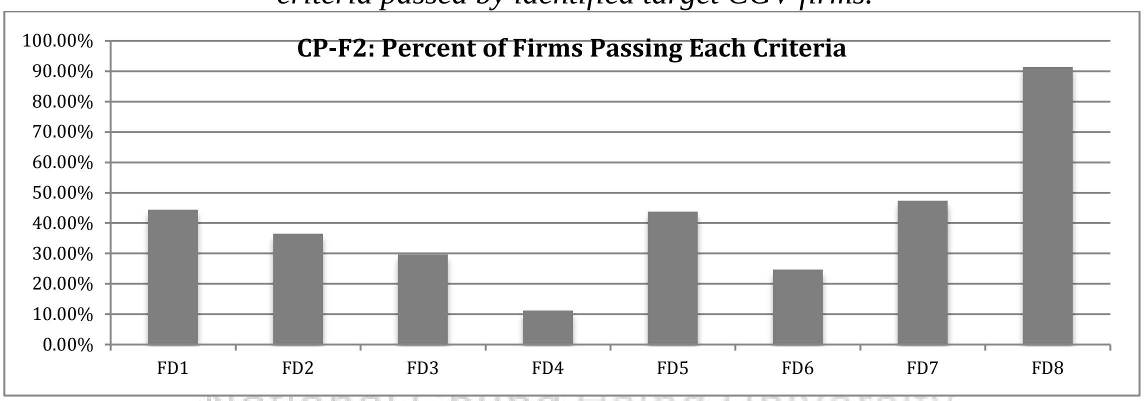

Figure E-12: Scenario A (HTC) CP-F2: Percentage of identified CGV targets that passed each of the FCIV-CP Report metric criteria.

Table E-11: Scenario A (HTC) CP-F3: List of Identified CGV targets who passed more than 6 of the FCIV CP-Report metric criteria representing 7.8% of the total number of identified CGV targets.

Firm	Criteria Passed	Firm	Criteria Passed
AMAZON.COM INC	8	INTUIT INC	7
APPLE INC	8	JPMORGAN CHASE & CO	7
GOOGLE INC	8	KYOCERA COMMUNICATIONS INC	7
LEVEL 3 COMMUNICATIONS INC	8	LG ELECTRONICS INC	7
MICROSOFT CORPORATION	8	LOWE'S COMPANIES INC	7
ORACLE CORPORATION	8	LSI CORPORATION	7
RESEARCH IN MOTION CORP	8	MEDIATEK INC	7
SPRINT COMMUNICATIONS COMPANY LP	8	MORGAN STANLEY	7
SYMANTEC CORPORATION	8	MOSAID TECHNOLOGIES INC	7
UNITED PARCEL SERVICES INC	8	MOTOROLA INC	7
VERIZON COMMUNICATIONS INC	8	NOKIA CORPORATION	7
ACER INC	7	NVIDIA CORPORATION	7
ADOBE SYSTEMS INCORPORATED	7	PEREGRINE SEMICONDUCTOR CORPORATION	7
ADVANCED MICRO DEVICES INC	7	PURDUE PHARMA LP	7
AMERICAN EXPRESS COMPANY	7	QUALCOMM INC	7
ASUSTEK COMPUTER INC	7	RUCKUS WIRELESS INC	7
AT&T CORP	7	SAMSUNG ELECTRONICS	7
AVALANCHE LLC	7	SANDOZ INC	7
BANK OF AMERICA CORPORATION	7	SANYO ELECTRIC CO LTD	7
BMW AG	7	SHAW INDUSTRIES GROUP INC	7
CISCO SYSTEMS INC	7	SILICON LABORATORIES INC	7
DELL INC	7	SKYPE INC	7
EBAY INC	7	SOFTVIEW LLC	7
FEDEX CORPORATION	7	SONY CORP	7
FUNAI CORPORATION INC	7	SOUTHWEST AIRLINES CO	7
FUTUREWEI TECHNOLOGIES INC	7	STARBUCKS CORPORATION	7
GENERAL ELECTRIC CO	7	T-MOBILE USA INC	7
GENERAL MOTORS LLC	7	TIVO INC	7
GSI COMMERCE SOLUTIONS INC	7	TOSHIBA CORPORATION	7
HEWLETT-PACKARD COMPANY	7	TOYOTA MOTOR CORPORATION	7
HTC CORPORATION	7	TRAVELOCITY.COM LP	7
HUAWEI AMERICA INC	7	WAL-MART STORES INC	7
INTUIT INC	7	WATCHGUARD TECHNOLOGIES INC	7

Table E-12: Scenario A (HTC) CP-F4: Subsection of Identified HLVLPV CGV targets who passed all 4 of the litigation based FCIV CP-Report metric criteria, but have no patent grants.

Firm	Lit Criteria Passed	Cum. Passed	Firm	Lit Criteria Passed	Cum. Passed
AIRTRAN AIRWAYS INC	4	4	MCDONALDS CORPORATION	4	4
ARTSYL TECHNOLOGIES INC	4	4	MILLENNIAL MEDIA INC	4	4
BARNES & NOBLE INC	4	4	NETFLIX INC	4	4
BEST WESTERN HOTELS	4	4	NEWEGG INC	4	4
COURTYARD MADISON EAST	4	4	NEXTEL OPERATIONS INC	4	4
DELTA AIR LINES INC	4	4	ROXANE LABORATORIES INC	4	4
DRIVVE US LLC	4	4	SAN DIEGO COUNTY CREDIT UNION CONTENT EXTRACTION AND TRANSMISSION LLC	4	4
EDRAWER	4	4	SBC INTERNET SERVICES INC	4	4
EXEDEA INC	4	4	STUDIO PLUS DELUXE STUDIOS	4	4
FAIRFIELD INN & SUITES	4	4	THE HOME DEPOT INC	4	4
HERITAGE FAMILY CREDIT UNION	4	4	THRUST PUBLISHING	4	4
HVM LLC	4	4	TNA ENTERTAINMENT LLC	4	4
IBASIS INC	4	4	U.S. NUTRACEUTICALS LLC	4	4
INNOVATIO IP VENTURES LLC	4	4	VALENSA INTERNATIONAL	4	4
JEWEL FOOD STORES INC	4	4	VIEWSONIC CORPORATION	4	4
LODSYS LLC	4	4	WESTINGHOUSE DIGITAL LLC	4	4
LSSP CORPORATION	4	4	WSFS FINANCIAL CORPORATION	4	4

