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Innovation and Economic Growth: The Case for Business Method Patents in China

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Abstract

Economic growth is based on innovations replacing old technologies, which drive entrepreneurial investments, creating change or creative destruction. Sustained economic growth comes not from imitation but technological innovation. In the United States software patent law expanded to recognize software patents including business method patents, inventions based on computer-based algorithms which produced tangible results. The result was a rise in industrial and commercial business method patents producing a beneficial economic benefit. The rush to exploit the enlargement in business method patents' principles, and the new flood of inventions seeking protection that followed challenged the evolving rules of software patents and limiting modifications in the theories and procedures governing business method patents.

Recently China's State Intellectual Property Office amended the Patent Examination Guidelines to allow software patents for business methods. China's goals of national development call for increased emphasis on innovation by the private sector. The expansion of business methods patents, similar to the US experience is a way to attain this goal.

***Keywords*:** *Business method patents, software patents, economic justifications for patents, innovation, United States Patent Law, People's Republic of China Patent Law*

1. Introduction

It is manifest that today's world revolves not only around the sun, but also technology. This paper explores one aspect of intellectual property, software patents and particularly business method patents. In the United States, judicial support of a patent for software has waxed and waned. Despite these peaks and valleys, as will be discussed, business method patents have continued to grow in amount and value. In the United States significant changes in the patent system during the 1980s and 1990s extended and strengthened the patent process and business method patents in particular. Despite qualms about relative value, business method patents are being more actively acquired and vigorously enforced in those countries which recognize this form of intellectual property protection.

Recently China's State Intellectual Property Office of the P.R.C. announced amendments to the Patent Examination Guidelines which are effective as of April 1, 2017. The changes seek to address concerns that some examiners have been too guarded by considering references to business models or computers as signs of unpatentability. Language changes in the new rules explain that claims relating to a business method are not excluded from patentability if they contain sufficient technical features. Specifically claims related to business methods that contain both business rules and methods and technical features shall not be excluded from the possibilities of obtaining patent rights under Article 25 of the Patent Law. Regarding inventions related to computer programs a claim composed in a style as "mediums plus a computer program" is allowable. Also, a claim directed to an apparatus may include a program as a component part (Leung, 2016).

In 1999 Lawrence Lessing, a Harvard University professor, published the 1999 book *Code and Other Laws of Cyberspace*. The primary idea of the book, as expressed in the title, is the notion that computer code regulates conduct in much the same way that the legal code does. More generally, Lessing argues that there are actually four major regulators namely law, norms, market and architecture each of which has a profound impact on technology, and for Lessing, wider society. For the purposes herein the initial definition helps bring focus on business method patents. The first of Lessing's controls are laws, rules made by government of which for the purposes of this paper aspects of patent law will be addressed. Another regulator is norms, behavior patterns adopted by users. The next aspect is the market: what makes money and what doesn't, as price and profit drives change. Finally, "The Code" the hardware, software and communication protocols defining computer technology that allows programmers to create their own rules: grant or deny access,

provide rules of use, govern transactions, in effect, to make private law. These different forces are shaping and channeling technological change and will be addressed (Lessing, 1999).

The event which makes the topic of this paper fitting at this time is a significant change in patent law in China opening a window which signals the protection of business method patents and more generally software claims of patentability. The effects of this new change cannot be predicted, yet the experience in other countries can shed light on how this could transpire and can be used as a guide. Accordingly, this paper's focus explores business method patents as they have evolved in the United States. The US is the only country which has firmly taken hold of business method patents, although this embrace has changed in warmth and intensity over the years. If will be argued that given China's announced goals of national development China would profit in a number of areas from broadly recognizing software patents.

2. Objectives

The main objectives of this research are to explore the drivers of technological innovation and how this relates to the protecting of ideas through an intellectual property system. Specifically, patents of software and the expression of this through business patents will be explored. The progressive history of business method patents in the United States will be reviewed with a focus on the rationale for the recognition of business method patents, the type of protection and how the scope of this type of protection has changed. Changes to China's patent guidelines will be introduced and compared to the experience in the United States to draw some conclusions on how China can benefit from the US experience with business method patents.

