RESEARCH VERSUS DEVELOPMENT: PATENT POOLING, INNOVATION AND STANDARDIZATION IN THE SOFTWARE INDUSTRY

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ABSTRACT

Despite the impressive pace of modern invention, a certain "patent thicket" effect that may be impeding what has become an increasingly difficult road to the commercialization of new technologies. Specifically, as new technologies build upon old technologies, they necessarily become increasingly complex, and as a result, are often subject to the protection of multiple patents, covering both the new cumulative technologies as well as old foundational technologies. The difficulties of acquiring licenses (e.g. hold-out problems) for all such patents has the potential to stifle the development and commercialization of these new technologies. As such, patent pooling, once condemned as facilitating antitrust violations in past eras, has been reintroduced as a practice that, if properly structured, has potentially strong pro-competitive benefits. Patent pooling has the potential to reduce the level of research and invention in new technologies that can compete with an incumbent standard. Recent patent jurisprudence and lenient federal antitrust agency of recent patent pooling proposals seem to create an environment that encourages the resurgence of patent pooling.

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> The master programmer stared at the novice. "And what would you do to remedy this state of affair?" he asked.
>
> The novice thought for a moment. "I will design a new editing program," he said, "a program that will replace all these others."
>
> Suddenly, the master struck the novice on the side of his head. It was not a heavy blow, but the novice was nonetheless surprised. What did you do that for?" exclaimed the novice.
>
> "I have no wish to learn another editing program," said the master.
>
> And suddenly, the novice was enlightened.
>
> from *The Zen of Programming*

I. INTRODUCTION: PATENT POOLING IN JAPAN

Despite the impressive pace of modern invention, commentators have observed a certain "patent thicket" effect that may be impeding what has become an increasingly difficult road to the commercialization of new technologies.[1] Specifically, as new technologies build upon old technologies, they necessarily become increasingly complex, and as a result, are often subject to the protection of multiple patents, covering both the new cumulative technologies as well as old foundational technologies.[2] The difficulties of acquiring licenses (e.g., hold-out problems) for all such patents has the potential to stifle the development and commercialization of these new technologies. As such, patent pooling, once condemned as facilitating antitrust violations in past eras, has been reintroduced as a practice that, if properly structured, has potentially strong pro-competitive benefits. However, while the most recent patent pooling literature extols its pro-competitive virtues and ability to reduce the problematic patent thicket, none seem to adequately examine the innovation effects of patent pooling with regard to standard-setting technologies. This lack of literature is understandable because innovation, as opposed to commercialization, does not seem to have been weakened by the patent thicket.

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[1] *See* Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, NBER Conference on Innovation Policy and the Economy (May 4, 2000).

[2] *See id.* at 1.

However, if patent pooling practices increase in highly standardized industries such as software, as is likely to be the case, the patent thicket may be cleared, but research and innovation in those industries may become misdirected or even stifled. As described in this Article, patent pooling has the potential to reduce the level of research and invention in new technologies that can compete with an incumbent standard. In addition to the recent pro-patent pooling literature, recent patent jurisprudence and lenient federal antitrust agency of recent patent pooling proposals do seem to create an environment that encourages the resurgence of patent pooling. In particular, recent patent jurisprudence has narrowed the scope of patent protection that ultimately may lead to an increase in the "narrow" patents that are needed to commercialize a technology. As such, before delving into the innovation effects of patent pooling in standardized industries, this Introduction offers as motivation a brief comparison of the U.S. patent system to the Japanese patent system, where patent scope is narrow and patent pooling is a common industry practice.

On November 29, 2000, the Federal Circuit, in a landmark decision, essentially ruled that no range of equivalents is available for patent claims whose scope has been narrowed by amendment.[3] The *Festo* decision severely limits the doctrine of equivalents under the patent laws of the United States.[4] As a result, the scope of

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[3] Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558, 563-64 (Fed. Cir. 2000), *cert. granted*, 533 U.S. 915 (2001). The court provided the following answers to four questions that were posed for briefing: (1) for determining whether an amendment for a claim represents prosecution estoppel history, "a substantial reason related to patentability," Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 25 (1997), is not limited to overcoming prior art, but includes other reasons related to the statutory requirements for a patent; (2) "voluntary" claim amendments are treated the same as other claim amendments; (3) when a claim amendment creates prosecution history estoppel, no range of equivalents is available for the amended claim element; and (4) "unexplained" amendments are not entitled to any range of equivalents.

On June 18, 2001 the Supreme Court granted Festo's petition for writ of certiorari and is scheduled to hear oral arguments on January 8, 2002. 533 U.S. 915 (2001). Festo presents two questions for the Court's consideration: (1) whether every claim-narrowing amendment designed to comply with any provision of the Patent Act – including those provisions not related to prior art – automatically creates prosecution history estoppel regardless of the reason for the amendment; and (2) whether the finding of prosecution history estoppel completely bars the application of the doctrine of equivalents.

[4] The doctrine of equivalents is a judicially created concept with its Supreme Court origins in *Winans v. Denmead*, 56 U.S. 330 (1853). It is an equitable doctrine intended to prevent the pirating of a patentee's invention in the absence of literal infringement. *See* Texas Instruments Inc. v. United States Int'l Trade Comm'n, 988 F.2d 1165, 1173 (Fed. Cir. 1993). The doctrine reflects an understanding that there is a balance between giving the public fair notice of an invention through clear, particular, and precise patent claims and protecting the patentee from competitors who usurp the essence of an invention by avoiding the literal language of the claim.

Much of the "modern contours" of the doctrine of equivalents was set out by the Supreme Court over 50 years ago in *Graver Tank and Manufacturing Co. v. Linde Air Products Co.*, 339 U.S. 605 (1950). Stating that the "essence of the doctrine is that one may not practice a fraud on a patent," the Court reemphasized that "a patentee may invoke this doctrine . . . 'if [a device] performs substantially the same function in substantially the same way to obtain the same result.'" *Id.* at 608 (quoting Sanitary Refrigerator Co. v. Winters, 280 U.S. 30, 42 (1929)). In applying this doctrine, "[a]n important factor is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was." *Id.* at 609. The doctrine of equivalents does not expand or broaden the scope of the claims of a patent. "The

U.S. patent protection has been narrowed. For example, patents on pioneering inventions in important new technologies, which have traditionally been afforded a broad scope of protection, may now receive much less protection depending upon the patent's prosecution history.[5]

Ironically, a narrower scope of patent protection has always been a major concern that American commentators have expressed about the Japanese patent system.[6] Indeed, historically, Japan did not recognize a doctrine of equivalents.[7] In a sense, then, the *Festo* decision might represent a sort of "Japanification" of the American patent system.[8] It is therefore helpful to briefly explore the relationship between the Japanese patent system, with its narrow scope of patent protection, and the development of Japanese industry.

While both American and Japanese patent law aim to promote "innovation," the two patent systems have different conceptions of the term. The American patent

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claims—i.e., the scope of patent protection as defined by the claims—remain the same and application of the doctrine expands the right to exclude to 'equivalents' of what is claimed." Wilson Sporting Goods Co. v. David Geoffrey & Assocs., 904 F.2d 677, 684 (Fed. Cir. 1990).

Much controversy surrounds the doctrine, with commentators arguing for its abolishment or limitation. *See* Clarence J. Fleming, *The Doctrine of Equivalents—Should it be Available in the Absence of Copying?*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 233, 237 (1994). The doctrine arguably contradicts the statutory requirement that the patentee disclose his invention in "full, clear, concise, and exact terms." 35 U.S.C. § 112 ¶ 1. *But see Warner-Jenkinson*, 520 U.S. at 25 (rejecting the argument that doctrine of equivalents is inconsistent with the statutory requirement that a patentee specifically "claim" the invention covered by a patent). Indeed, despite reaffirming the continued existence of the doctrine in 1997, Justice Thomas, in *Warner-Jenkinson,* admitted that "[t]here can be no denying that the doctrine of equivalents, when applied broadly, conflicts with the definitional and public-notice functions of the statutory claiming requirement." *Warner-Jenkinson,* 520 U.S. at 33.

[5] Prosecution history estoppel, or file wrapper estoppel, serves as a limitation on the doctrine of equivalents by precluding a patentee from recapturing what was relinquished through claim amendments and arguments during the prosecution of the patent application. Therefore, "the doctrine of equivalents is subservient to prosecution history estoppel." Autogiro Co. v. United States, 181 Ct. Cl. 55, 67 (1967). "The logic of prosecution history estoppel is that the patentee, during prosecution, has created a record that fairly notifies the public that the patentee has surrendered the right to claim particular matter as within the reach of the patent." *Festo*, 234 F.3d at 564-65.

For a more detailed discussion of prosecution history and the doctrine of equivalents before *Festo*, see Donald S. Chisum, *The Scope of Protection for Patents After the Supreme Court's Warner-Jenkinson Decision: The Fair Protection-Certainty Conundrum,* 14 SANTA CLARA COMPUTER & HIGH TECH. L.J. 1, 45-46 (1998).

[6] *See, e.g.*, Edmund W. Kitch, *The Japanese Patent System and U.S. Innovators*, 29 INT'L L. & POL. 177 (1996-97); *Patent Protection in Japan*, 15 EAST ASIAN EXECUTIVE REP. 9, 11 (Oct. 1993) (the first article of a series of three based on a report by the U.S. General Accounting Offices on U.S. companies patent experiences in Japan); Toshiko Takenaka, *Japan: The Role of the Japanese Patent System in Japanese Industry,* 13 UCLA PAC. BASIN L.J. 25, 29 (1994).

[7] *See* Toshiko Takenaka, *Interpreting Patent Claims: The United States, Germany, and Japan*, 17 IIC STUD.: STUD. IN INDUS. PROP. & COPYRIGHT L. 1, 243 (1995). Professor Takenaka's comparative study is the authoritative literature on the interpretation of U.S., German, and Japanese patent claims.

On February 24, 1998, the Supreme Court of Japan finally recognized the presence of the doctrine of equivalents under the Japanese Patent System. *See* Tsubakimoto Seiko Co. Ltd. v. THK K.K., (1994) (o) 1083 (Feb. 24, 1998) (translation by Chris T. Mizumoto), *available at* http://okuyama.com/doe.html.

[8] This observation arises from discussions with Steven E. Feldman.

system, under the U.S. Constitution, emphasizes the *invention* by focusing on the inventor's exclusive rights.[9] Thus, on a spectrum from imitation to invention, the American patent system might place "innovation" more towards the invention end than the imitation end of the spectrum. In contrast, Article 1 of Japan's Patent Law makes no mention of the inventor's rights. It simply states that its goal is to promote industrial *development* by encouraging the protection and exploitation of inventions.[10] Japan's conception of "innovation" might therefore be placed more towards the imitation end and to the left of the American conception.