Scenario B: Luxgen

TA Report
UPC Class Value Identification Report

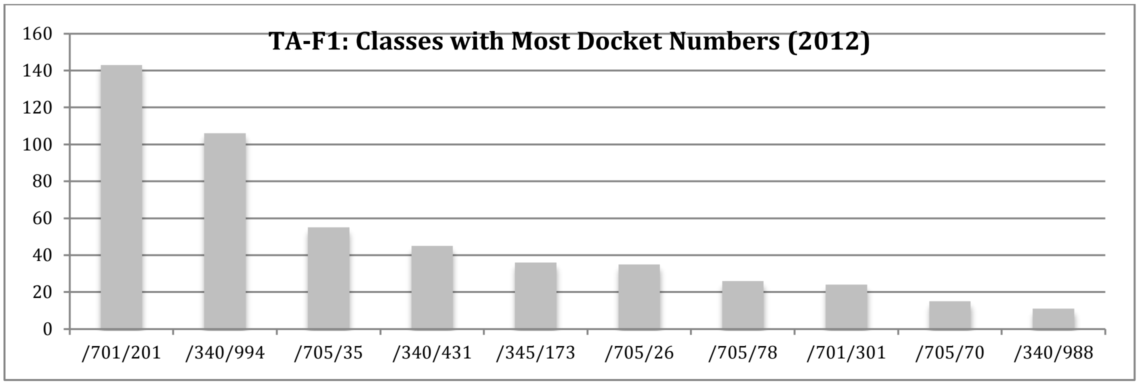

Figure E-13: Scenario B (Luxgen) TA-F1: Competitor subclasses with most docket numbers (2012).

Table E-13: Scenario B (Luxgen) TA-F1: Titles of subclasses with most docket numbers (2012).

UPC	Title
/701/201	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: NAVIGATION: Determination of travel data based on the start point and destination point
/340/994	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: Vehicle's arrival or expected arrival at remote location along route indicated at that remote location (e.g., bus arrival systems)
/705/35	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Finance (e.g., banking, investment or credit)
/340/431	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: For trailer
/345/173	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE: Touch panel
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/705/78	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including third party
/701/301	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: RELATIVE LOCATION: Collision avoidance
/705/70	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Home banking
/340/988	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION:

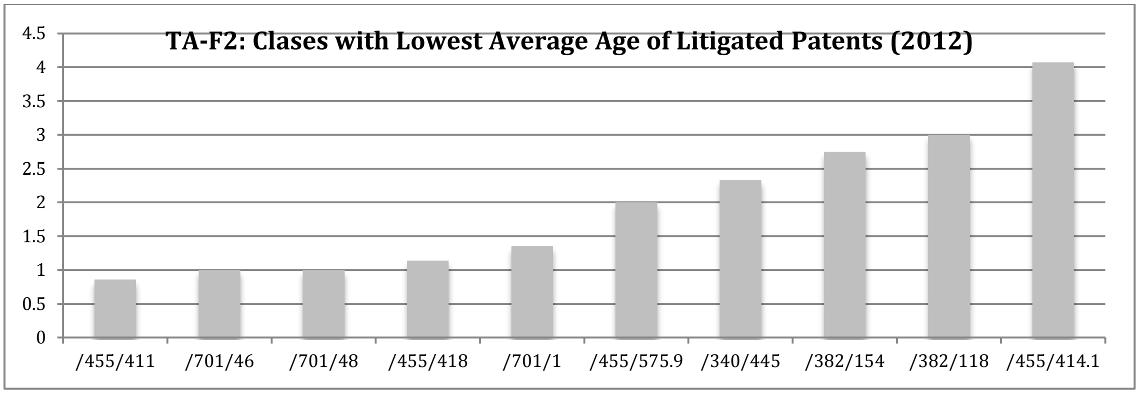

Figure E-14: Scenario B (Luxgen) A-F2: Competitor subclasses with lowest average age of litigated patents (2012).

Table E-14: Scenario B (Luxgen) A-F2: Titles of competitor subclasses with lowest average age of litigated patents (2012).

UPC	Title
/455/411	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Privacy, lock-out, or authentication
/701/48	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Cooperative or multiple control (e.g., suspension and braking)
/455/418	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Programming control
/701/1	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION:
/382/154	IMAGE ANALYSIS: APPLICATIONS: 3-D or stereo imaging analysis
/382/118	IMAGE ANALYSIS: APPLICATIONS: Using a facial characteristic
/455/414.1	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Special service
/340/435	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: Of relative distance from an obstacle
/345/7	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: IMAGE SUPERPOSITION BY OPTICAL MEANS (E.G., HEADS-UP DISPLAY):
/705/35	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Finance (e.g., banking, investment or credit)

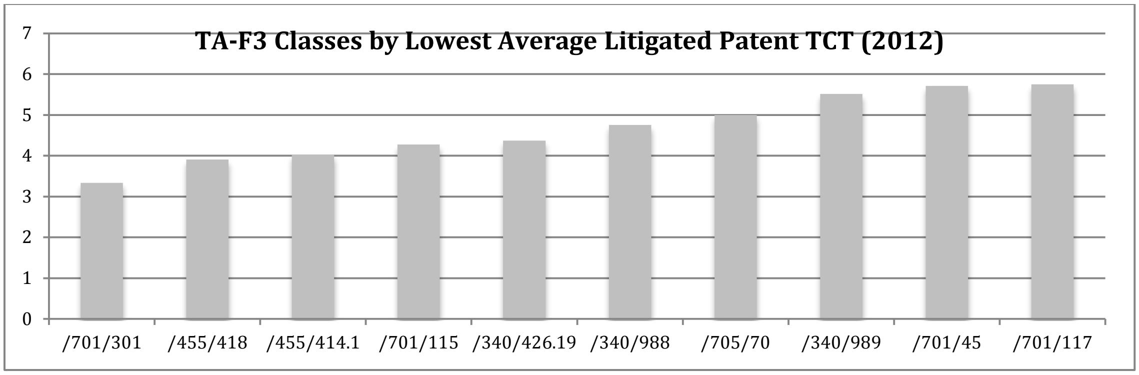

Figure E-15: Scenario B (Luxgen) TA-F3: Competitor subclasses with lowest average TCT of litigated patents (2012).

Table E-15: Scenario B (Luxgen) TA-F3: Titles of competitor subclasses with lowest average TCT of litigated patents (2012).