3. Methodology

The methodology employed in the instant research is literature review. Publications addressing the issues explored in this paper include peer-reviewed research papers relevant to the topic, the most authoritative legal cases from the highest appellate courts which are recognized for establishing principles under discussion herein, plus official government publications and websites which announced or explained government policy on the topics explored in in this writing. Both quantitative and particularly qualitative sources are included. The inclusion standards used in this research paper is peer-reviewed, for legal cases the most enduring precedents are included and government information presents appropriate pronouncement of government standards and policy.

4. Discussion

4.1 Patents and innovation

Innovation accumulates expertise and ability in industrial sectors resulting in more brisk development of particular industries correlating with economic development. Invention is a potent dynamic which distinguishes successful businesses as well as the divergence in cross-country economic growth, hence it plays a critical role in changing patterns of competitiveness at the national, regional and firm levels. In addition, particular innovations and the speed of their adoption imply significant and far-reaching changes in quality and quantity of employment (Najda-Janoszka, 2014)

Joseph Schumpeter's widely recognized growth model is based on three ideas: first, new innovations replace old technologies, second, long-run growth results from innovations which are driven by entrepreneurial investments motivated by the prospects of monopoly rents and finally growth involves creative destruction. It is axiomatic that countries transit from a technological paradigm exclusively or largely based on imitation of foreign technologies to one with an increasing percentage of domestic innovation (Aghion, 2015).

There are four broad theories about the purposes patents serve in commerce. First, patents provide motivation for useful inventions. Second, patents induce needed investments to develop and commercialize them. Third, patents reward individuals who disclose their inventions as part of the patenting process. Lastly, patents enable the orderly exploration of a broad prospect or ongoing benefit from the invention (Mazzoleni, 1998). The fact that patents motivate useful invention is the most familiar theory about the economic function of patents. The underlying assumption is patents are needed to provide firms with the incentive to invent, and that this does justify the costs of the temporary monopoly their granting gives. It must be observed that the

granting of patents entails economic costs as well as potential economic benefits. Accordingly, broad patents should not be granted lightly as in some cases firms charge very high prices for their patented products. Also, firms can maximize a patent into a monopoly or near monopoly position in an important product fields. Light bulb patents enabled GE and Westinghouse to prevent entry into the light bulb business in the US for many years.

If an inventor cannot exploit all possible uses of the invention, then, to the extent that the publication of a patent attracts the attention of parties who can make use of the invention, patenting can increase use. From a commercial, entrepreneurial standpoint patents represent something of important material value to potential investors. The impression that holding a patent signifies something of substance and profit potential can have more "psychological" than legal value, attracting venture capital. From the perspective of protecting valuable commercial assets, methods of doing business safeguarded by a patent provides assurances to investors, or possible purchaser of a company that the technology can be shielded from unwanted misappropriation. Patent protection fortifies the defenses – beyond the common method of trade secret protection – an organization has against competition from former employees in taking intellectual property with them should they leave a company. Finally, patents protection for keys methods of doing business increase the so-called "freedom of operate" which might be constrained by the being obligated to curtail or cease promising research and development in certain areas of technology by being required to pay royalties. Commonly a company's desire to hold patents of its own which can be used to enter into cross-licensing agreements with other patent owners. On a positive note the presence of a patent incentivizes competitors to work on alternatives that may be very different from what is already patent (Hanson, 2010).

The argument suggests that an important issue on which the analysis of the benefits and costs of granting patents on the beneficial prospects the invention holds turns on the market for patent licenses. On the plus side if one assumes the transaction costs of patent licensing would be slight and patents could be freely licensed broad patent grants would be preferable. On the other hand, if one believes that transaction costs often are high, and patent holders are prone to litigation the prospects of a broad patent are less obvious (Mazzoleni, 1998).

The evolution in the recognition of the value and acceptance of business method patents derives from the similarities and differences between two areas of intellectual property copyrights and patents as it is found in the expression of computer programs. In intellectual property law, generally computer software is an originally authored work commonly protected by copyright law. Computer programs are functional causing a computing machine to work toward achieving a certain beneficial outcome. This combination of ideas leads to the conclusion the computer programs can accomplish many valuable commercial functions largely outside the scope of copyright law. This combination could be better protected by patents. It can be asserted that the differences between copyrights, which protect *non-functional* works of computer programs, and patents which have the key role of protecting *functional* works of computer programs should be protected by patents and not copyrights (Zekos, 2014).