Indeed, the history of Japanese industry in the last fifty years reveals that Japanese innovation has focused on developments in applied technology rather than inventions in basic technology.[11] Past studies have indicated that Japanese industry has great advantages in developing improvements and innovations based on *external* inventions, but not *internal* inventions.[12] These external inventions were basic technologies imported from Western countries, such as the United States. Japanese companies would improve and modify these technologies and apply them to products very quickly. By importing and imitating basic Western technologies, Japan could concentrate on improving related process technologies by reducing cost, increasing quality, and investing heavily in equipment. This practice has enabled Japan to catch up to, if not exceed, the technological levels of Western countries.[13]

The Japanese focus on improvement through imitation rather than invention is quite consistent with the narrow scope of patent protection afforded to Japanese technology. The result of such narrow protection is that Japanese companies have developed the strategy of surrounding a core technology patent, likely owned by another inventor, with many narrow, minor improvement patents and in essence, holding "hostage" the core patent by charging a toll for use of the improvements.[14] This tactic of "patent flooding" has generated much criticism from U.S. commentators who attribute part of the problem to attempts by Japanese companies to counter the

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[9] Under Article I, section 8, clause 8 of the U.S. Constitution, Congress shall have the power to "promote the Progress of Science and useful Arts, by securing for limited Time to Authors and *Inventors the exclusive Right* to their respective Writings and Discoveries." U.S. CONST. art I, § 8, cl. 8. (emphasis added).

[10] "The purpose of this Law shall be to encourage inventions by promoting their protection and utilization so as to *contribute to the development of industry*." Tokkyo Ho [Patent Law], Law No. 121 of 1959, *as last amended* May 6, 1998, art. 1 (Japan) (emphasis added). Translation of Tokkyo Ho is available at the *Japan Patent Office Homepage*, http://www.jpo-miti.go.jp. *See also* Takenaka, *supra* note 7, at 25.

[11] *See* Takenaka, *supra* note 7, at 25.

[12] *See* Edwin Mansfield, *Industrial Innovation in Japan and the United States*, 241 SCIENCE 1769 (Sep. 30, 1988). Mansfield observes that one reason for this phenomenon is that Japanese companies emphasize process engineering and efficient manufacturing by allocating more resources in tooling, manufacturing equipment, and facilities, thereby leading to innovation in the form of improvements on existing technologies. In contrast, U.S. companies allocate more resources in marketing start-up leading to innovations in the form of basic technological inventions.

[13] *See* Kitch, *supra* note 6, at 178 ("The Japanese licensee enters the market, and although its initial efforts may be weak, its learns from experience, masters the technology, and becomes an important international competitor in subsequent generations of the technology."); Kazuo Nomura, *The Context for Innovation in Japan*, 17 CAN.-U.S. L.J. 51 (1989).

[14] *See* Thomas J. Klitgaard, *The Context for Innovation in Japan: Comparative Aspects and Some Practical Comments*, 21 CAN.-U.S. L.J. 55 (1995).

effect of the narrow patent protection.[15] However, the culture of the "keiretsu" system in Japan has prevented such patent flooding from becoming a hindrance to Japanese business and technology development.[16] Indeed, under the keiretsu system, Japanese companies have embraced the development of collective rights organizations ("CROs") to foster cooperation and minimize business conflicts. As such, patent pooling arrangements are standard corporate practice in Japan.[17]

All the foregoing suggest that, in light of *Festo* and the "Japanification" of the American patent system, patent pooling will also become an increasingly important practice in the United States. Furthermore, the recent approvals of patent pool arrangements for MPEG-2[18] and DVD[19] technology by the United States Department of Justice also suggest a more tolerant antitrust treatment of such pooling

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[15] *See, e.g.*, Jeffrey A Wolfson, Note, *Patent Flooding in the Japanese Patent Office: Methods for Reducing Patent Flooding and Obtaining Effective Patent Protection*, 27 GEO. WASH. J. INT'L L. & ECON. 531, 541 (1994).

[16] "Keiretsu" describes the unique organization of Japan's economy and literally means "affiliation." A keiretsu is a group of companies linked together by "close and enduring bonds that transcend ties of legal contract or short-term market considerations." DANIEL I. OKIMOTO, REGIME OF CHARACTERISTICS OF JAPANESE INDUSTRIAL POLICY IN JAPAN'S HIGH TECHNOLOGY INDUSTRIES: LESSONS AND LIMITATIONS OF INDUSTRIAL POLICY 35, 58 (Hugh Patrick ed., 1986). The cooperation provided by the keiretsu system enables "already powerful companies, banks, and insurance firms [to combine] into even more powerful groups that can dominate markets in good times, drive out competition in bad times, and provide protection from the kind of hostile takeovers and stockholder demands for quick profits that plague many American industries." Paul Blustein, *Japan's Corporate Connections Create Challenge for U.S Businesses*, WASH. POST, Oct. 6, 1991, at A1 (first part of a two-part series on the Japanese keiretsu); *see also* Paul Blustein, *Inside Japan Inc.: Cozy Ties Foster Political Friction*, WASH. POST, Oct. 7, 1991, at A1.

[17] Sung and Pelto observe that:

> [D]e facto patent pooling arrangements represent standard corporate practice in Japan, where companies favor acquisition of extensive patent portfolios as a defensive measure against litigation and other business conflicts. Patent pools have particular advantage in Japan in view of the traditionally narrow scope of protection granted in their individual patents and the consequentially greater number of patents in a given technology, when compares with the United States. These aspects, in conjunction with cultural norms, motivate Japanese corporations to commit their respective patent portfolios to pooling arrangements to obtain less costly access to vital technology as well as an added measure of security against competitor conflicts.

Lawrence M. Sung & Don J. Pelto, *Greater Predictability May Result in Patent Pools*, NAT. L.J., June 22, 1998, at C2; *see also* David S. Taylor, Note, *The Sinking of the United States Electronic Industry Within Japanese Patent Pools*, 26 GEO. WASH. J. INT'L L. & ECON. 181, 187 (1992) ("The keiretsu system of the Japanese electronics industry encourages cartelization and the formation of agreement among competitors.").

[18] *See* Business Review Letter from Joel I. Klein, Acting Assistant Attorney General, to Gerrard R. Beeney, Esq., Sullivan & Cromwell (June 26, 1997), *available at* http://www.usdoj.gov/atr/public/busreview/1170.htm [hereinafter MPEG-2 Letter].

[19] *See* Business Review Letter from Joel I. Klein, Assistant Attorney General, to Garrard R. Beeney, Esq., Sullivan & Cromwell (December 16, 1998), *available at* http://www.usdoj.gov/atr/public/busreview/2121.htm [hereinafter Sony Review Letter]; Business Review Letter from Joel Klein, Assistant Attorney General, to Carey R. Ramos, Esq., Paul, Weiss, Rifkind, Wharton & Garrison (June 10, 1999), *available at* http://www.usdoj.gov/atr/public/busreview/2485.htm [hereinafter Toshiba Review Letter].

arrangements than demonstrated in the past.[20] This Article focuses on the effect of patent pooling on highly standardized industries, and, in particular, the software industry.[21] It suggests that the Japanification of the U.S. patent system may lead to the Japanification of the U.S. software industry. Specifically, while patent pooling arrangements may lead to more efficient *development* of standardized software, they will also likely lead to a further retardation of *research* and *invention* in the standards market by increasing the incentive to create standards-compliant software.[22] Part II reviews the economic effects of standardization in the software industry. Part III reaffirms the patentability of software and explores the debate concerning open and proprietary standards. It concludes that regardless of whether a standard is open, patent pools that control access to the standard may still arise because competitors will simply acquire patents surrounding the landscape of the open standard. Part IV examines the effect of patent pooling on software innovation. This section lays out the argument that patent pooling will exacerbate the retardation of innovation already caused by standardization. It also explores the structure of the MPEG-2 patent pool and challenges the importance of "essentiality" of patents to the MPEG-2 standard as defined by the Department of Justice in its approval of the pool.

II. NETWORK EFFECTS AND STANDARDIZATION IN THE SOFTWARE INDUSTRY

A. Network Externalities and Effects

The software market is widely regarded as a market that exhibits network externalities.[23] The "network" created by software is not an actual physical network, like the telephone network or Internet, but rather a *virtual* network that increases the value of the software to a consumer when there are additional users of the software.[24] Because this increased value is directly attributable to the number of software users and is separate from the inherent value of the software itself, it is known as a *network externality*.[25] That is, network externalities arise when the

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[20] *See, e.g.*, Andrea C. Brunetti, *Wading into Patent Pools*, INTELLECTUAL PROP., Nov. 1997, *available at* http://www.ipmag.com/brunetti.html (last visited Apr. 6, 2001).

[21] While this Article focuses on the software industry, its conclusions are likely applicable to other highly standardized industries.

[22] Even in the absence of patent pooling, retardation of innovation in standardized industries is a well-recognized phenomenon. *See, e.g.*, Joseph Farrell, *Standardization and Intellectual Property*, 30 JURIMETRICS J. 35, 37 (1989).

[23] *See* Mark Lemley & David McGowan, *Legal Implications of Network Economic Effects*, 86 CAL. L. REV. 479, 481 (1998); Mark Lemley, *Antitrust and the Internet Standardization Problem*, 28 CONN. L. REV. 1041, 1045 (1996); M. Joseph Hinshaw, *The Role of Standardization and Interoperability in Copyright Protection of Computer Software*, 4 COMM. L. & POLICY 299, 305-06 (1999).

[24] *See* Lemley & McGowan, *supra* note 23, at 491.

[25] The software market exhibits a "weak" form of network externalities because a software product can have inherent value (i.e., it can be used) to a consumer regardless of whether other persons own or use the product. In contrast, examples of the "strong" form of network externalities

value that existing users get from a network increases when another user joins the network.[26] For example, a consumer may choose Microsoft® Word over WordPerfect® because the larger network of Word users will provide the consumer the ability to easily exchange documents with others.[27] Similarly, corporations may choose Word because it is easier to find employees who are trained to use it.[28] Thus, despite the technical similarities between the two products, the network externalities provided by Word increase its value over WordPerfect®.[29]

In addition to the direct effects of network externalities, software markets also display secondary effects that are also attributed to its network characteristics.[30] Specifically, the demand in the aftermarket for complementary goods increases when additional users join the virtual network of a software product.[31] For example, the Microsoft® Windows® operating system is a software product that has more than 90 percent market share in the desktop market.[32] Therefore, software developers tend to produce application programs (i.e., complementary goods) designed for the Windows® operating system. Such an increase in application programs reinforces the popularity and market strength of the Windows® operating system.[33] As evidenced by the monopoly position of the Windows® operating system, this reinforcement phenomenon, known as the positive feedback effect, can be quite strong and suggests the tendency of a network market to move towards a single network.[34]

As a result of the foregoing effects, network markets can suffer from natural market failures or pathologies.[35] Several commentators have recognized the presence

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are telephone networks and the Internet, in which the value of using a telephone or an Internet connection is so heavily dependent on the adoption by others. *See* Lemley, *supra* note 23, at 1045.

[26] Liebowitz and Margolis point out that for some network markets, once a critical mass is achieved, the marginal utility of an additional user joining the network is zero. This idea of inframarginal externality suggests that in instances where the marginal benefits of network size are exhausted, multiple networks can coexist. *See* S.J. Liebowitz & Stephen Margolis, *Network Externality: An Uncommon Tragedy*, 8 J. ECON. PERSP. 133, 140 (1994).

[27] *See* Lemley, *supra* note 23, at 1045.