UPC	Title
/701/301	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: RELATIVE LOCATION: Collision avoidance
/455/418	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Programming control
/455/414.1	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Special service
/701/115	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Specific memory or interfacing device
/340/988	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION:
/705/70	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Home banking
/701/45	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Control of vehicle safety devices (e.g., airbag, seat-belt, etc.)
/701/117	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Traffic analysis or control of surface vehicle
/340/441	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: Speed of vehicle, engine, or power train
/340/461	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: With particular display means

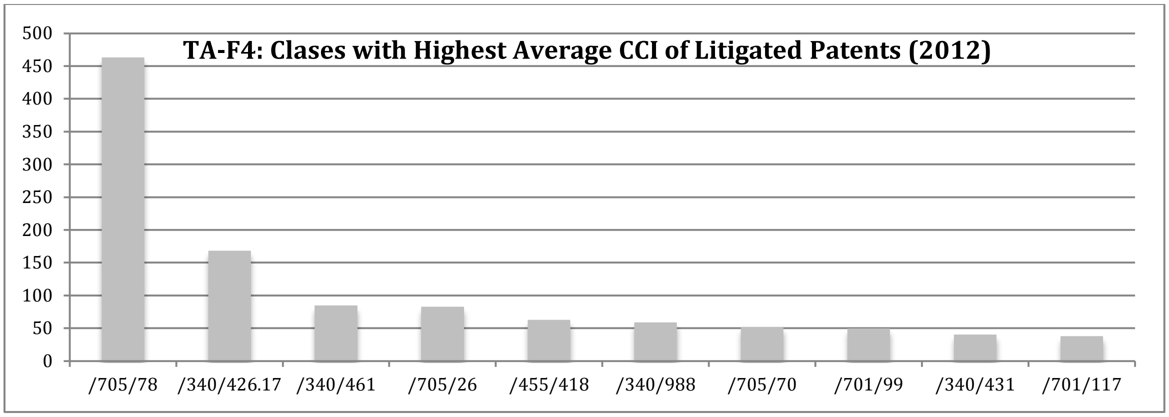

Figure E-16: Scenario B (Luxgen) TA-F4: Competitor subclasses with highest average CCI of litigated patents (2012).

Table E-16: Scenario B (Luxgen) A-F4: Titles of competitor subclasses with highest average CCI of litigated patents (2012).

UPC	Title
/705/78	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including third party
/340/426.17	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: Transmitter on user
/340/461	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: With particular display means
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/455/418	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Programming control
/340/988	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION:
/705/70	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Home banking
/701/99	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: With indicator or control of power plant (e.g., performance)
/340/431	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: For trailer
/701/117	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Traffic analysis or control of surface vehicle

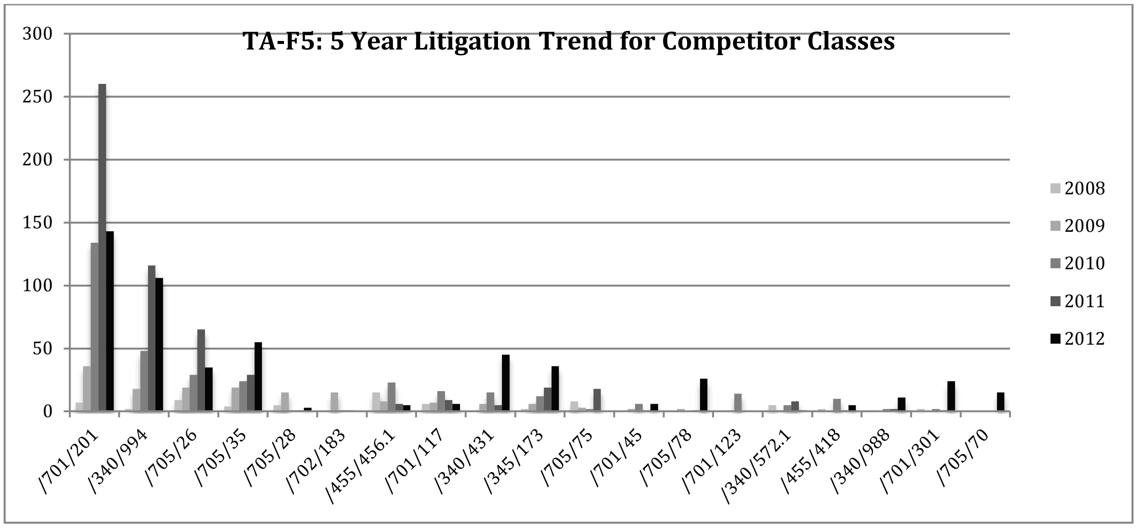

Figure E-18: Scenario B (Luxgen) TA-F5: Competitor classes' 5-year litigation trends (2008-2012).

Table E-18: Scenario B (Luxgen) TA-F5: Titles of competitor classes' 5-year litigation trends (2008-2012).

UPC	Title
/701/201	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: NAVIGATION: Determination of travel data based on the start point and destination point
/340/994	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Finance (e.g., banking, investment or credit)
/705/35	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Inventory management
/705/28	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Diagnostic analysis
/702/183	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Location monitoring
/455/456.1	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Traffic analysis or control of surface vehicle
/701/117	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: For trailer
/340/431	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE: Touch panel
/345/173	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Transaction verification
/705/75	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Control of vehicle safety devices (e.g., airbag, seat-belt, etc.)
/701/45	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including third party
/705/78	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: With indication of fuel consumption rate or economy of usage
/701/123	COMMUNICATIONS: ELECTRICAL: CONDITION RESPONSIVE INDICATING SYSTEM: Detectable device on protected article (e.g., "tag")
/340/572.1	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Programming control
/455/418	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION:
/340/988	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: RELATIVE LOCATION: Collision avoidance
/701/301	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Home banking

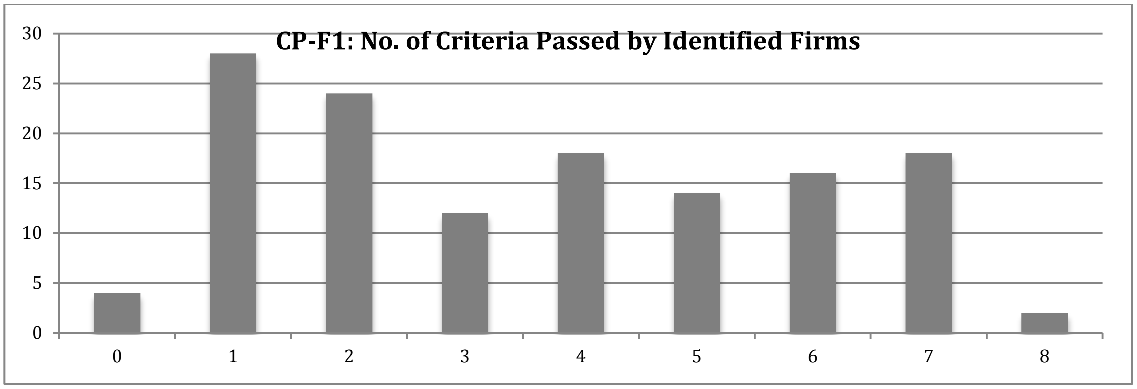

Figure E-19: Scenario B (Luxgen) CP-F1: The total number FCIV-CP Report metric criteria passed by identified target CGV firms