The perception and value of patents has changed significantly in recent history. Two decades ago companies had patents, but, with the exception of pharmaceuticals, patents were legal instruments only cautiously exploited in business. Used defensively, patents were used mainly for protecting key products and manufacturing processes from imitation. Patents have grown in importance becoming essential in the information and communications technology sector (Rivette & Kline, 2000). In exchange for the patent monopoly, the Patent Act forces inventors to disclose the know-how expressed in the patent. This disclosure has the effect of increasing public access and knowledge of the business method that would have been kept secret. According to innovation theory, firms are likely to be more willing to advertise and license their business methods under a patent regime than under a non-patent format such as a trade secret regime. However, in order to profit from the gains associated with disclosure before the patent expires, the patent holder must decide to license the patent to other interested parties. In general, patent holders will be willing to license their inventions in two ways: one, where the patent holder does not possess the resources to develop the invention and bring it to market and second, patent holders may license inventions to firms in other business lines desiring to use the invention in different ways from the patent holder (Grusd, 1999).

Most economists consider the patent system as an evil that must be allowed for a greater good to result. Patents represent a trade-off, first a relatively short-term exclusive right in an invention in return for

an incentive to create innovation, and second the publication of the innovation as part of the patent granting process for the reference of all. Fewer innovations would be produced without the patent system and those that were produced might be kept as secret as possible to protect and exploit the original idea. The patent system also is a vehicle for investment as a valuable idea will attract sponsors seeking to profit from the commercialization of the invention. In considering the economic impacts of business method patents the costs and benefit tradeoffs between the grant of a monopoly right and the benefits are at least as important as they are in any other technological arena (Hall, 2009).

Software patents proponents argue that the public disclosure requirement of patent laws gives other software developers information to develop new software inventions (based on the underlying ideas in the previous invention) without infringing on any of the disclosed claims of which the new inventor is aware and can now avoid duplicating. The patent term is far shorter than the respective terms in copyright or trade secret (which is potentially unlimited) and, therefore, the protected invention is outside of the public domain for less time (Nieh, 2010).

Empirical studies commonly conclude that patents are the most powerful form of legal protection. The extensive practice of patents in high-tech sectors is driven by the need to protect innovative ideas and methods but also to strengthen the bargaining power of firms in cross-licensing. Developing high-tech products requires multiple sourcing of industry knowledge and building a wide patent portfolio protects firms more often against claims of intellectual property infringement rather than imitative practices of competitors (Najda-Janoszka, 2014).

4.2 Patent jurisprudence in the United States

As a beginning a common fallacy is that business method patents in the US did not exist until the 1990s, but arguably the first grants date back to the 1790s. The U.S. Patent Office granted forty-one such patents in its first fifty years, including its first two: Detecting Counterfeit Notes, granted to Jacob Perkins in March 1799; and A Mode of Preventing Counterfeiting in April 1815 to John Kneass. The earliest stock printing communications systems arrived with Edward Calahan's stock telegraph printing instrument in 1867. These early methods were of course not operated by software by mechanical registering devices. The birth of business data processing was in 1889 when the first electromechanical data processing system was granted three patents for automating and tabulating statistical information for businesses. In 1924 Thomas J. Watson renamed his Tabulating Machine Company to International Business Machines (IBM) (U.S. Patent & Trademark Office, 1999).

It is instructive to trace the authority and jurisprudence in the United States common law system. Patent law principles in the United States have existed since the enactment of the current US constitution which came into effect in 1789. As authorized by the U.S. Constitution, Article One, section 8, clause 8, which states: The Congress shall have power ... To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries; Upon that constitutional basis the organic statutory enactment underlying patent law is relatively brief as found in 35 U.S.C., section 101, which states that: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

Patentability rests on five essential elements: proper subject matter, utility, novelty, non-obviousness, and disclosure. Section 101 specifies four independent categories of inventions or discoveries that are eligible for protection: processes, machines, manufactures, and compositions of matter. Court precedents provide three specific exceptions to §101's broad patent-eligibility principles: "laws of nature, physical phenomena, and abstract ideas." The exceptions are not required by the statutory text, but are consistent with the idea that a patentable process must be "new and useful." (Diamond v. Chakrabarty, 1980).

An observation on which U.S. courts hears patent matters. In the United States court system The United States Court of Appeals for the Federal Circuit in Washington, D.C. was created by Congress with passage of the Federal Courts Improvement Act of 1982. This legislation merged the United States Court of Customs and Patent Appeals and the appellate division of the United States Court of Claims. The Federal Circuit renders key decisions on patent law, as it is the only appellate-level court with the jurisdiction to hear patent case appeals. In cases where the ultimate court in the US, the Supreme Court has an issue with a

Federal Circuit decision, it can hear an appeal from one of the litigants to address the matter. United States Court of Appeals for the Federal Circuit Court (2018).