[28] *Id.*

[29] It is true, of course, that Microsoft® Word and WordPerfect® both have conversion and compatibility features. However, the assumption, for the purposes of this observation, is that the cost of the conversion technology, due to its imprecision and inconvenience, coupled with the network externalities of using Word, convince the consumer to purchase Word. Other factors important to the decision making process such as cost and company reputation are also momentarily set aside.

[30] Some commentators simply describe these effects as "indirect" network externalities. *See, e.g.,* David S. Evans & Bernard J. Reddy, *Some Economic Aspects of Standard in Network Industries and their Relevance to Antitrust and Intellectual Property Law,* 1 INTELL. PROP. ANTITRUST 177, 185 (1996).

[31] *See id.* at 184; Hinshaw, *supra* note 23, at 306; Lemley & McGowan, *supra* note 23, at 494.

[32] *Competition in the Network Market: The Microsoft Challenge* 8, *available at* http://www.siia.net/sharedcontent/govt/issues/compete/servcomp.pdf (last visited Feb. 4, 2001).

[33] *See* Lemley & McGowan, *supra* note 23, at 491.

[34] *See* Evans & Reddy, *supra* note 30, at 186. As Lemley and McGowan point out, the strength of such secondary network effects will vary depending on the type of software in question. For example, such effects will be much stronger for operating system software than for more isolated standalone applications. *See* Lemley & McGowan, *supra* note 23, at 492. *But see* Liebowitz & Margolis, *supra* note 26, at 140.

[35] Simple network theory teaches that even without consideration of positive feedback effects, network markets are under-utilized from a social perspective. That is, even if a network product is competitively priced at cost, a consumer will only purchase such products where his *private*

of a *tipping effect* in network markets.[36] Tipping is the natural tendency of a single product to pull away from its competition once it has gained an initial edge due to network effects. This tipping effect can occur quite rapidly and stems, in part, from consumers' inclinations to gravitate towards the product that they expect will become dominant.[37] Once consumers commit resources to a chosen product, they become disinclined to move to competing products because of substantial levels of collective inertia, switching costs and other network lock-in effects.[38]

B. De Facto Standards

The positive feedback effect and network externalities coupled with tipping and lock-in effects (collectively referred to as "network effects") suggest that software companies will compete vigorously to have their product emerge as the single dominant "de facto" standard around which consumers will choose to develop a virtual network.[39] Indeed, once a product becomes a de facto standard, it is quite difficult to dislodge because of the cyclical durability it gains from network effects.[40] Thus, because of the "all or nothing" nature of this de facto standards competition, the winner will emerge holding an extremely profitable market position. Each competitor in the de facto standards competition anticipates that it will win and, therefore, reap returns not only from the software product itself, but also from the benefits of the virtual network. As a result, all competitors are willing to engage in

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marginal benefit exceeds that cost. However, due to network externalities, the *social* marginal benefit of having the consumer purchase the product is greater than his *private* marginal benefit because of the benefits that accrue to others already in the network. Thus, because the social marginal benefits exceed private marginal benefits, the equilibrium network size will be inefficient since it is smaller than the socially optimal network size. When positive feedback effects are considered, the aggregation of even small losses at the individual level can result in significant social welfare losses. *See* Michael Katz & Carl Shapiro, *Systems Competition and Network Effects*, 8 J. ECON. PERSP. 93, 96 (1994).

[36] Stanley M. Besen & Joseph Farrell, *Choosing How to Compete: Strategies and Tactics in Standardization*, 8 J. ECON. PERSP. 117, 118 (1996); Evans & Reddy, *supra* note 30, at 186; Lemley, *supra* note 23, at 1049; Lemley & McGowan, *supra* note 23, at 496.

[37] Besen & Farrell, *supra* note 36, at 118; Lemley, *supra* note 23, at 1050.

[38] For example, after consumers are trained to use a particular software product, they are more reluctant to switch to a new product. Similarly, once consumers invest in a software product through which they create documents and data readable only by that product, they are reluctant to switch to a new product. *See* Lemley, *supra* note 23, at 1050.

[39] *But see* Liebowitz & Margolis, *supra* note 26, at 140 (suggesting that multiple networks can coexist in markets that exhibit inframarginal externalities).

[40] The underlying assumption in the de facto standards competition model is that the products introduced by competitors are incompatible. That is, each firm prefers to lose a battle to become the industry standard than to make its product compatible with other firms' products. This de facto standards competition is likely to occur where: (1) firms are symmetric in their market and technology positions; (2) the standards competition does not greatly delay the adoption of technology by consumers; and (3) if competition at the would-be compatible products level (as opposed to the incompatible standards level) would be likely to dissipate potential industry profits. *See* Besen & Farrell, *supra* note 36, at 122; Hinshaw, *supra* note 23, at 304. For more on compatibility decisions, see generally Michael L. Katz & Carl Shapiro, *Network Externalities, Competition, and Compatibility*, 75 AM. ECON. REV. 424 (1985).

more competitive strategies and tactics than they otherwise would.[41] However, such fierce competition can greatly dissipate a large proportion of the potential market gain, because only a single winner emerges.[42] Furthermore, as discussed below, once the winner emerges, natural pathologies in the dynamics of the virtual network become apparent.[43]

Network theory teaches that a firm should price a de facto standard product as low as possible to allow widespread adoption of the standard. The reason is that every potential user that joins the network not only brings benefits to himself, but also brings benefits to everyone else in the network. However, if what emerges from de facto standards competition is a single winner with great market power, then that winner will maximize revenue by setting monopolistic prices above competitive prices. The result is that would-be consumers are excluded from the network, creating a social deadweight loss.[44] This inefficiency is compounded by the possibility that a technically inferior product can easily emerge as the winner in a standards competition due to aggressive marketing strategies that lead to the tipping effect.[45] Once a technically inferior product becomes the de facto standard, the network effects make it extremely difficult for a superior product to challenge its market position. Indeed, even if consumers would be better off switching to the new standard, collective action problems or excess inertia may make it difficult to move to that new standard.[46] In fact, Farrell and Saloner show that in the absence of perfect information, consumers may even unanimously favor a change to a new technology but still never make the switch because no single consumer is sufficiently motivated to start a bandwagon rolling effect to overcome the current network effects.[47] Excess

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[41] Examples of such strategies and tactics are: (1) penetration pricing; (2) attracting suppliers of complements; (3) product pre-announcements; (4) puffery; and (5) price commitments. *See* Besen & Farrell, *supra* note 36, at 122-24; Evans and Reddy, *supra* note 30, at 192. Some of these strategies are ineffective unless the technology is proprietary. For example, a firm will not engage in penetration pricing unless their technology is protected by property rights, because it would not be able to recoup its losses because competitors may flood the market with compatible goods. *See* Evans & Reddy, *supra* note 30, at 193; Farrell, *supra* note 22, at 43.

[42] *See* Besen & Farrell, *supra* note 36, at 120.

[43] *But see* Liebowitz & Margolis, *supra* note 26, at 133 (suggesting that network externalities as market failures are theoretically fragile and empirically undocumented).

[44] *See* Lemley & McGowan, *supra* note 23, at 515-16.

[45] *See* Besen & Farrell, *supra* note 36, at 118; Lemley & McGowan, *supra* note 23, at 497; Farrell, *supra* note 22, at 40.

[46] The classic example of excess inertia is the standard QWERTY typewriter keyboard that is used to this day. Many have argued that the QWERTY keyboard is inferior to alternatives such as the Dvorak keyboard, which failed to catch on. *See* Paul A. David, *Clio and the Economics of QWERTY*, 75 AM. ECON. REV. 332 (1985). *But see* S.J. Liebowitz & Stephen Margolis, *The Fable of the Keys*, 33 J.L. & ECON. 1 (1990). Farrell and Saloner describe and model the excess inertia problem in their influential 1985 article. *See* Joseph Farrell & Garth Saloner, *Standardization, Compatibility, and Innovation*, 16 RAND J. ECON. 70 (1985).

[47] *See* Farrell & Saloner, *supra* note 46, at 72. Alternatively, Katz and Shapiro discuss and model an effect called "insufficient friction," which is the opposite of excess inertia. They show that under certain circumstances, excess inertia cannot arise. Rather, firms will introduce and consumers will adopt a new incompatible technology even if it does not contribute to total social surplus. One reason for this effect is that adopters of the new technology ignore the fact that by choosing the old technology, they would provide network benefits to users of the existing technology. Instead, by choosing a new technology, these new adopters may worsen industry performance by

inertia inevitably leads to the issue of whether network effects retard innovation, which is discussed in a later section.

However, regardless of whether network effects retard innovation, it is clear that a market driven de facto standards competition in a network industry can lead to undesirable social inefficiencies, particularly if the winning product is proprietary. As discussed previously, aggressive de facto standards competition between firms can lead to the dissipation of industry gain since only a single winner emerges. Furthermore, the winner will set prices at monopolistic levels in order to maximize profits, leading to an under-utilization of the network that harms both current consumers and would-be consumers.

C. Formal Standard Setting Organizations

One solution that addresses these inefficiencies is to impose an *interoperable* standard that is accessible to all competitors.[48] That is, if firms explicitly or implicitly agree to make their products compatible through standardization, competition among firms will shift from competing at the de facto standards level (known as *inter-technology* competition) to competing at the compatible products level (known to as *intra-technology* competition). Since intra-technology competition does not have same "all or nothing" flavor that inter-technology competition has due to the tipping effect, intra-technology competition tends to lessen the dissipation of industry profits due to competition.[49] Furthermore, intra-technology competition also tends to lessen the probability that a single winner will control the network and thus price monopolistically. Having multiple firms participating within a standard means that those companies can compete to offer products incorporating the standard, thereby expanding output, lowering prices, and encouraging interchangeability.[50]

Perhaps the best way to impose an interoperable standard on a network industry is through a group standard setting process by a private industry organization.[51] The group standard setting process can be much faster than the de

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stranding customers who own the older technology. Furthermore, Katz and Shapiro demonstrate that firms with new incompatible technologies have private incentives to introduce their products *earlier* than would be socially desirable. *See* Michael L. Katz & Carl Shapiro, *Product Introduction with Network Externalities*, 40 J. INDUS. ECON. 55 (1992).

[48] *See* Lemley, *supra* note 23, at 1060.

[49] According to Besen and Farrell, there is no general answer to the question of whether firms will prefer competition for potentially enormous prices under inter-technology competition, or the more conventional competition that occurs in an intra-technology context. *See* Besen & Farrell, *supra* note 36, at 120.

[50] *See generally* James J. Anton & Dennis A. Yao, *Standard-Setting Consortia, Antitrust, and High-Technology Industries*, 64 ANTITRUST L.J. 247 (1995); Lemley, *supra* note 23 at 1064-65.