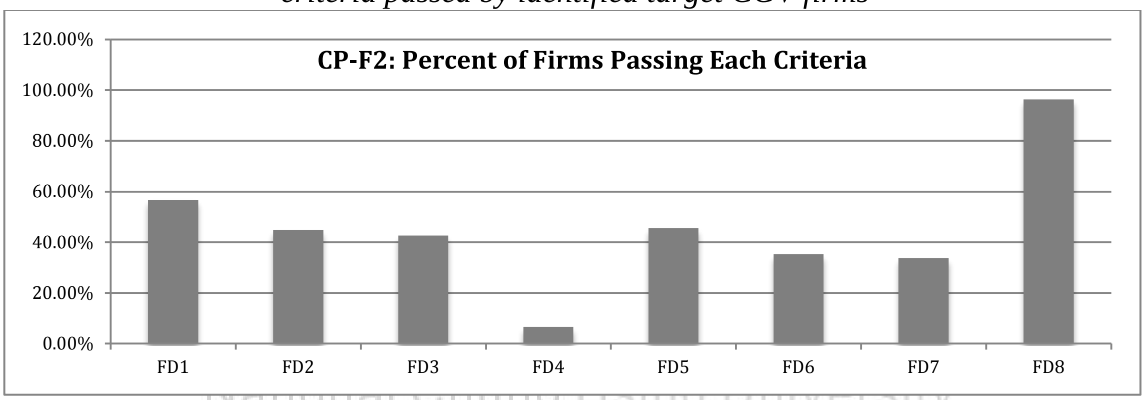

Figure E-20: Scenario B (Luxgen) CP-F2: Percentage of identified CGV targets that passed each of the FCIV-CP Report metric criteria

Table E-19: Scenario B (Luxgen) CP-F3: List of Identified CGV targets who passed more than 6 of the FCIV-CP Report metric criteria representing 14.7% of the total number of identified CGV targets.

Firm	Criteria Passed	Firm	Criteria Passed
NETWORK CO INC	8	HYUNDAI MOTOR CO	7
RESEARCH IN MOTION LTD	8	KYOCERA CO INC	7
ACER AMERICA CORPORATION	7	LENOVO INC	7
ALCATEL-LUCENT USA INC	7	LG ELECTRONICS INC	7
BMW AG	7	PANTECH WIRELESS	7
DELL INC	7	SAMSUNG ELECTRONICS CO LTD	7
FEDEX CORPORATION	7	SHAW INDUSTRIES INC	7
GENERAL ELECTRIC CO	7	SONY CORPORATION	7
GENERAL MOTORS COMPANY	7	TOSHIBA INC	7
HTC CORPORATION	7	TOYOTA MOTOR CORPORATION	7

Table E-20: Scenario B (Luxgen) CP-F4: Subsection of Identified HLVLPV CGV targets who passed all 4 of the litigation based FCIV-CP Report metric criteria, but have limited patenting activity.

Firm	Lit Criteria Passed	Cum. Passed	Firm	Lit Criteria Passed	Cum. Passed
CROWD SOURCED TRAFFIC	4	4	ELECTRONICS FOR IMAGING INC	4	5
NEWEGG INC	4	4	INTELLIPHARMACEUTICS CORPORATION	4	6
PAR PHARMACEUTICAL INC	4	4	TOMTOM INC	4	6
BEST BUY	4	5	WAZE INC	4	6
COSTCO WHOLESALE CORPORATION	4	5			

Scenario C: Big Data

TA Report
UPC Class Value Identification Report

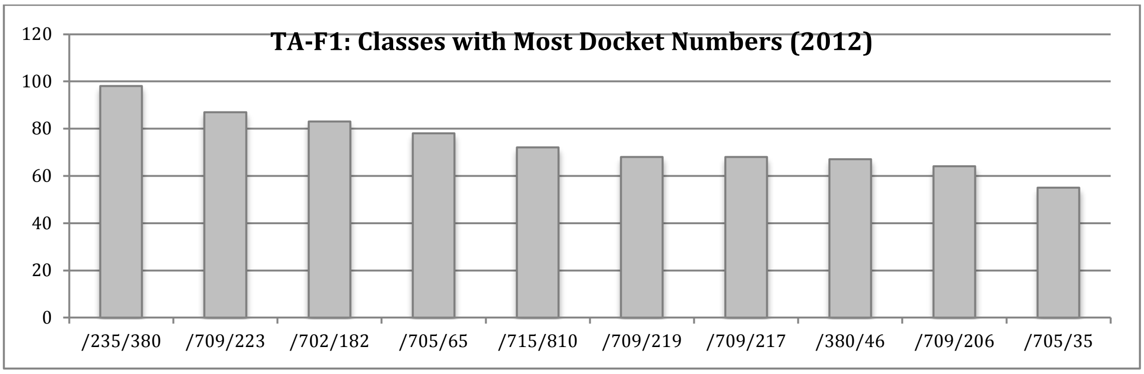

Figure E-21: Scenario C (Big Data) TA-F1: Subclasses with most docket numbers (2012).

Table E-21: Scenario C (Big Data) TA-F1: Titles of subclasses with most docket numbers (2012)

UPC	Title
/235/380	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS: Credit or identification card systems
/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
/702/182	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Performance or efficiency evaluation
/705/65	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including intelligent token (e.g., electronic purse)
/715/810	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Menu or selectable iconic array (e.g., palette)
/709/219	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server
/709/217	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/380/46	CRYPTOGRAPHY: KEY MANAGEMENT: Nonlinear (e.g., pseudorandom)
/709/206	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Demand based messaging
/705/35	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Finance (e.g., banking, investment or credit)