As a general observations, machines with working parts had always comfortably fit within section 101 as patentable subject matter. This early business methods protection, i.e., non-software based business methods, were based on mechanical, electromechanical, and later transistor technology for instructions. As the instructions were sufficiently tied to utility through the actions performed by the machines, patentability was not an issue. However, as technology advanced to software based on algorithms that generated the solutions, the argument that the abstractions of thought could now be separated from the action of the computing platform. Thus, it was the computing platform that came to provide utility. Microprocessors employing transistor technology would calculate and store data, and peripheral devices would receive inputs, perform outputs, and take on other required functions. The patent system was left with a significant dilemma: Why should instructions be any less patentable as (i) software functioning on a microprocessor platform than as (ii) hardwired data etched on transistors of an outdated hardware machine? This dilemma needed to be overcome. In addition, recognizing patentable business methods proved problematical because most modern business methods are expressed in computer software. Arguably software-embodied business method constitute a "process" under § 101, but attempts to patent software collided with the long-established rule that laws of nature, physical phenomena, and abstract ideas are not patentable subject matter Tousi and Ralph (2009).

An early case *Gottschalk v. Benson* saw claimants who had invented a faster and more efficient mathematical procedure for transforming the normal "decimal" type of numbers (base 10) into true "binary" numbers (base 2) which are simpler to process within computers. The program worked in a general purpose digital computer. The United States Patent Office rejected the patent application as representing a mathematical expression. US courts had previously held that pure mathematical expressions to be unpatentable. The *Gottschalk* court quoted Mackay Co. v. Radio Corp. (1939) in ruling a process claim directed to a numerical algorithm was not patentable because "the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself." (Gottschalk v. Benson, 1972).

As demonstrated in *Gottschalk* the three notable exceptions to patentability, laws of nature, natural phenomena, abstract ideas, created a great conceptual roadblock in the recognition of software patents as expressed in business methods. The meaning of these terms might seem fairly obvious, but the US Courts had great difficulty coming to concrete definitions as the following cases demonstrate. Legal scholarship grappled on defining what these terms meant in a commercial, scientific or philosophical context – that is, what science considers to be a "law of nature", whether a phenomenon is "natural", or when a product is "of nature" (Sherkow 2014).

The road toward business method patents became smoother in (Diamond v. Diehr, 1980). The invention at issue was an improved press that cured rubber by controlled heating. The press measured the temperature rise of the rubber in the press and through a process calculated the rubber cure time with a computer which was able to determine when to open the press and eject the cured rubber. Under initial patent review the patent was rejected using the rationale of *Gottschalk v. Benson*. The Patent Office argued the inventors had simply combined an unpatentable program with a conventional rubber curing press. Disagreeing, the court held that a machine that transforms materials physically under the control of a programmed computer is patentable. Importantly, the court reasoned that while mathematical algorithms or abstractions by themselves may not be patented, they may be patented if applied to physical elements or process steps such as a significant activity of utility following the number crunching. In addition, upholding *Gottschalk v. Benson* the court explained that a mathematical procedure cannot be patented, but that all computer programs are not unpatentable leaving undecided the question of whether computer programs standing alone could ever be patentable (Diamond v. Diehr, 1980).

The road for business method patents was substantially cleared in a 1998 case *State Street Bank and Trust Company v. Signature Financial Group, Inc*., where the court articulated the business method exception, declaring that business methods were patentable as long as they yielded a useful, concrete, and tangible result. In *State Street Bank*, the patent was related to a data processing system for implementing an investment strategy. The description of the patent in the court's decision was that it was "generally directed

to a data processing system (the system) for implementing an investment structure which was developed for use in Signature's business as an administrator and accounting agent for mutual funds." In essence, the system, identified by the proprietary name Hub and Spoke, facilitates a structure whereby mutual funds (Spokes) pool their assets in an investment portfolio (Hub) organized as a partnership. This investment configuration provides the administrator of a mutual fund with the advantageous combination of economies of scale in administering investments, coupled with the tax advantages of a partnership. The court reasoned that it would be inappropriate to prevent an otherwise patentable invention from being issued a patent simply because it is implemented using a computer. This fit squarely within the prior definition of a "business method" invention, and the court held it to be patentable (State Street Bank and Trust Company v. Signature Financial Group, Inc.,1998).