[51] There are at least two other solutions to imposing an interoperable standard. One solution is to preclude the winning firm of inter-technology competition from enforcing its proprietary rights in the standard. The difficulty with this solution is to ensure that the winning firm still has adequate incentives to develop and bring the product to market without proprietary rights. The second solution is to have the government set a standard and compel industry participants to adopt the standard. The difficulties with this solution are that: (1) government entities are likely not the most qualified entities to be setting industry standards; (2) government-set standards may prove too durable despite being ill-conceived; (3) government action may deter investment and reduce incentives to innovate; (4) government set standards are less likely to evolve with time and more

facto standardization arising from inter-technology competition.[52] One reason for this is that the establishment of a standard through member cooperation avoids the duplicative efforts present in inter-technology competition.[53] Another reason is that the endorsement of a standard by an industry group can instill confidence in that standard, leading to its quicker adoption by manufacturers and producers.[54] As long as members of the private standard-setting group have enough market share, the adoption of the standard will have enough momentum to create network benefits to consumers.[55] Unlike other alternatives, such as government-controlled standard setting, private standard-setting organizations are less likely to choose an inefficient standard.[56] Multiple members of a standard-setting group can combine their expertise to overcome information problems and offer a better-developed standard.[57] Furthermore, such group standards are more likely to technically evolve with time rather than stagnate.[58]

However, there are also problems associated with private standard setting. For example, while a group standard may evolve with time, it must also remain backwards compatible with its older versions so as not to strand users who do not immediately adopt the new version of the standard.[59] For example, the current Internet protocol is known as Internet Protocol version 4 ("IPv4").[60] The Internet Engineering Task Force ("IETF"), an Internet standards-setting organization, has developed a new protocol Internet Protocol version 6 ("IPv6") to replace IPv4.[61] However, because of the need to accommodate current Internet users during the transition from IPv4 to IPv6, IPv6 is arguably bogged down from the need to be backwards compatible with IPv4.[62] Furthermore, such a formal standard-setting process can also be time consuming due to the difficulty of achieving agreement among members of the standard-setting organization, each of whom has a vested interest in its own technologies.[63] In contrast to de facto standardization, where inter-technology competition encourages early action by competitors, the formal standard-setting process is less likely to reach an outcome before a given deadline.[64]

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likely to stagnate; and (5) government agencies are influences by powerful private interest groups. *See* Lemley, *supra* note 23, at 1059-65.

[52] *See* Joseph Farrell & Garth Saloner, *Coordination Through Committees and Markets*, 19 RAND J. ECON. 235, 239 (1988); Marcus Maher, *An Analysis of Internet Standardization*, 3 VA. J.L. & TECH. 5, ¶ 26 (1998).

[53] *See* Maher, *supra* note 52, ¶ 26.

[54] *See id.*

[55] *See* Lemley, *supra* note 23, at 1059-65.

[56] *See id.*

[57] *See* Maher, *supra* note 52, ¶ 26.

[58] *See* Lemley, *supra* note 23, at 1059-65.

[59] *See id.*

[60] *See Internet Protocol: DARPA Internet Program Protocol Specification*, RFC 791 (Jon Postel ed., Sept. 1981), *available at* http://www.faqs.org/rfcs/rfc791.html.

[61] *See* Rob Glenn et al., *Project: IPv6 Technology*, *available at* http://snad.ncsl.nist.gov/ant-proposals/proj-ipv6/proj-ipv6.html (last visited Apr. 4, 2002).

[62] *See* Maher, *supra* note 52, ¶ 81.

[63] *See* Farrell, *supra* note 22, at 40.

[64] *See* Garth & Saloner, *supra* note 52, at 239. However, despite the formal standard setting process' potential to languish before the deadline, Garth and Saloner, factoring in the importance of speed, still find that the formal standard is better than the de facto standard because the formal

Indeed, the standard that is ultimately adopted will certainly disadvantage certain subgroups of existing competitors whose technologies are not adopted into the standard.[65] As a result of the time-consuming process, the agreed-upon standard must often be forward-looking, predicting how consumers will use the technology to prevent it from being out-of-date even before it is brought to market.[66] Finally, private-setting groups can be susceptible to capture by influential or powerful members.[67]

Moreover, the consideration of strong intellectual property rights, such as patents, can have a profound influence on industry standard-setting organizations.[68] Because strong intellectual property rights increase a participating member's vested interests in having its patented technology adopted into a proposed standard, such rights can have the tendency to retard the formal standard-setting process.[69] Additionally, as in the de facto standards context, strong intellectual property rights can also prevent the optimal adoption of the formal standard by consumers. That is, the owner of a patent that is part of a formal standard will charge a monopolistic price for its use thereby preventing certain consumers who would otherwise have used the standard from using it.[70] Patent owners always have the choice to license their technology at little or no cost to facilitate standardization process to make the standard "open" rather than "sponsored."[71] However, they may not necessarily do so, particularly if their technology is considered to be an integral part of the proposed standard.[72] Indeed, if standard-setting organizations insist on adopting patent-free standards, patent-owning members of the standard-setting group may have a perverse incentive to engage in improper capture of the standard. For example, in 1992, the Video Electronics Standards Association ("VESA") approved and adopted the VL-bus design standard for carrying information between a computer's central processing unit and the computer's peripheral devices. As a member of the VESA, Dell Computer Corporation certified that practicing the standard did not infringe Dell's patents. Nevertheless, eight months later, after the VL-bus had become established as a successful standard, Dell asserted a patent against other VESA members for using the VL-bus standard. As a result, the Federal Trade Commission issued a complaint alleging that Dell had engaged in acts and practices that unreasonably restrained competition.[73] Similarly, more recently in 1999, Microsoft

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process has much better coordination and causes fewer errors in the final standard. *See id.* at 239-40.

[65] *See* Anton & Yao, *supra* note 50, at 247.

[66] *See* Farrell, *supra* note 22, at 40-41.

[67] *See* Lemley & McGowan, *supra* note 23, at 517.

[68] "Strong" intellectual property rights, as used in this paper, means that the owner of the right can exclude others from using the invention, or can charge a fee to use it. *See* Farrell, *supra* note 22, at 45.

[69] *Id.* at 44.

[70] *See id.* at 46.

[71] *See id.* at 42.

[72] *See id.* at 43.

[73] *See In re* Dell Computer Corp., 121 F.T.C. 616 (1996). However, Commissioner Mary L. Azcuenaga, in a dissenting statement, noted that:

> Nothing in the limited information available to the Commission suggests that Dell had any greater role in the development and promulgation of the VESA VL-bus standard than that described in the minimal factual allegations in the complaint. For example, the complaint does not allege that Dell proposed or sponsored the

Corporation, a member of the World Wide Web Consortium, a nonprofit group working to standardize the Web, created great controversy when it received a patent covering a fundamental Web technology adopted by the Consortium without informing the other members before the technology was adopted as a standard by the Consortium.[74]

Nevertheless, concerns that patents are harmful to formal standard setting, as discussed above, may be exaggerated, particularly in an industry with network effects such as software. As discussed in the next Part, despite the attraction of open standards, the involvement of software patents in the standard setting process may be inevitable and may ensure that the best technologies are adopted into standards having great durability due to network effects.

III. THE EFFECT OF SOFTWARE PATENTS ON OPEN STANDARDS

The issue of software patentability has a fascinating history, with both the U.S. Patent and Trademark Office ("PTO") and the courts struggling to grasp the concept of software and its proper place in the patent system. Today, however, the PTO and the courts both embrace the notion that software-related inventions are no different than any other inventions with respect to patentability. Indeed, it is estimated that the PTO currently issues more than 20,000 software-related patents a year.[75] This Part first provides a brief introduction to the patent system as a whole. It then details the interesting development and the current trends regarding software patents. Finally, the Part maintains that, in light of current legal trends regarding software patents, contrary to certain popular conceptions, such patents can be helpful in producing the best results in software standardization. Furthermore, regardless of whether a software standard itself is open, software patent pools that ultimately control access to the standard may still arise because competitors will simply acquire software patents that surround the landscape of the open standard.

> standard, that Dell urged others to vote for the standard, that Dell employees participated in drafting the standard, that Dell employees were present, in person or online, during the committee drafting sessions, that Dell steered the VESA committee toward adopting a standard that incorporated Dell technology, or that Dell had any hand whatsoever in shaping the standard.

Id. Nevertheless, a settlement agreement was entered in which Dell agreed to cease and desist from asserting its patent. *See In re* Dell Computer Corp., No. 931-0095 (F.T.C. 1996).

[74] However, Microsoft did ultimately say that its failure to disclose the patent application was inadvertent and that it would freely license the patent. *See* Teresa Riordan, *Microsoft Moves Sparks Controversy Over Web Standards,* N.Y. TIMES ON THE WEB (Feb. 22, 1999), *at* http://www.nytimes.com/library/tech/99/02/biztech/articles/1.

[75] In 1998, Greg Aharonian reported that the PTO issued 17,500 software-related patents and estimated that 1999 would see more than 22,500 issued software-related patents. This 1999 estimate is seventeen times more than number of software related patents issued(1300) nine years earlier in 1990, and almost fifteen percent of the total amount of patents issued in 1999 (159,166). *See PATNEWS: 17,500 software patents to issue in 1998*, INTERNET PATENT NEWS SERVICE (Greg Aharonian ed.), Oct. 18, 1998; *A Patent and Trademark Review: Century of American Invention, Fiscal Year 1999* (U.S. Pat. & Trademark Off.), *available at* http://www.uspto.gov/web/offices/com/annual/1999/ (last visited Apr. 4, 2002).

A. Background on the Patent System

The federal government derives its power to grant patents under Article I, section 8, clause 8 of the Constitution, which states that Congress shall have the power to "promote the Progress of Science and useful Arts, by securing for limited Time to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." [76] The patent system promotes this progress by offering a right of exclusion to inventors in order to foster innovation by rewarding their time, research, development, and effort. In return for this right of exclusion, inventors are required to disclose their invention to the public by providing a full and clear description of the invention that is sufficient enough to enable any person skilled in the field of the invention to read the description, and thereafter make and use the invention.[77] Such disclosure stimulates further innovation, permits the public to practice the invention once the patent expires, and assures that ideas in the public domain remain there for the free use of the public.[78] The patent system thus recognizes the need to balance the rights of the inventor against the dissemination of information to the public.[79]

The present Patent Act, which was enacted in 1952, is codified in Title 35 of the United States Code.[80] In order to be granted a patent, an inventor must demonstrate that the invention is novel,[81] non-obvious,[82] and useful.[83] However, a patent need not necessarily be an original work nor reveal any "flash of genius."[84] Indeed, a patent may simply disclose a small improvement over a known technology, a novel combination of well-known elements, or even a new use for an old invention.[85] The inventor must prepare and submit a patent application to the PTO.[86] An examiner at the PTO then conducts a search of past patents and relevant technical literature (known as "prior art") to determine whether the invention is indeed novel, non-obvious, and useful.[87] Often, an inventor may need to amend his original application,

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[76] U.S. CONST. art. I, § 8, cl. 8.

[77] *See* 35 U.S.C. § 112 ¶ 1 (1994).

[78] *See* Aronson v. Quick Point Co., 440 U.S. 257, 262 (1979); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480-81 (1974).

[79] *See* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 146 (1989) ("From their inception, the federal patent laws have embodied a careful balance between the need to promote innovation and the recognition that imitation and refinement through imitation are both necessary to invention itself and the very lifeblood of a competitive economy.").

[80] *See* 35 U.S.C. §§ 1-376 (1994).

[81] *See id.* § 102.

[82] *See id.* § 103.

[83] *See id.* § 101.