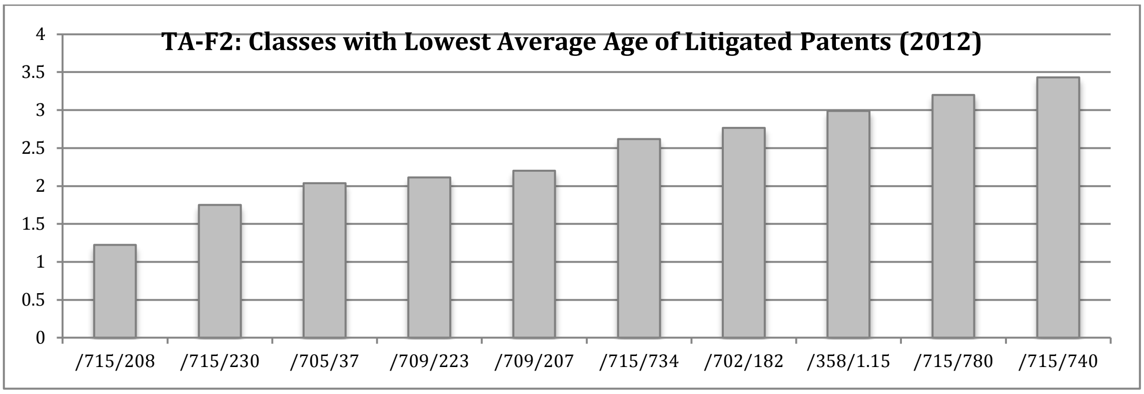

Figure E-22: Scenario C (Big Data) TA-F2: Subclasses with lowest average age of litigated patents (2012).

Table E-22: Scenario C (Big Data) TA-F2: Titles of subclasses with lowest average age of litigated patents (2012).

UPC	Title
/715/208	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Hyperlink editing (e.g., link authoring, rerouting, etc.)
/715/230	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Annotation control
/705/37	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Trading, matching, or bidding
/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
/709/207	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Priority based messaging
/715/734	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Interactive network representation of devices (e.g., topology of workstations)
/702/182	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Performance or efficiency evaluation
/358/1.15	FACSIMILE AND STATIC PRESENTATION PROCESSING: STATIC PRESENTATION PROCESSING (E.G., PROCESSING DATA FOR PRINTER, ETC.): Communication
/715/780	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Entry field (e.g., text entry field)
/715/740	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Remote operation of computing device

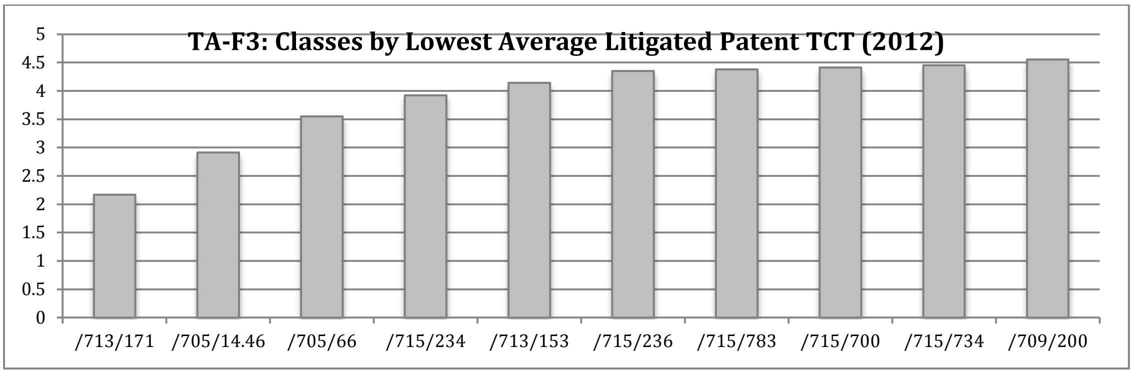

Figure E-23: Scenario C (Big Data) TA-F3: Active subclasses with lowest average TCT of litigated patents (2012).

Table E-23: Scenario C (Big Data) TA-F3: Titles of subclasses with lowest average TCT of litigated patents (2012).

UPC	Title
/713/171	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Having key exchange
/705/14.46	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Calculate past, present, or future revenue
/705/66	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Intelligent token initializing or reloading
/715/234	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Structured document (e.g., HTML, SGML, ODA, CDA, etc.)
/713/153	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/715/236	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Stylesheet based markup language transformation/translation (e.g., to a published format using stylesheet, etc.)
/715/783	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): On-screen window list or index
/715/700	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE):
/715/734	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Interactive network representation of devices (e.g., topology of workstations)
/709/200	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: MISCELLANEOUS:

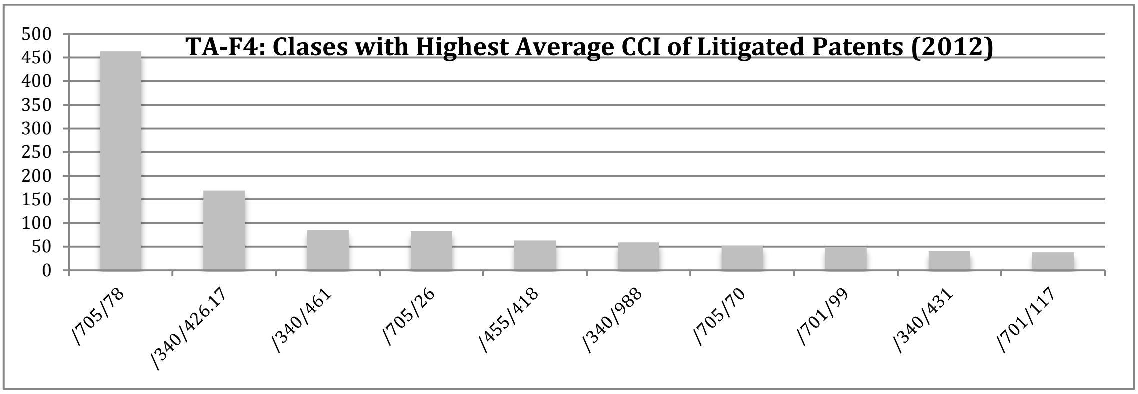

Figure E-24: Scenario C (Big Data) TA-F4: Active classes with highest average CCI of litigated patents (2012).

Table E-24: Scenario C (Big Data) TA-F4: Titles of active classes with highest average CCI of litigated patents (2012).