Arrhythmia Research Technology, Inc. v. Corazonix Corp. was another in the line of cases which opened up the recognition of business method patents in United States jurisprudence. It could be argued that based on the beneficial result of the device in question the court fashioned new rationale to protect the novel development. The invention was a monitoring device that analyzed electrocardiographic signals to determine certain characteristics of heart function. The monitoring device was capable of determining which heart attack victims were at the highest risk for ventricular tachycardia. Certain steps of the invention were described as conducted with the aid of a digital computer, and the patent set forth software instructions that were used to configure the computer. The machine accepted input signals from a heart monitor, but the core of the invention was software. The heart signals were manipulated using software, which required the use of mathematical formulae. The resulting, manipulated information was displayed in wave form on a monitor and/or recorded on a chart. The core of the invention was unquestionably software. The input signals were manipulated using software, which required the use of mathematical formulae. The court found the invention patentable relying on the language of the patent statute. The court concluded that the "apparatus claims satisfy the criteria for statutory subject matter…directed to a specific apparatus of practical utility and specified application…" (Arrhythmia Research Technology Inc. v. Corazonix Corp.,1992).

Claims involving the combination of computer programs and machines were further supported in jurisprudence in In re Alappat. The claimant Alappat was an oscilloscope manufacturer that devised a novel digital oscilloscope. The problem the invention solved was to smooth waveform data before displaying the waveform on an oscilloscope screen. Alappat had devised an algorithm which when applied to the oscilloscope inputs "smoothed" the waveform display. The court found that Alappat claimed "a machine for converting discrete waveform data samples into anti–aliased pixel illumination intensity data to be displayed on a display means," and not an abstract idea. The court noted that "Alappat admits that claim 15 would read on a general purpose computer programmed to carry out the claimed invention." The court nonetheless found that this did not preclude the issuance of a patent because the claimed subject matter was nonetheless a machine. "We have held that such programming creates a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software." The Alappat court defined a "two-step test process" regarding the computer algorithm, holding that a software invention as a whole is patentable if a mathematical algorithm can generate any "practical, concrete and tangible result…" (In re Alappat, 1994).

Further extensions of the *State Street* reasoning was found in (AT& T v. Excel Telecommunications, Inc., 1999). AT&T Corp. was issued a patent for a message-record system that would aid long-distance carriers in establishing differential billing for customers based on the identity of the long-distance service provider used. The patent included claims for a process that involved using a mathematical formula and caller information to calculate different billing rates. In 1996, AT&T brought a patent infringement suit against Excel Communications, Inc. for a similar system. The district court held that several of the claims included in AT&T's patent simply recited a mathematical formula and were thus invalid as unpatentable subject matter within the recognized exception for laws of nature. AT&T argues that the claims in its patent are valid subject matter under the Patent Act. In the decision the court confirmed the patent relying on the *State Street* decision explaining that "…the focus is understood to be not on whether there is a mathematical algorithm at work, but on whether the algorithm-containing invention, as a whole, produces a tangible, useful, result." (AT & T v. Excel Telecommunications, Inc., 1999).

A fork in the road — significant limitation to business method patents — was promulgated in Alice Corporation Pty. Ltd.v CLS Bank International. Alice Corporation held four patents for a financial trading system that spread the risk of non-payment for the buyer and seller by mitigating the risk with a third party. Effectively the third party held the payments between the buyer and seller in escrow. CLS Bank started a similar service and Alice sued for infringement. CLS countersued, alleging the invalidity of Alice's patents. All of these processes were machine-based. The issue the court framed was are the claims regarding computer-implemented inventions — including systems, machines, processes, and items of manufacture — patent-eligible subject matter? The court held no, reasoning that patent law should not restrain abstract ideas that are the "building blocks of human ingenuity" and held all of Alice's claims ineligible for patent protection. Because using a third party to eliminate settlement risk is a fundamental and prevalent practice, it is essentially a building block of the modern economy. "(T)he claims at issue are drawn to the abstract idea of intermediated settlement, and that merely requiring generic computer implementation fails to transform that abstract idea into a patent-eligible invention." The Court held that Alice's claims did no more than require a computer to implement the abstract idea of "intermediated settlement" by performing common computer functions, which is not enough to transform an abstract idea into a patent-eligible invention. The court enunciated a 2-pronged test on patentability for software inventions. The 2-part test asks: (1) whether the claims at issue are directed to patent-ineligible concepts; and (2) if yes, is there something "significantly more" in the claim to ensure that the claim is not merely covering just the ineligible concept. The "significantly more" is characterized as a search for an "inventive concept," , an element or combination of elements that ensures the patent in practice amounts to significantly more than a patent on the ineligible abstract idea itself (Alice Corporation Pty. Ltd. v. CLS Bank International, 2014).