[84] *See id.* § 103 ("Patentability shall not be negatived by the manner in which the invention was made."); *see also* Graham v. John Deere Co., 383 U.S. 1, 9 (1966) ("It also seems apparent that Congress intended . . . § 103 to abolish the test it believed this Court announced in the controversial phrase 'flash of creative genius,' used in *Cuno Corp.* v. *Automatic Devices Corp.*, 314 U.S. 84, 91 (1941).").

[85] *See* KENNETH NICHOLS, INVENTING SOFTWARE: THE RISE OF "COMPUTER-RELATED PATENTS," 10 (1998).

[86] *See* 35 U.S.C. § 111(a)(1) ("In general . . [a]n application for patent shall be made, or authorized to be made, by the inventor, except as otherwise provided in this title, in writing to the Director.")

[87] *See* 37 C.F.R. § 1.104(a)(1) (1999) ("On taking up an application for examination or a patent in a reexamination proceeding, the examiner shall make a thorough study thereof and shall make a

sometimes narrowing the scope of the invention to avoid overlap with prior art, before a patent examiner will agree that the invention is indeed novel, non-obvious, useful, and therefore patentable. However, if the PTO does ultimately grant a patent, the owner of the patent has "the right to exclude others from making, using, offering for sale, or selling" the patented invention in the United States for a period of twenty years.[88] Once the patent is granted and issued, the owner can sue anyone believed to be infringing the patent.[89] Since patents have the attributes of personal property, the owner can also assign, exclusively license, nonexclusively license, or covenant not to sue others to practice the patent.[90]

The Patent Act specifically enumerates the types of things that can be patented. In particular, only a process, machine, manufacture, or composition of matter can be patented.[91] These four express statutory categories (known as "statutory subject matter") exhaust the possible subject matter that can be patentable inventions.[92] However, these categories are meant to be quite broad, and the Supreme Court has repeatedly referred to legislative history, indicating that "Congress intended statutory subject matter to 'include anything under the sun that is made by man.'"[93] There are, however, limitations to the broad interpretation of patentable subject matter within these four categories. Specifically, laws of nature, natural phenomena, and abstract ideas are excluded from patentable subject matter.[94] The reason for this exclusion is that a patent granted on such discoveries or inventions would simply be too powerful. That is, because these discoveries and inventions are the basic building blocks for other inventions, a grant of exclusive rights would contravene the very purpose of the patent system to promote technological progress.[95] Thus, as long as the subject matter of an invention is not a law of nature, natural phenomenon, or abstract idea, the invention would more likely than not satisfy the statutory subject matter requirement.[96]

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thorough investigation of the available prior art relating to the subject matter of the claimed invention.").

[88] 35 U.S.C. § 154(a)(1)-(2) (1994).

[89] *See id.* § 281 ("A patentee shall have remedy by civil action for infringement of his patent.").

[90] *See id.* § 261 ("[P]atents shall have the attributes of personal property.").

[91] *See id.* § 101 ("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 therefore, subject to the conditions and requirements of this title.").

[92] *See* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 483 (1974) ("[N]o patent is available for a discovery, however useful, novel, and nonobvious, unless it falls within one of the express categories of patentable subject matter of 35 U.S.C. s. 101.").

[93] Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980); *see also* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 154 (1989); Diamond v. Diehr, 450 U.S. 175, 182 (1981); *In re* Alappat, 33 F.3d 1526, 1542 (Fed. Cir. 1994) ("Thus, it is improper to read into § 101 limitations as to the subject matter that may be patented where the legislative history does not indicate that Congress clearly intended such limitations.").

[94] *See Diehr*, 450 U.S. at 185 ("This Court has undoubtedly recognized limits to § 101 and every discovery is not embraced within the statutory terms. Excluded from such patent protection are laws of nature, natural phenomena, and abstract ideas.").

[95] *See* Gottschaulk v. Benson, 409 U.S. 63, 67 (1972) ("Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work.").

[96] Satisfying the statutory subject matter requirement, alone, is insufficient to fulfill the requirements for receiving a patent. It is also necessary to satisfy the statutory requirements for novelty, non-obviousness, and utility of the invention, as discussed earlier.

B. The Development of Software-Related Patents

However, these statutory patent categories perhaps reflect an outdated industrial-age conception of invention, and the rise of computer software inventions in the information age left the PTO and the courts quite perplexed as to how to fit such inventions within the statutory categories.[97] The 1960s saw incredible advancements in computing and its viability as a commercial tool.[98] As such, software designs and algorithms used to control computers became increasingly important in the business context. However, the 1960s were also a time of aggressive antitrust policy and enforcement in the United States, and, thus, patents were often viewed as a way for big business to stifle competition.[99] Against this anti-patent backdrop, the PTO, already ill-prepared to handle the growth of software-related patent applications, knew that it was unlikely to receive federal funding to increase its facilities to deal with software patent applications.[100] As a result, the PTO adopted a policy of instructing its examiners to reject such software algorithms as unpatentable subject matter.[101] Understandably, these rejections resulted in patent applicants appealing to the federal courts, and specifically, to the Court of Customs and Patent Appeals ("CCPA"). However, in contrast to the PTO, the CCPA, unburdened by fiscal considerations, adopted a more tolerant attitude towards software patents. In a line of software-related cases from 1969 to 1971, the CCPA appeared to firmly embrace computer software as patentable subject matter.[102]

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[97] Statutory patentable subject matter has essentially remained the same since the first patent statute was enacted in 1790. Under the 1790 Patent Act, patentable subject matter included "any art, manufacture, engine, machine or device, or any invention or improvement upon." 1 Stat. 109, 111, § 4 (1790). In 1793, the act was repealed and replaced with a longer act largely attributed to Thomas Jefferson. The 1793 Patent Act set forth the definition of what constitutes patentable subject matter that is almost unchanged even today: "any new and useful art, machine, manufacture or composition of matter and any new and useful improvement on any art, machine, manufacture or composition of matter." 1 Stat. 318, 319, § 1 (1793). The term "art" in the definition was eventually replaced by "process" in 1952, but this term is itself defined as a "process, art or method." 35 U.S.C § 101.

[98] For example, in 1964, Digital Equipment Corporation received its first patent for magnetic core memory and by 1965, its PDP-8 computers were a great success. In 1968, Computer Science Corporation became the first software company to be listed on the New York Stock Exchange and IBM revenues approached seven-billion dollars. The 1960s also saw the invention of the mouse as well as initial developments in ARPAnet, the grandfather to the Internet. *See The Main Events in the History of Computing*, *available at* http://www.bozdoc.f2s.com/history.html (last visited Apr. 6, 2001).

[99] *See* Gregory J. Maier & Robert C. Mattson, State Street Bank *in the Context of the Software Patent Saga*, 8 GEO. MASON L. REV. 307, 309 (1999).

[100] *Id.*

[101] *Id.* at 310.

[102] *See In re* Benson, 441 F.2d 682, 688 (C.C.P.A. 1971) ("It seems beyond question that the machines—the computers—are in the technological field, are part of one of our best-known technologies, and are in the 'useful arts.' . . . How can it be said that a process having no practical value other than enhancing the internal operation of those machines is not likewise in the technological or useful arts? We conclude that the Patent Office has put forth no sound reason why the claims in this case should be held to be non-statutory."), *rev'd sub nom.* Gottschalk v. Benson, 409 U.S. 63 (1972); *In re* Mahony, 421 F.2d 742, 745 (C.C.P.A. 1970) ("Appellant . . . intends the claims to cover only the machine implementation of the process and not the mental implementation thereof. If the appealed claims accomplish that intent, . . . he will . . . have overcome the § 101

The CCPA cases represented a series of defeats for the understaffed PTO, and it finally appealed its case to the Supreme Court in 1972.[103] In its first software patent case, *Gottschalk v. Benson*, the Court held that an algorithm for converting binary coded decimal (BCD) into pure binary numerals was not a process and therefore not statutory subject matter.[104] In reaching its decision, the Court reasoned that the steps in the claimed algorithm could be performed by hand, and, therefore, the invention was an unpatentable idea rather than a patentable process.[105] However, the Court also indicated that its decision did not definitively preclude the possibility of software patents.[106] The Court further suggested that Congress would have to make a decision as to whether a new statutory category should be created for software.[107] Despite its ambiguity, the PTO interpreted the *Benson* decision as a victory over the CCPA, supporting its anti-software patent policy.[108] While many thought that *Benson* meant software was unpatentable, the issue continued to generate great criticism and debate.[109] As a result, six years later, the Supreme Court again took up the issue in *Parker v. Flook*.[110] In *Flook*, the inventor claimed a

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rejection, since the machine-implemented process is clearly statutory."); *In re* Musgrave, 431 F.2d 882, 893 (C.C.P.A. 1970) ("All that is necessary, in our view, to make a sequence of operational steps a statutory 'process' within 35 U.S.C. 101 is that it be in the technological arts so as to be in consonance with the Constitutional purpose to promote the progress of 'useful arts.'"); *In re* Bernhart, 417 F.2d 1395, 1400 (C.C.P.A. 1969) ("[I]f a machine is programmed in a certain new and unobvious way, it is physically different from the machine without that program; its memory elements are differently arranged. . . . If a new machine has not been invented, certainly a 'new and useful improvement' of the unprogrammed machine has been, and Congress has said in 35 U.S.C. 101 that such improvements are statutory subject matter for a patent.").

[103] *See* Maier & Mattson, *supra* note 99, at 315.

[104] *See Gottschalk*, 409 U.S. 63 (1972).

[105] *See id.* at 71-72.

> It is conceded that one may not patent an idea. But in practical effect that would be the result if the formula for converting BCD numerals to pure binary numerals were patented in this case. The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that if the judgment below is affirms, the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.

Id.

[106] *See id.* at 71 ("It is said that the decision precludes a patent for any program servicing a computer. We do not so hold.").

[107] *See id.* at 72-73.

> It may be that the patent laws should be extended to cover these programs, a policy matter to which we are not competent to speak. The President's Commission on the Patent System rejected the proposal that these programs be patentable . . . .
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> . . . .
>
> If these programs are to be patentable, considerable problems are raised which only committees of Congress can manage, for broad powers of investigation are needed, including hearings which canvass the wide variety of views which those operating in this field entertain. The technological problems tendered in the many briefs before us indicate to us that considered action by the Congress is needed.

Id.

[108] *See* Maier & Mattson, *supra* note 99, at 318.

[109] *See id.*; *see also* NICHOLS, *supra* note 85, at 16.

[110] 437 U.S. 584 (1978).

method for monitoring variables during a chemical conversion process and updating a numerical value that determined whether an alarm would sound during the conversion process.[111] Like *Benson*, the claim included an algorithm for determining the alarm value that could have been performed by hand.[112] However, unlike *Benson*, the claim further included the additional step of actually updating the old value with the new value in a computerized chemical conversion process (referred to as "post-solution activity").[113] Nevertheless, despite likely satisfying a literal interpretation of the term "process," the Court refused to recognize the *Flook* claim as a statutory process simply because it contained the simple additional step of using the numerical value resulting from the algorithm in a physical process.[114] Thus, the Court, following its reasoning in *Benson*, rejected the *Flook* invention as unpatentable subject matter.[115] Again, as it did in *Benson*, however, the Court refused to assert that software should not be patentable and deferred to Congress to make such a policy decision.[116] And again, *Flook* was seen as a victory for the PTO, but, like *Benson*, did not definitively resolve the fundamental philosophical differences between the PTO and CCPA concerning software.[117]

Three years later, in 1981, the Supreme Court would issue its last opinion to date on the software patent issue. With Ronald Reagan as President, the era of aggressive antitrust enforcement effectively ended and technological innovation was soon identified as an essential element on the road to the nation's economic recovery.[118] As such, the anti-patent sentiment was discarded and replaced with a

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[111] *Id.* at 585.