UPC	Title
/705/78	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including third party
/340/426.17	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: Transmitter on user
/340/461	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: With particular display means
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/455/418	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Programming control
/340/988	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION:
/705/70	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Home banking
/701/99	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: With indicator or control of power plant (e.g., performance)
/340/431	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: For trailer
/701/117	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Traffic analysis or control of surface vehicle

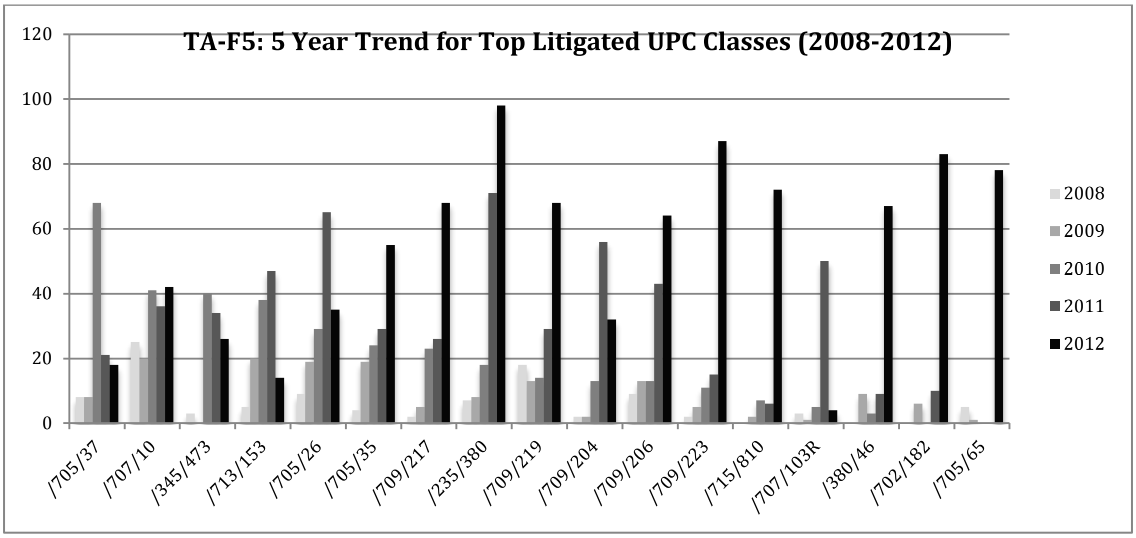

Figure E-25: Scenario C (Big Data) TA-F5: Classes' 5-year litigation trends (2008-2012).

Table E-25: Scenario C (Big Data) TA-F5: Titles of classes' 5-year litigation trends (2008-2012).

UPC	Title
/705/37	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Trading, matching, or bidding
/707/10	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES: DATABASE SCHEMA OR DATA STRUCTURE: Distributed or remote access
/345/473	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Animation
/713/153	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/705/26	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/705/35	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Finance (e.g., banking, investment or credit)
/709/217	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/235/380	REGISTERS: SYSTEMS CONTROLLED BY DATA BEARING RECORDS: Credit or identification card systems
/709/219	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server
/709/204	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING:
/709/206	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Demand based messaging
/709/223	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
/715/810	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Menu or selectable iconic array (e.g., palette)
/707/103R	DATA PROCESSING: DATABASE AND FILE MANAGEMENT OR DATA STRUCTURES: DATABASE SCHEMA OR DATA STRUCTUREL: Object-oriented database structure
/380/46	CRYPTOGRAPHY: KEY MANAGEMENT: Nonlinear (e.g., pseudorandom)
/702/182	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Performance or efficiency evaluation
/705/65	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including intelligent token (e.g., electronic purse)

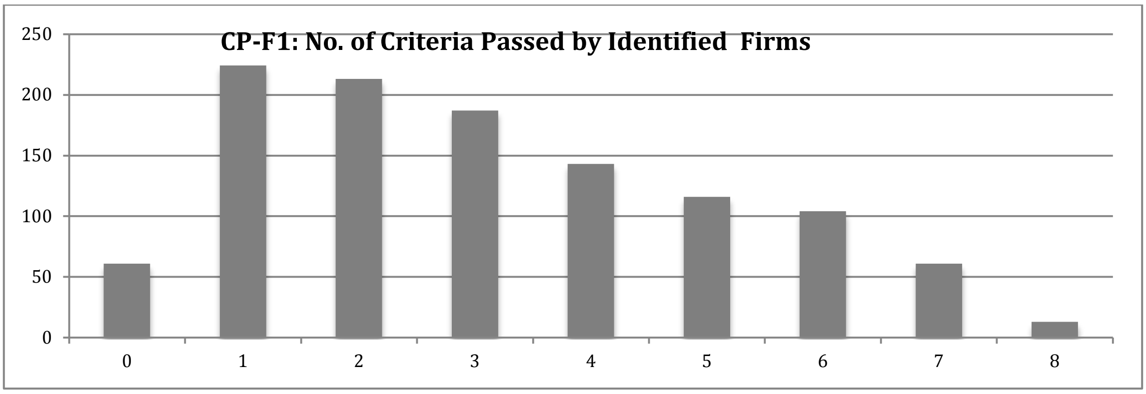

Figure E-26: Scenario C (Big Data) CP-F1: The total number FCIV-CP Report metric criteria passed by identified target CGV firms.

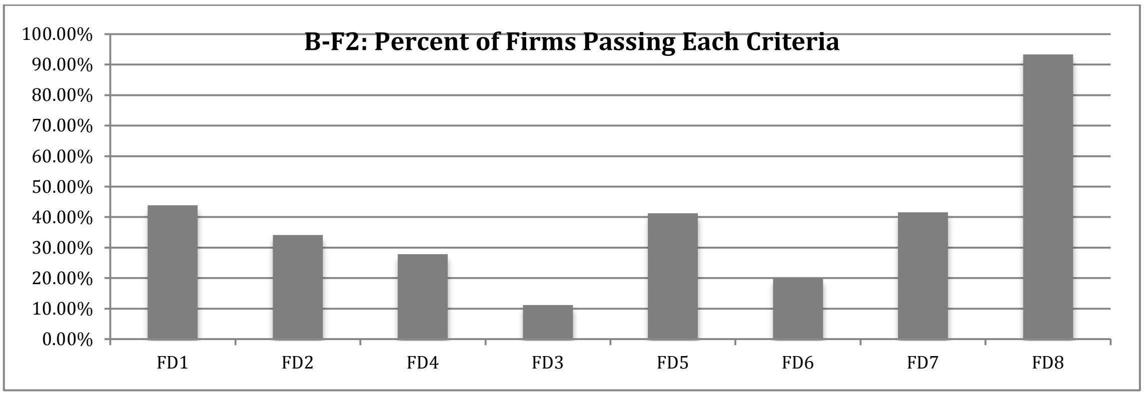

Figure E-27: Scenario C (Big Data) CP-F2: Percentage of identified CGV targets that passed each of the FCIV-CP Report metric criteria.