Besides court cases such as Alice which narrowed the definition of business method patents the US Congress' passage of the America Invents Act of 2011 further narrowed business method patents. AIA placed administrative roadblocks in the way of patent filers. Reacting to the perception of patent abuse from overly ambitious seekers of legal protection for software related inventions, the AIA law established the USPTO's Patent Trial and Appeal Board (PTAB) and created covered business method (CBM) review proceedings. A CBM proceeding can be used to invalidate patent claims directed at a method or a corresponding apparatus that performs data processing related to the practice of administration or financial services. This check has had a beneficial impact on limiting the outer bounds of business method patent software protections (American Intellectual Property Law Association, 2017).

4.3 Chinese business methods patents

Under Article 25 of the most recent Patent Law, "rules and methods for mental activities" are not patentable subject matter. This includes business methods, which may be involved in computer program-related patent applications. In Chinese patent examination practice, a business method claim will be rejected for falling within the scope of "rules and methods for mental activities" if it includes only human-made business methods and no technical means. The April 1 2017 revisions by the State Intellectual Property Office (SIPO) Guidelines for Patent Examination amended the guidelines in respect of computer programs, the amended patent examination guidelines broaden patentability by explicitly stipulate that "if a claim is defined by not only rules and methods for mental activities but also technical features, the claim, as a whole, is not one of the methods and rules for mental activities, so it should not be excluded from patentability in accordance with Article 25 of the Chinese Patent Law". In other words, according to the PRC State Intellectual Property Office, a claim is usually deemed to meet the subject-matter requirements if it contains technical features and is subject to patentability evaluation under other criteria.

The recent SIPO amended guidelines in respect of computer programs, include the following:

- An apparatus as the subject matter may comprise not only hardware, but also computer programs.
- "Virtual apparatus" should be interpreted as a program module architecture that implements a solution mainly using a computer program that is disclosed in the specification. The modules constituting the virtual apparatus are program modules, which are different from the usual functional features.

- The latest guidelines clarify that "a computer-readable storage medium defined solely by a computer program per se which the medium records" is non-patentable subject matter. Therefore, a computer program-related invention protectable under the Patent Law is distinguishable from computer programming codes that are protectable under the Copyright Law. In other words, in patent practice the claim of a computer program-related invention may now be written in the form of "medium + computer program flow" (Guangyu, 2017).

According to SIPO's interpretation, the claim form "medium + program" – which is a permissible form for "a pure software solution" in United States patent jurisprudence – will also be allowed in China. The fact that "the constituting parts of an apparatus include not only hardware but programs as well" means that for a solution combining software and hardware, a 'program' may constitute a claim element parallel to other hardware elements. This implies a reformed approach by the administrative authorities which should contribute to reinforced protection of software patents. Under these guidelines patentable subject matter in China encompasses methods, virtual apparatuses and apparatuses including the forms "processors + memories", "medium + program" and "hardware + program" (Zhou & Song, 2017).

4.4 The United States' tortured road to business method patents and China's direction

The direction and commitment toward innovation and technology for China can be found in the National Medium to Long-term Plan for the Development of Science and Technology (2005-2020). Introduced in January 2006, the National Medium to Long-term Plan for the Development of Science and Technology (MLP) offers some momentous changes in the Chinese way of science. Earlier efforts focused on strong government leadership to achieve scientific and technological development while the current emphasis is stimulating the innovative capabilities of Chinese companies and giving them support to succeed in international market competition. The broad objectives of the MLP are to create an "overall well-off society" by 2020 characterized by a high degree of innovative capabilities. In furtherance of this plan, China initiated a number of national programs to address the innovation deficit include those run by the Ministry of Education or the Chinese Academy of Sciences. The MLP offers numerous quantitative measures of success. Objectives tied to this goal include raising overall national R&D expenditures to 2.5 percent of China's GDP by 2020, up from 1.34 percent in 2005 and 1.7 percent in 2009. Also Reducing China's dependency on foreign technology to less than 30 percent in 2020 and joining the top 5 countries in terms of invention patents granted annually (State Council People's Republic of China, 2006).