[112] *Id.* at 586.

[113] *Id.*

[114] *See id.* at 590.

> The notion that post-solution activity, no matter how conventional or obvious in itself, can transform an unpatentable principle into a patentable process exalts form over substance. A competent draftsman could attach some form of post-solution activity to almost any mathematical formula; the Pythagorean theorem would not have been patentable, or partially patentable, because a patent application contained a final step indicating that the formula, when solved, could be usefully applied to existing surveying techniques. The concept of patentable subject matter under §101 is not "like a nose of wax which may be turned and twisted in any direction . . . ."

Id.

[115] *See id.* at 595 ("Very simply, our holding today is that a claim for an improved method of calculation, even when tied to a specific end use, is unpatentable subject matter under § 101.").

[116] *See id.* at 595.

> Neither the dearth of precedent, nor this decision, should therefore be interpreted as reflecting a judgment that patent protection of certain novel and useful computer programs will not promote the progress of science and the useful arts, or that such protection is undesirable as a matter of policy. Difficult questions of policy concerning the kinds of programs that may be appropriate for patent protection and the form and duration of such protection can be answered by Congress on the basis of current empirical data not equally available to this tribunal.

Id.

[117] *See* Maier & Mattson, *supra* note 99, at 320.

[118] *Id.* at 321; *see also* THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT: A HISTORY 1982-1990, at 8 (1991).

desire to improve an American court system regarded to be impeding innovation due to lack of uniformity in the patent laws.[119] Despite no changes in its composition, even the Supreme Court seemed to embrace this change of attitude in *Diamond v. Diehr*.[120] Factually, *Diehr* was quite similar to *Flook*.[121] The invention involved a process for curing synthetic rubber. Similar to *Flook*, the computerized process in *Diehr* continuously monitored variables during the curing and recalculated the cure time by solving the well-known Arrhenius equation.[122] However, the *Diehr* claims went slightly further than *Flook*, including actual physical steps to automatically open the rubber mold if the cure time had elapsed.[123] This slight distinction was enough for the Court to hold that *Diehr's* claimed subject matter was patentable.[124] In doing so, the Court emphasized that courts "should not read into the patent laws limitations and conditions which the legislature has not expressed," thus recognizing software as fitting within the traditional statutory categories of subject matter and discarding its past view of software as a new category of subject matter.[125] The *Diehr* decision represented a symbolic shift by the Court away from the reluctance to extend patent rights to unforeseen areas such as software as seen in *Benson* and *Flook*, to embracing a new attitude that "anything under the sun that is made by man," could be patentable subject matter.[126]

The Supreme Court's decision in *Diehr* paved the way for the United States Court of Appeals for the Federal Circuit, the newly-formed national court of appeals for patent matters that replaced the CCPA, to solidify the patentability of software-related inventions in the United States. In a series of decisions in the 1990s, the Federal Circuit continually whittled away the PTO's long-standing policy of rejecting software-related inventions.[127] As a result of the new Federal Circuit precedent, the PTO changed its entire examination process for software-related inventions and

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[119] The desire resulted in the establishment of the Court of Appeals for the Federal Circuit, the national court of appeals for all patent matters, in 1982. *See* THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT: A HISTORY 1982-1990, *supra* note 118, at 1-14.

[120] 450 U.S. 175 (1981); *see* Maier & Mattson, *supra* note 99, at 321.

[121] *See Diehr,* 450 U.S. at 187.

[122] *Id.* at 179.

[123] In contrast, the *Flook* claim included no such physical step, but simply used its calculated number to update an alarm limit in memory.

[124] *See Diehr,* 450 U.S. at 188.

[125] *Id.* at 182 (citing Diamond v. Chakrabarty, 447 U.S. 303, 308 (1980)).

[126] *See Chakrabarty*, 447 U.S. at 309.

[127] *See In re* Beauregard. 53 F.3d 1583, 1584 (Fed. Cir. 1995) ("[C]omputer programs embodied in a tangible medium, such as floppy diskettes, are patentable subject matter under 35 U.S.C. § 101 and must be examined under 35 U.S.C. §§ 102 and 103."); *In re* Alappat, 33 F.3d 1526, 1567 (Fed. Cir. 1994) ("[A] computer operating pursuant to software may represent patentable subject matter, provided, of course, that the claimed subject matter meets all of the other requirements of Title 35."); *In re* Warmerdam, 33 F.3d 1354, 1361 (Fed. Cir. 1994) ("[T]he storage of data in a memory physically alters the memory, and thus in some sense gives rise to a new memory."); *In re* Lowry, 32 F.3d 1579, 1583-84 (Fed. Cir. 1994) (holding that particular data structures are statutory subject matter because, "more than mere abstraction, . . . data structures are specific electrical or magnetic structural elements in a memory . . . that provide increased efficiency in computer operation."); Arrythmia Research Tech., Inc. v. Corazonix Corp., 958 F.2d 1053, 1060 (Fed. Cir. 1992) (holding that computer-performed operations that simply "transform a particular input signal to a different output signal, in accordance with the internal structure of the computer as configured by electronic instructions," are statutory subject matter.).

issued its Guidelines for Computer Related Inventions ("PTO Guidelines") in 1996.[128] The Federal Circuit's software jurisprudence culminated in its 1998 landmark decision, *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*,[129] which confirmed that software patents issued even prior to the PTO Guidelines would be enforced by the courts in litigation. In *State Street Bank*, the Federal Circuit dramatically shifted the subject matter analysis with regard to software related inventions away from prior concerns with mathematical algorithms and physical requirements.[130] It developed a new "practical utility" test as to whether a software claim was statutory subject matter by simply assessing whether it produced "a useful, concrete, and tangible result."[131] One year later, in *AT&T Corp. v. Excel Communications, Inc.*,[132] the Federal Circuit extended its *State Street* decision, which had involved a system claim, to method claims. The *AT&T* court held that a method claim need not physically transform the subject matter of the invention from one form to another.[133] Rather, the inquiry is whether the mathematical algorithm used in the method is applied in a practical manner to produce a useful result.[134] As such, the Federal Circuit recognized that software-related inventions were no different than other inventions with regard to using principles of novelty, non-obviousness and utility to determine patentability.

C. Patented Formal Software Standards

As a result of the foregoing discussion, it seems clear that software algorithms that are part of a formal standard can indeed be patented.[135] Indeed, the computer industry has driven much of the growth of formal standardization due to its rapid growth of the industry, which has led to increased fragmentation and cries for coordination.[136] As such, many of the traditional software standard-setting organizations have adopted specific policies regarding patents and formal standards. For example, the American National Standards Institute ("ANSI") has an express policy for consideration of candidate standards that may require the use of a

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[128] *See* Examination Guidelines for Computer Related Inventions, 61 Fed. Reg. 7478, 7479 (Dep't Commerce Feb. 28, 1996).

[129] 149 F.3d 1368 (Fed. Cir. 1998).

[130] *See* Indira Saladi, *Computer Software: Patentable Subject Matter Jurisprudence Comes of Age*, 18 J. MARSHALL J. COMPUTER & INFO. L. 113, 133-137 (1999).

[131] *State Street Bank*, 149 F.3d at 1373.

[132] 172 F.3d 1352 (Fed. Cir. 1999).

[133] *Id.* at 1358.

[134] *Id.* at 1360.

[135] While this article reaffirms the patentability of computer software inventions, it does not take a position on whether the PTO has been too lax in its assessment of novelty and non-obviousness in granting such software patents. For more on this issue, see Greg Aharonian, *Does the Patent Office Respect the Software Community?*, IEEE SOFTWARE, July/Aug., 1999, at 87-89; Robert P. Merges, *As Many As Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577 (1999); U.S. Department of Commerce, Office of Inspector General, *Patent Quality Controls Are Inadequate*, PTD-9977-7-0001 (1997).

[136] *See* Garth & Saloner, *supra* note 52, at 236.

patented invention.[137] The ANSI Patent Policy requires the possible patent holder to sign a statement that the patent holder either: (1) does not hold and does not intend holding any invention the use of which would be required for compliance with the proposed standard; (2) will offer a patent license without compensation to applicants; or (3) will offer a license to applicants under reasonable terms and conditions that are demonstrably free of any unfair discrimination.[138] Furthermore, ANSI has issued guidelines for implementing its patent policy, emphasizing early disclosure of patent rights and an early indication of a willingness to license.[139] The Institute of Electrical and Electronics Engineers ("IEEE") has a similar provision in its bylaws to assure that a patent holder will license applicants under reasonable terms and conditions.[140] Similarly, the directives of the Joint Technical Committee 1 ("ISO/IEC JTC 1") provide that the originator of a proposed standard shall notify the committee of any patent rights that may cover the proposed standard.[141] If the proposed standard is accepted, the originator must obtain statements from patent holders that they are willing to negotiate worldwide patent licenses on reasonable and non-discriminatory terms and conditions.[142]

However, more recent standard-setting organizations such as the Internet Society ("ISOC")[143] and the World Wide Web Consortium ("W3C")[144] that deal

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[137] ANSI is a nonprofit, privately-funded membership organization that coordinates the development of U.S. voluntary national standards and is the U.S. member body to the International Organization for Standardization ("ISO") and, via the United States National Committee ("USNC"), the International Electrotechnical Commission ("IEC"). ANSI coordinates standards in all industries, including safety and health, telecommunications, information processing, petroleum, medical devices, etc. Some of the well-known computer-related standards sponsored by ANSI are: (1) the famous ASCII character code (ANSI X3.4-1986); (2) the FORTRAN programming language (ANSI X3.9-1978); (3) the COBOL programming language (ANSI X3.23-1985); (4) the BASIC programming language (ANSI X3.113-1987); and (5) the C programming language (ANSI X3.159-1989).

[138] *See ANSI's Procedures for the Development and Coordination of American National Standards,* §§ 1.2.11.1-1.2.11.4 (January 2001), *available at* http://web.ansi.org/public/library/std_proc/anspro.html.

[139] *See Guidelines for Implementation of the ANSI Patent Policy: An Aid to More Efficient and Effective Standards Development in Fields That May Involve Patented Technology*, *available at* http://web.ansi.org/public/library/guides/ppguide.html (last modified March 24, 2000).

[140] *See IEEE-SA Standards Board Bylaws,* cl. 6 (2001), *available at* http://standards.ieee.org/guides/bylaws/index.html. IEEE-SA is the standards association for IEEE and is responsible for encouraging, developing, and publishing IEEE standards. While ANSI is primarily concerned with software, IEEE is primarily concerned with hardware. There are, however, some well-known computer-related standards developed by IEEE, including (1) the PASCAL programming language (IEEE 770-1983) and (2) the POSIX API for a standard OS/program interface (IEEE 1003.1-1990).