Table E-26: Scenario C (Big Data) CP-F3: List of Identified CGV targets who passed more than 6 of the FCIV-CP Report metric criteria representing 6.6% of the total number of identified CGV targets

Firm	Criteria Passed	Firm	Criteria Passed
AMAZON WEB SERVICES LLC	8	IRDETO USA INC	7
AMAZON.COM INC	8	JPMORGAN CHASE & CO	7
APPLE INC	8	KYOCERA CORP	7
CISCO SYSTEMS INC	8	LENOVO INC	7
GOOGLE INC	8	LG ELECTRONICS INC	7
LEVEL 3 COMMUNICATIONS INC	8	LOWE'S COMPANIES INC	7
MICROSOFT CORPORATION	8	LSI CORPORATION	7
ORACLE CORPORATION	8	MEDIATEK INC	7
RESEARCH IN MOTION CORPORATION	8	METAVANTE CORPORATION	7
SPRINT COMMUNICATION COMPANY LP	8	MORGAN STANLEY	7
SYMANTEC CORPORATION	8	MOSAID TECHNOLOGIES INC	7
VERIZON ONLINE LLC	8	MOTOROLA INC	7
ZOLL MEDICAL CORPORATION	8	MYLAN INC	7
ABBOTT LABORATORIES	7	NEXTEL OPERATIONS INC	7
ACER INC	7	NOKIA CORPORATION	7
ADOBE SYSTEMS INC	7	NOVATEL WIRELESS INC	7
ADVANCED MICRO DEVICES INC	7	NVIDIA CORPORATION	7
ALCATEL-LUCENT USA INC	7	PANTECH CO LTD	7
AMERICAN EXPRESS COMPANY	7	QUALCOMM INC	7
ASUSTEK COMPUTER INC	7	SAMSUNG ELECTRONICS	7
AT&T CORP	7	SANDOZ INC	7
AVALANCHE LLC	7	SANYO ELECTRIC CO LTD	7
BANK OF AMERICA CORPORATION	7	SAS INSTITUTE INC	7
BMW LLC	7	SEARS BRANDS LLC	7
CELLCO PARTNERSHIP INC	7	SHAW INDUSTRIES GROUP INC	7
DELL INC	7	SKYPE INC	7
EBAY INC	7	SOFTVIEW LLC	7
FEDEX CORPORATION	7	SONY CORP	7
FUNAI CORPORATION INC	7	SOUTHWEST AIRLINES CO	7
FUTUREWEI TECHNOLOGIES INC	7	STARBUCKS CORPORATION	7
GENERAL ELECTRIC COMPANY	7	T-MOBILE INC	7
GENERAL MOTORS LLC	7	TIVO INC	7
GSI COMMERCE INC	7	TOSHIBA INC	7
HEWLETT-PACKARD COMPANY	7	TRAVELOCITY.COM LP	7
HTC CORPORATION	7	U.S. NUTRACEUTICALS LLC	7
HUAWEI TECHNOLOGIES LTD	7	WAL-MART STORES INC	7
INTUIT INC	7	WILDBLUE COMMUNICATIONS INC	7

Table E-27: Scenario C (Big Data) CP-F4: Subsection of Identified HLVLPV CGV targets who passed all 4 of the litigation based FCIV-CP Report metric criteria, but have no patent grants.

Firm	Lit Criteria Passed	Cum. Passed	Firm	Lit Criteria Passed	Cum. Passed
AIRTRAN AIRWAYS INC	4	4	LODSYS LLC	4	4
ARTSYL TECHNOLOGIES INC	4	4	LSSP CORPORATION	4	4
BARNES & NOBLE INC	4	4	MACY'S INC	4	4
BEST WESTERN	4	4	MCDONALDS CORPORATION	4	4
CHEDDAR'S CASUAL CAFE INC	4	4	MILLENNIAL MEDIA INC	4	4
DELTA AIR LINES INC	4	4	NETFLIX INC	4	4
DRIVVE US LLC	4	4	NEWEGG INC	4	4
EDRAWER	4	4	PAR PHARMACEUTICAL INC	4	4
EXEDEA INC	4	4	RESIDENCE INN	4	4
FAIRFIELD INN	4	4	SORENSEN RESEARCH AND DEVELOPMENT TRUST	4	4
HEALTHINATION INC	4	4	STUDIO PLUS DELUXE STUDIOS	4	4
HERITAGE FAMILY CREDIT UNION	4	4	TELETRACKING TECHNOLOGIES INC	4	4
HVM LLC	4	4	THRUST PUBLISHING	4	4
IBASIS INC	4	4	TNA ENTERTAINMENT LLC	4	4
INNOVATIO IP VENTURES LLC	4	4	VALENSA INTERNATIONAL	4	4
IWIN INC	4	4	VIEWSONIC CORPORATION	4	4
JEWEL FOOD STORES INC	4	4	WSFS FINANCIAL CORPORATION	4	4

Appendix F

Analysis of FCIV Results

Table F-1: Scenario B (HTC) Analysis of the results of the FCIV-TA cumulative total of times included in the top ten active classes for metrics included (TA-F1-TA-F4).

UPC Class	AF1	AF2	AF3	AF4	Cum. Total	UPC Class	AF1	AF2	AF3	AF4	Cum. Total
/345/156	*	*		*	3	/345/173	*	*			2
/345/419	*	*	*		3	/345/421	*	*			2
/370/328		*	*	*	3	/370/350			*	*	2
/382/232	*	*		*	3	/370/470		*	*		2
/455/436	*		*	*	3	/370/206				*	1
/455/566	*		*	*	3	/455/569.1		*			1
/710/301		*	*	*	3	/702/190			*		1
/713/300	*		*	*	3	/707/705		*			1
/345/87	*		*	*	3	/713/320	*				1

Table F-2: Scenario A - HTC active classes with highest cumulative total of times included in the top ten classes for metrics included (TA-F1-TA-F4).

UPC Class	Cum. Total	Title
/345/156	3	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: DISPLAY PERIPHERAL INTERFACE INPUT DEVICE:
/345/419	3	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: COMPUTER GRAPHICS PROCESSING: Three-dimension
/370/328	3	MULTIPLEX COMMUNICATIONS: COMMUNICATION OVER FREE SPACE: Having a plurality of contiguous regions served by respective fixed stations
/382/232	3	IMAGE ANALYSIS: IMAGE COMPRESSION OR CODING: IMAGE COMPRESSION OR CODING
/455/436	3	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Handoff
/455/566	3	TELECOMMUNICATIONS: TRANSMITTER AND RECEIVER AT SAME STATION (E.G., TRANSCEIVER): Having display
/710/301	3	ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT: INTRASYSTEM CONNECTION (E.G., BUS AND BUS TRANSACTION PROCESSING): Card insertion
/713/300	3	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: COMPUTER POWER CONTROL:
/345/87	3	COMPUTER GRAPHICS PROCESSING AND SELECTIVE VISUAL DISPLAY SYSTEMS: PLURAL PHYSICAL DISPLAY ELEMENT CONTROL SYSTEM (E.G., NON-CRT): Liquid crystal display elements (LCD)

Table F-3: Scenario B (HTC) Analysis of the results of the FCIV-TA cumulative total of times included in the top ten competitor subclasses for metrics included (TA-F1-TA-F4).