A central objective of the MLP is to build and strengthen the national innovation system and a capacity for "indigenous innovation" requiring Chinese industrial enterprises to replace government research institutes and universities as the center of the national innovation system. Under this initiative Chinese companies have been the beneficiaries of policy preferences and funding to an extent not seen before. The goal is to integrate enterprises, institutes and universities in collaborative research efforts, and to promote, among other facets, patenting within companies (Springut, 2011).

Academic, industrial, and technological practices of business in the post-WWII era had a profound influence on the rise of business method patents in the United States. The mid-20th century saw the emergence of operations research that applied logical structures which crunched data in new, novel ways to address business problems. This coincided with the incorporation of engineers and physical scientists into the academic disciplines of business, economics, and management. This was first felt during the 1980s in the financial industry with the influence of "quants", commonly former academics in mathematics or physics who fashioned new ways to apply the computer to a myriad of problems. Financial engineering is an amalgamation of finance, economics, business, political science, and statistics. This resulted in systems such as the ability to time the sale of huge volumes of stock to minimizing transaction costs and maximize profits or to assess the risk and value mortgage-backed securities. Another indicator influencing business method patents can be observed in university programs, especially the programs at top engineering and technical schools. Since the 1980s, numerous universities have created courses, programs, laboratories, and even whole departments dedicated to the study of topics like financial engineering. Eight of the top ten and fifteen of the top twenty engineering universities in the US have degrees, programs, concentrations, on financial engineering, or as it is less commonly called, quantitative finance or financial mathematics. The programs

tend to be interdisciplinary focusing on a university's business school, but with participation from other departments in engineering, mathematics, and statistics (Duffy, 2011).

Historically patent laws can have important effects for channeling and intensifying economic growth. As a general observation, innovation in countries without patent laws clusters in small industrial groups whereas innovation in countries with patent laws is much more diversified as it appears that patents serve to expand the set of industries where innovation is attractive to inventors. Patent laws influence innovation by creating profit incentives, working as a conduit directing innovation by bending in a positive direction a country's comparative advantage (Moser, 2005).

Innovation involves many factors of invention and commercialization, and measure of if a country is innovative is the number of inventions that can be commercialized into useful products. The most aggressive definitions of software patents, such as found in the liberal post *State Street Bank and Trust Company* period resulted in a large increase in the number of business method patents recognized and subsequently commercialized. The US experience post — *State Street* demonstrated the result of a liberal reading of the subject of patentability. The findings of *State Street* Bank and follow on cases resulted in a dramatic increase in business method software patents. Software patent numbers climbed from around 30,000 per year to over 100,000 per year in the 10 years following the 1998 decision. Business method patents ranged from e-commerce, cell phone apps, to insurance, banking, tax compliance and financial services. It was asserted in many quarters that the United States Patent and Trademark Office was ill-equipped to properly examine the flood of filings, and excessive, overly broad claims were granted (Merges, 1999).

A diverse number of business methods were protected. For example, the PTO issues patents covering financial instruments, online gambling, health care administration systems, and a method of distributing digital music. Other method patents related to new or enhanced product attributes rather than new products. Many e-commerce patents protected features of Internet retailing sites. Patents were granted for such products and services as an online auction method, a method for real-time payments for Internet transactions, a patent for an online method of evaluating credit risk, a method for paying web users who view web advertising and methods of protecting consumer privacy. Patents also allow a patent owner to distinguish a retail site with distinctive characteristics. Administrative method patents touched on a variety of management techniques including financial method patents relating to the analysis and presentation of financial data, inventory and distribution management methods (Meurer, 2002).

During the boom years of patenting software in the US, these grants concentrated in some surprising areas. In the second half of the 1990s, firms in the software industry received 1% of all patents granted to firms and at most 7% of all software patents. Manufacturers accounted for 3 out of 4 software patents. Firms in just three manufacturing industries (machinery, electronics, and instruments) alone accounted for two thirds of software methods patents granted to firms. Manufacturers of machinery, electronics, and instruments employed only 6% of all computer programmers and yet they obtained 2 out of 3 software patents (Bessen 2004).