[141] *See ISO/IEC Directives Part 2: Methodology for the development of International Standards* 17 Annex A (1992, as amended by Amendment 1, 5/31/95), *available at* http://isotc.iso.ch/livelink/livelink/fetch/2000/2123/SDS_WEB/dir2.html. The ISO/IEC JTC 1 is a joint committee of the International Organization for Standardization ("ISO") and International Electrotechnical Commission ("IEC") dealing with standardization in the field of information technology. Some of the well-known computer related standards developed by ISO/IEC JTC 1 include the JPEG and MPEG standards for image and video compression, respectively.

[142] *Id.*

[143] Formed in 1992, the ISOC is the organizational home of the Internet Engineering Task Force ("IETF"), the Internet Architecture Board ("IAB"), the Internet Engineering Steering Group

specifically with the Internet standards have adopted differing attitudes concerning patents. The ISOC adopts an approach similar to the traditional standard-setting bodies, encouraging disclosure and obtaining assurances of openly specified, reasonable, and non-discriminatory licenses from patent holders.[145] Nevertheless, the Internet Engineering Task Force ("IETF"), the standards-developing body under the ISOC, has considered developing less technically appealing standards, because the ideal standard would be encumbered by a third-party patent.[146] Similarly, the W3C has traditionally preferred open standards that are free from patents or can be implemented on a royalty-free basis.[147] Indeed, the W3C explicitly states that "whenever possible, technical decisions should be made unencumbered by intellectual property right (IPR) claims."[148] In contrast, and perhaps due to their broader experience, neither ANSI, IEEE, nor ISO/IEC JTC 1 expressly objects to standards that include use of patented inventions.[149]

As commentators have acknowledged, the goal of open standards and patent protection of inventions need not necessarily be inconsistent.[150] Indeed, as most standard-setting bodies seem to have recognized, patents are an important consideration in the standard-setting process. First, on a practical level, the procurement of patents can provide additional protection for a company if its proposed standard is rejected by a standard-setting body, or if negotiations during a standards-development process break down. Second, organizational policies that disfavor adopting proposed standards that involve patents may create a perverse effect for firms owning the best patented technologies to shy away from the formal standards-setting process, opting to commit resources to the less efficient de facto standard route. However, if a sub-optimal software standard without the best patented technologies is promoted by a standard-setting body and gains momentum in industry due to network effects, only the dramatic improvement of a "leapfrogging"

("IESG"), and the Internet Research Task Force ("IESG"). These bodies are the standards setting and research arms of the Internet community. Internet standards are developed by the IETF, then considered by the IESG, with appeal to the IAB, and finally promulgated by the ISOC as international standards.

[144] The W3C was created in October 1994 by Tim Berners-Lee, inventor of the Web, to develop common protocols that promote the evolution and ensure the interoperability of the World Wide Web.

[145] *See The Internet Standards Process—Revision 3*, RFC 2026, §§ 10.3.2-10.4 (Scott Bradner ed., October 1996), *available at* http://www.ietf.org/rfc/rfc2026.txt.

[146] *See* Carolyn Duffy Marsan, *Patent Flap Could Slow Multilingual Domain Name Plan*, COMPUTERWORLD, Mar. 28, 2001, *available at* http://computerworld.com/cwi/story/0%2C1199%2CNAV47_STO59043_NLTam%2C00.html (last visited April 6, 2001).

[147] *See* Daniel J. Weitzner, *Patent Standards: A Path Forward to Preserve Openness and Innovation in the Evolving Web Infrastructure*, § 1 (Oct. 25, 2000), *available at* http://www.w3.org/2000/10/24-patents-standards.html.

[148] *World Wide Web Consortium Process Document*, § 2.2 (Feb. 8, 2001), *available at* http://www.w3.org/Consortium/Process-20010208/.

[149] However, while the ISO/IEC Directives, Part 2, 1992 (as amended), *supra* note 141, expressly states that "there is no objection in principle to preparing an International Standard in terms which include the use of items covered by patent rights," the ISO Web page does state, somewhat contradictorily, that "[t]he strong recommendation to standards developers is to avoid reference to patented items in ISO publications."

[150] *See* David Friedman, *Standards as Intellectual Property: An Economic Approach*, 19 DAYTON L. REV. 1109, 1120 (1994).

standard will be able to dislodge it.[151] Therefore, in network industries such as software, it may be of particular importance for standard-setting organizations to select the "best" standard, incorporating the best patented technologies, rather than the most open standard that is free from patents. That is, if the total social utility derived from a more limited use of a patented standard exceeds the total social utility derived from a more widespread use of the open standard utilizing sub-optimal technology, then the standard setting organization should support the standard incorporating the best patented technologies.[152] Finally, by accepting patented technologies in standards, standard-setting organizations encourage participants not only to introduce already developed patented technologies into the process, but also to commit more resources to develop better technology during the process in hopes of acquiring patents.

Furthermore, software standard-setting organizations devoted to open standards will be unable to control patents acquired by entities that are not involved in the standard-setting process. There are at least two scenarios that can arise. First, particularly in an increasingly crowded field like software, "renegade" patents covering aspects of a formal standard may issue to inventors not involved in the standard-setting process, but having nevertheless independently invented and patented technology used by the standard. For example, in 1987, CompuServe, Inc. introduced the Graphics Interchange Format ("GIF") for archiving and exchanging computer images.[153] CompuServe released it as a free and open standard and for the next seven years, GIF grew to be the most popular file format.[154] However, the GIF file format utilized the LZW compression algorithm for which Unisys had acquired a patent that issued in 1985 and was apparently unknown to CompuServe and others in the online community.[155] For the next six years, Unisys entered into over 2,000 license agreements, making it perhaps the most widely licensed patent in history.[156] While more a de facto standard rather than a formal standard-setting situation, the GIF story nevertheless demonstrates that third parties holding patents can affect an open standard effort. More recently, in the formal standard setting situation, the IETF stated that it was prepared to move to sub-optimal alternative proposed standards for supporting multilingual Internet domain names if the owner of a third-party patent covering the optimal standard refused to freely and openly license its patent.[157] Indeed, standard-setting organizations that openly disfavor patents may increase the incentives for "submarine" patent situations where third-party patent

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[151] *See* Lemley, *supra* note 23, at 1058.

[152] Indeed, if inframarginal externalities, *see supra* note 26, exist such that the marginal benefits of network size are exhausted once a critical mass is achieved, the patented standard would be a better choice as long as the patent holder offers reasonable licenses such that the critical mass can be achieved.

[153] *See The GIF Controversy: A Software Developer's Perspective, available at* http://cloanto.com/users/mcb/19950127giflzw.html (last visited March 21, 2001).

[154] *Id.*

[155] *Id.*

[156] *See* Mark K. Anderson, *The Latest GIF Tiff*, THE STANDARD (April 25, 2000), *available at* http://www.thestandard.com/article/display/1,1151,14486,00.html.

[157] *See* Marsan, *supra* note 146.

holders do not reveal or assert patents related to a standard until the standard has been adopted and has gained momentum in industry.[158]

Second, regardless of whether a standard-setting organization promotes an open standard that is free from intellectual property protection, competitors may still acquire patents that surround the landscape or boundaries of the standard. These third-party patents can block free use of the standard. For example, patents on specific software implementations of an open standard or on hardware devices that use the standard can be, for all practical purposes, necessary for effective use of that standard in a commercial product. Such a situation is analogous to the earlier discussed Japanese practice of holding a core technology patent "hostage" by surrounding it with small improvement patents. In both these situations, where patents are either included within the standard or surround the standard, techniques like patent pooling, as discussed in the next Part, can increase accessibility to the standard and increase the social utility derived from network effects.

IV. THE EFFECT OF PATENT POOLING ON SOFTWARE INNOVATION

As discussed above, software patents are an important and perhaps inevitable consideration in both setting and using software standards. Specifically, the acceptance of patented software technology by standard setting organizations provides the correct incentives for disclosure of the best patented technologies. Choosing the best standard over the most open standard can increase the social utility derived from network effects. Furthermore, renegade patents and patents surrounding the landscape of the standard can still infiltrate use of the standard despite efforts to make it open. In light of these factors, it is clear that if patents are not licensed on a royalty-free basis, then consumers and developers will have more limited access to standards that incorporate patented technology. Thus, to maximize the availability of such standards, cost-reducing techniques such as patent pooling should be utilized. Additionally, by increasing access to the standard, patent pooling encourages the development of further efficiencies in standardized software. However, such development may, ironically, be accompanied by a corresponding retardation in innovation in the standards market. This Part first examines the economics of patent pooling and then reviews the historical and current antitrust treatment given to such pooling. It then concludes that although patent pooling arrangements may lead to more efficient *development* of standardized software, they will also likely lead to a further retardation of *research* and *invention* in the standards market by increasing the incentive to create standards-compliant software.

A. Economics of Patent Pooling

Patent pooling typically arises when multiple patents held by different companies are required to produce a given product.[159] This may occur, for example,

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[158] *See* Shapiro, *supra* note 1, at 9.

when the product is made of an aggregation of components, each of which may require a patent to make.[160] When the actual or potential manufacturers do not hold any of these patents, the pooling of the required patents into a central independent entity is useful to facilitate patent licensing to those manufacturers.[161] This central entity is typically a partnership or limited liability company that administers the licensing of the patent pool.[162] The entity may sell licenses to the patent pool as a package and then accordingly divide up the royalty stream generated through the licensing revenues to the patent holders.[163]

When the patents in the pool are either *blocking* or *complementary* patents, such an arrangement can achieve great efficiencies. A second patent is "blocked" when it cannot be used without the first patent. The first patent may or may not be blocked without the second patent.[164] Blocking typically arises when there is a first *pioneer* patent and a subsequent *improvement* patent on the pioneer invention.[165] That is, the improvement patent may not be practiced without acquiring rights under the pioneer patent. Furthermore, if the pioneer patent may still be practiced without the improvement patent, it may nevertheless be impractical to do so. Similarly, complementary patents are patents whose value increases when combined with a separate patented invention.[166] Often one patent has no value absent a license to the other patent.[167] For example, a patent for a razor shaving handle and a patent for a connecting razor cartridge are complementary patents. Both blocking and complementary patents that are owned by separate companies can create a situation known as the "tragedy of the anticommons."[168] The tragedy of the anticommons occurs where a manufacturer must acquire licensing rights from multiple patent holders in order to create a single useful product.[169] As a result, it is much more difficult to develop the product, leading to its underutilization.[170] Patent pooling addresses the tragedy of the anticommons by aggregating blocking and complementary patents and reducing the transaction costs needed to acquire licenses.[171] In contrast, patent pools that include *competing* or *rival* patents

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[159] *Id.*

[160] *See* Steven C. Carlson, *Patent Pools and the Antitrust Dilemma*, 16 YALE J. ON REG. 359, 364-65 (1999).

[161] *See* Shapiro, *supra* note 1, at 9.

[162] *See* Carlson, *supra* note 160, at 368.