UPC Class	AF1	AF2	AF3	AF4	Cum. Total	UPC Class	AF1	AF2	AF3	AF4	Cum. Total
/709/217	*		*	*	3	/455/450	*				1
/709/218	*		*	*	3	/455/458		*			1
/709/203			*	*	2	/455/517				*	1
/709/206	*			*	2	/455/574		*			1
/709/219	*		*		2	/705/26				*	1
/709/223	*	*			2	/707/10		*			1
/713/153			*	*	2	/709/207		*			1
/715/236			*	*	2	/709/224				*	1
/235/380	*				1	/709/229				*	1
/358/1.15		*			1	/710/316		*			1
/370/310			*		1	/713/168	*				1
/370/352		*			1	/713/171			*		1
/380/247			*		1	/715/234			*		1
/380/46	*				1	/715/780		*			1
/455/343.4		*			1	/715/810	*				1

Table F-4: Scenario A - HTC competitor subclasses with highest cumulative total of times included in the top ten classes for metrics included (TA-F1-TA-F4).

UPC Class	Cum. Total	Title
/709/217	3	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/709/218	3	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Using interconnected networks
/709/203	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: DISTRIBUTED DATA PROCESSING: Client/server
/709/206	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER CONFERENCING: Demand based messaging
/709/219	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: Accessing a remote server
/709/223	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
/713/153	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/715/236	2	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Stylesheet based markup language transformation/translation (e.g., to a published format using stylesheet, etc.)

Table F-5: Scenario B (Luxgen) Analysis of the results of the FCIV-TA cumulative total of times included in the top ten classes for metrics included (TA-F1-TA-F4).

UPC Class	AF1	AF2	AF3	AF4	Cum. Total	UPC Class	AF1	AF2	AF3	AF4	Cum. Total
/340/988	*		*	*	3	/345/173	*				1
/455/418		*	*	*	3	/382/118		*			1
/705/70	*		*	*	3	/382/154		*			1
/340/426.19			*	*	2	/455/411		*			1
/340/431	*			*	2	/455/575.9		*			1
/455/414.1		*	*		2	/701/1		*			1
/701/117			*	*	2	/701/115			*		1
/701/301	*		*		2	/701/201	*				1
/705/26	*			*	2	/701/45			*		1
/705/78	*			*	2	/701/46		*			1
/340/445		*			1	/701/48		*			1
/340/461				*	1	/701/99				*	1
/340/989			*		1	/705/35	*				1
/340/994	*				1						

Table F-6: Scenario B (Luxgen) Subclasses with highest cumulative total of times included in the top ten subclasses for metrics included (TA-F1-TA-F4).

UPC Class	Cum. Total	Title
/340/988	3	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION:
/455/418	3	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Programming control
/705/70	3	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Home banking
/340/431	2	COMMUNICATIONS: ELECTRICAL: VEHICLE POSITION INDICATION: For trailer
/455/414.1	2	TELECOMMUNICATIONS: RADIOTELEPHONE SYSTEM: Special service
/701/117	2	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: VEHICLE CONTROL, GUIDANCE, OPERATION, OR INDICATION: Traffic analysis or control of surface vehicle
/701/301	2	DATA PROCESSING: VEHICLES, NAVIGATION, AND RELATIVE LOCATION: RELATIVE LOCATION: Collision avoidance
/705/26	2	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: AUTOMATED ELECTRICAL FINANCIAL OR BUSINESS PRACTICE OR MANAGEMENT ARRANGEMENT: Electronic shopping (e.g., remote ordering)
/705/78	2	DATA PROCESSING: FINANCIAL, BUSINESS PRACTICE, MANAGEMENT, OR COST/PRICE DETERMINATION: BUSINESS PROCESSING USING CRYPTOGRAPHY: Including third party

Table F-7: Scenario B (Big Data) Analysis of the results of the FCIV-TA cumulative total of times included in the top ten classes for metrics included (TA-F1-TA-F4).

UPC Class	AF1	AF2	AF3	AF4	Cum. Total	UPC Class	AF1	AF2	AF3	AF4	Cum. Total
/702/182	*	*			2	/709/200			*		1
/709/217	*			*	2	/709/203				*	1
/709/223	*	*			2	/709/206	*				1
/713/153			*	*	2	/709/207		*			1
/715/236			*	*	2	/709/218				*	1
/715/734		*	*		2	/709/219	*				1
/235/380	*				1	/709/229				*	1
/358/1.15		*			1	/713/165				*	1
/380/46	*				1	/713/171			*		1
/705/14.46			*		1	/715/208		*			1
/705/26				*	1	/715/230		*			1
/705/35	*				1	/715/234			*		1
/705/36R				*	1	/715/700			*		1
/705/37		*			1	/715/740		*			1
/705/65	*				1	/715/780		*			1
/705/66			*		1	/715/783			*		1
/705/78				*	1	/715/810	*				1

Table F-8: Scenario C (Big Data) classes with highest cumulative total of times included in the top ten classes for metrics included (TA-F1-TA-F4).

UPC Class	Cum. Total	Title
/702/182	2	MEASURING CALIBRATING TESTING: MEASUREMENT SYSTEM: Performance or efficiency evaluation
/709/217	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: REMOTE DATA ACCESSING: REMOTE DATA ACCESSING
/709/223	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING: COMPUTER NETWORK MANAGING:
/713/153	2	ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: SUPPORT: MULTIPLE COMPUTER COMMUNICATION USING CRYPTOGRAPHY: Particular node (e.g., gateway, bridge, router, etc.) for directing data and applying cryptography
/715/236	2	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: PRESENTATION PROCESSING OF DOCUMENT: Stylesheet based markup language transformation/translation (e.g., to a published format using stylesheet, etc.)
/715/734	2	Data processing: presentation processing of document, operator interface processing, and screen saver display processing: OPERATOR INTERFACE (E.G., GRAPHICAL USER INTERFACE): Interactive network representation of devices (e.g., topology of workstations)