China's push to emphasize the private sector in innovation can benefit from a liberalized business method patent regime. Historical data strongly suggest that intellectual property has a significant effect on the direction of innovation. Software patents are correlated with successful investments and assist smaller competitors in challenging larger industry competitors and contribute to decentralization in the technology industries. Patents facilitate intra-industry technology transfers upon which innovation depends in a realm of cumulative innovation (Mann 2007).

China has seen remarkable growth in innovation and business method patents can expand this accomplishment. Over the years 2012-2015 information communication technology patents accounted for about 34% over all patent categories filed in OECD countries, with the figure having stayed constant for the past decade. In contrast, China has increased its share by 40% and its filing became more specialized in the ICT sector. In 2017, more than 1.3 million patent applications were filed with China's State Intellectual Property Office, the largest patent filing total for any country and greater than the combined filings that year in the United States, Japan, South Korea and Europe. In 2016, China was also the top nation for patent application filings, the first year that the country broke one million filings in a one-year period (OECD, 2017).

Success in the commercialization of inventions in the United States' can be attributed to its pro-innovation patent system and its leading position in patenting. Although many inventions start with inventors'

intellectual novelties, patents are particularly important in securing financial investment and technology licensing in the commercialization process. It can be argued that the weakness in the commercialization of inventions in most Chinese industries indicates that the role of intellectual property laws needs to be strengthened. Despite the impressive number of patent applications, China remains a largely imitation-oriented country. For example, it was estimated that the commercialization of inventions in Chinese universities is about ten percent, which is fairly low compared with thirty percent commercialization rate at universities in industrialized countries. Without commercialization, many inventions, even patented, will remain in laboratories. A liberalization of patent protection through a strong support of business method patents would spur innovation and commercialization efforts in China (Li, 2011).

As the US experience demonstrated, an expansive reading of software patents for business methods can produce excessive and unproductive business method software filings. China's patent protection of computer programs has also taken a positive direction in broadening the definition for software protection. China's late start in patent protection – China's modern intellectual property laws are less than 30 years old – coupled with the rapid development of the software industry means existing laws and regulations are imperfect. Therefore, China can not completely copy the software patent protection measures of United States but must go forth from the reality of China's current software industry development in light of national goals for innovation and commercial development (Zhou & Song, 2017).

5. Conclusion

China's aspirations as set forth in official government proclamations are to spur academic, industrial, and technological advances. The US's history is that stronger, broader patent laws advanced commerce particularly in the financial area. A virtuous circle of successful, innovative financial products secured by business method patents – with important contributions by the academic community – stimulated more academic/business collaboration which produced more beneficial financial products. University faculties such as business, engineering, mathematics, and statistics greatly profited from these relationships. China's foray in offering business method patent protection could help foster more innovation on the part of academia by offering an easier and more profitable road to the commercialization of original ideas and designs not only directed toward the consumer, but in the manufacturing area.

The broadening of the definition of software patents saw the growth of business methods in the US, helping to attract investment which fueled a concentration of innovation in technology. This thrust saw tremendous economic growth, particularly in the 1980's and 1990's. The protection afforded to software patents spotlighted innovation, allowing investors to channel resources toward innovative, commercially viable products and services which benefitted consumers and particularly industry. China's desire for technological growth is not by imitation but through innovation. Broad software patent laws helped to broaden and diversify innovation throughout industries China's desire is to develop the private sector could result in a similar narrative as experienced in the US.

Lawrence Lessing's observation that technology is govern by law, the market, norms and architecture is a fitting paradigm in support of an expansive and far-reaching spin on business method patents. The experience in the United States demonstrates that as the courts extended the law for software patents – the architecture – to encompass business methods the market responded by innovating novel and useful products across a wide range of industries in a variety of applications. New commercial norms entered the marketplace and the overall economy profited.

The United States benefited from the expansion of business methods patents by increasing innovation, allowing entrepreneurs to develop new methods of industry and commerce which benefits business, consumers and the goal of national development. Hopefully the recent developments in China's intellectual property scheme will produce the same synergies, opening the door and facilitating business to push China's entrepreneurial spirit toward meeting the ambitious targets it has set for national technological development.

Future research on this topic could encompass the reaction to China's changes in software patents. Has the modification resulted in a positive effect, a spur the innovation and commercial growth, or has less beneficial outcomes requiring the modification of regulations resulted?

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