[163] *See id.*

[164] *See id.* at 362-63.

[165] Carlson describes the classic pioneer-improvement situation concerning the Wright brothers' pioneer patent on the wings of an aircraft. Subsequently, Glenn Curtis and Alexander Graham Bell improved on the Wright brothers' pioneer invention and received a patent for using a set of wing flaps to stabilize the aircraft. However, the Curtis patent was found to infringe the Wright patent. Similarly, the Wright brothers had no legal right to license the crucial technology of wing flaps for their wings. Thus, the Wright and Curtis patents mutually infringed and blocked one another. *Id.* at 363.

[166] *See* Roger B. Andewalt, *Practical Problem in Counseling: Analysis of Patent Pools under the Antitrust Laws,* 53 ANTITRUST L.J. 611, 613 (1984).

[167] *See* Carlson, *supra* note 160, at 364-65.

[168] *See* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998).

[169] *Id.* at 699.

[170] *Id.*

[171] *See* Carlson, *supra* note 160, at 379.

(different from competing or rival patent *owners*) do not address the tragedy of the anticommons, but rather eliminate competition and can lead to higher prices through collusive price fixing.[172]

From the perspective of the manufacturer, patent pools are clearly beneficial because they provide a convenient "one stop shop" by clearing blocking patents and significantly reducing transaction costs by eliminating the need to negotiate with each patent holder.[173] Furthermore, by offering a package license for all necessary patents, a pool greatly reduces the concern that a patent owner will "hold out" for higher royalties, knowing that the manufacturer has individually negotiated for and already acquired the rest of the necessary complementary and blocking patent licenses, and that the value of all those licenses depends on obtaining a license to its own patent.[174] However, momentarily putting aside antitrust issues of market power, collusion, and price-fixing, it is less obvious why the patent holders, themselves, would have an economic incentive to form such pools. After all, their monopolistic position with respect to their patented technologies already enable them to set monopoly prices. However, as Cournot demonstrated in 1838, an integration of complementary monopolies can lead to even higher profits, consumer surplus, social welfare than if those monopolies were "stacked" one on top of the other.[175] Thus, complementary patent owners will find it in their joint interest to offer a package price that is actually less than if each patent owner had licensed their technologies separately.[176] Specifically, pricing externalities arising from the double marginalization of stacked monopolies are internalized when these monopolies are integrated, enabling the integrated entity to offer lower prices yet still achieve higher profits, consumer surplus, and social welfare.

Although the clearing of blocking patents and the reduction of transaction costs are perhaps the primary pro-competitive effects of patent pools, commentators have identified several other benefits. For example, by increasing access to patented technologies by lowering costs, pooling can lead to production efficiencies, increased output, and lower prices.[177] Furthermore, patent pools reduce the need for costly patent litigation because such disputes can be settled through pooling arrangements.[178] They also facilitate the rapid development of new technology by enabling pool members and licensees to build upon all the patents in the pool.[179] Patent pools also enable pool members to share the risks and benefits of further research and development by distributing patent royalties among members who have invested resources to create patented inventions, thereby increasing the probability that such members will recoup their investments.[180] Finally, patent pooling provides an institutionalized exchange of technical information not covered by patents that

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[172] *See* Shapiro, *supra* note 1, at 17.

[173] *See* JEANE CLARK ET AL., U.S. PAT. & TRADEMARK OFF., PATENT POOLS: A SOLUTION TO THE PROBLEM OF ACCESS IN BIOTECHNOLOGY PATENTS? 8 (December 5, 2000).

[174] *See id.* at 9; Brunetti, *supra* note 20.

[175] *See* Shapiro, *supra* note 1, at 4-5.

[176] *Id.*

[177] *See* Andewalt, *supra* note 166, at 614.

[178] *See* Carlson, *supra* note 160, at 380.

[179] *Id.* at 379-80.

[180] *Id.* at 381-82.

fosters communication and reduces overlap and redundancies in future inventions.[181] However, patent pool critics have also identified several potential anti-competitive effects as well.[182] For example, although patents can be legally blocking, they may also be factually competitive.[183] That is, companies may make and sell competing products that infringe others' patents because such patents are simply not asserted.[184] A pooling of such patents that would not otherwise have been asserted by individual companies can reduce the competition between these companies and increase prices.[185] Additionally, pools can also shield patents that would have been determined to be invalid in litigation.[186] Finally, pools can increase the risk that members will collude and price-fix.[187]

B. Antitrust History of Patent Pooling

While the foregoing suggests that patent pooling can be beneficial for both pool members and patent licensees, antitrust authorities are more concerned with the benefits and harms of patent pooling to *consumers*.[188] Federal antitrust agencies as well as antitrust jurisprudence have gone through various perspectives regarding patent pools. The mid-1800s to early-1900s was a period that saw great deference to patent pools and their effect on restraining trade. Prior to the passage of the Sherman Act in 1890, the sewing machine industry saw one of the first patent pools arise in 1856.[189] In 1902, the Supreme Court in *Bement v. National Harrow Co.* affirmed the triumph of patent law and freedom of contract over antitrust concerns.[190] National Harrow Company was a holding company formed by harrow manufacturers to license their patents.[191] Bement was one of the harrow manufacturers that assigned its patents to National Harrow.[192] When National Harrow brought suit against Bement for violating certain contracts regarding patent rights and royalties, Bement argued that such contracts were void because National Harrow, together with its contributing harrow manufacturers (including Bement,

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[181] *See* CLARK ET AL., *supra* note 173, at 10.

[182] *See generally* Michael F. Bailey, *Patent Pools and the MPEG LA Consortium*, White Paper, Brown & Bain, P.A. (October 1997). For purposes of this article, I do not consider patent pools as consisting of competing patents, but only of blocking and complementary patents. However, it is clear that patent pools containing competing patents are likely to be detrimental to competition in the patent licensing market, increasing the possibility of market power or collusion. *See generally*, Andewalt, *supra* note 166.

[183] *See* Carlson, *supra* note 160, at 384-87.

[184] *Id.*

[185] *Id.*

[186] *Id.* at 387-88.

[187] *Id.* at 388.

[188] *See* Shapiro, *supra* note 1, at 9.

[189] The members of the sewing machine patent pool were Elias Howe, Wheeler and Wilson, Grover and Baker, and I.M. Singer. They dominated the industry until after 1877, when the majority of the patents in the pool expired. *See* FLOYD L. VAUGHAN, THE UNITED STATES PATENT SYSTEM: LEGAL AND ECONOMIC CONFLICTS IN AMERICAN PATENT HISTORY 39-68 (1956).

[190] Bemont v. National Harrow Co., 186 U.S. 70 (1902).

[191] *Id.*

[192] *Id.*

itself), were members of a combination to regulate output and fix prices in violation of the Sherman Act.[193] The Supreme Court disagreed, however, holding the contracts valid and asserting that National Harrow, as the owner of the patents, enjoyed absolute freedom to license such patents under any conditions imposed by the patentee (i.e., National Harrow) and agreed to by the licensee (i.e., Bement).[194] For the Court, "[t]he fact that the conditions in the contracts [kept] up the monopoly or fix[ed] prices [did] not render them illegal."[195]

By 1912, however, as large corporations began to supplant individual inventors in the exploitation of patents, the Court shifted its attitude and began to condemn patent pooling as a practice that did indeed violate the Sherman Act.[196] In *Standard Sanitary Manufacturing Co. v. United States*,[197] the Court condemned a patent pool for enameled ware as a combination in violation of the Sherman Act. The Court observed that by forming the patent pool, the contributing manufacturers "subjected themselves to certain rules and regulations, among others not to sell their product to the jobbers except at a price fixed not by trade and competitive conditions but by the decision of the committee."[198] For the Court, the patent pool agreements "transcended what was necessary to protect the use of the patent or the monopoly which the law conferred upon it."[199] The lower courts continued to strike down patent pooling arrangements in industries ranging from motion pictures to automobile bumpers.[200] The Supreme Court's anti-patent pool jurisprudence continued in 1931 with *Standard Oil Co. (Ind.) v. United States* where it developed a market power test to determine whether a pool of competing patents could violate the Sherman Act.[201] In 1948, the Court showed that it would even strike down arrangements to combine blocking patents (as opposed to competing patents) if price-fixing was involved.[202] In *United States v. Line Material Co.*, the Court determined that a cross-licensing arrangement between a pioneer patent holder and an improvement patent holder for an electric fuse cutout was per se unlawful under the Sherman Act because such agreements included price maintenance provisions.[203]

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[193] *Id.*

[194] *Id.* at 91.

[195] *Id.*

[196] *See* Vaughan, *supra* note 189, at 43-44.

[197] 220 U.S. 20 (1912).

[198] *Id.* at 47.

[199] *Id.* at 48.

[200] *See* United States v. Motion Picture Patents Co., 225 F. 800 (E.D. Pa. 1915). *See generally* Vaughan, *supra* note 189, at 46-47.

[201] Standard Oil Co. (Ind.) v. U.S., 283 U.S. 163, 174 (1931) ("If combining patent owners effectively dominate an industry, that power to fix and maintain royalties is tantamount to the power to fix prices. Where domination exists, a pooling of competing process patents . . . is beyond the privileges conferred by the patents and constitutes a violation of the Sherman Act." (citations omitted)).

[202] *See* United States v. Line Material Co., 333 U.S. 287 (1948).

[203] *Id.* at 314.

> Even if a patentee has a right in the absence of a purpose to restrain or monopolize trade, to fix prices on a licensee's sale of the patented product in order to exploit properly his invention or inventions, when patentees join in an agreement as here to maintain prices on their several products, that agreement,

The forties also saw the Court begin to adopt regulatory forms of remedies to deal with suspicious patent pools.[204] Rather than dissolving such pools, the Court began to mandate compulsory licenses with reasonable royalties.[205] For example, in *Hartford-Empire v. United States*,[206] the Court applied its market power test from *Standard Oil* and struck down perhaps one of the most infamous pooling arrangements as violating the Sherman and Clayton Acts. Controlling over six hundred pooled patents in the glass industry, Hartford-Empire, a company specifically formed to pool the patents of glass companies, licensed machinery to make ninety-four percent of the glass containers manufactured in the United States on feeders and formers.[207] The Court noted that "by cooperative arrangements and binding agreements, the appellant corporations, over a period of years, regulated and suppressed competition in the use of glassmaking machinery and employed their joint patent position to allocate fields of manufacture and to maintain prices of unpatented glassware."[208] As part of its remedy, the Court compelled the glass companies to license their patents without discrimination or restriction at standard royalty rates.[209] Such compulsory licenses have formed the basis of the non-discrimination and reasonable royalty provisions seen in the agreements of modern patent pool structures.[210]

When the United States Department of Justice began to articulate its antitrust policies in the late 1960s, it followed the lead of the Court in expressing hostility and suspicion towards restraints caused by patent licensing arrangements.[211] The Justice Department presumed that patents conferred monopoly power on the patent owner and therefore adopted the position that patents were to be treated more harshly than other assets under the antitrust laws.[212] This approach culminated in a list of "Nine No-Nos" regarding patent licensing, which the Justice Department viewed as per se illegal.[213] Such aggressive policies adopted by the antitrust

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> however advantageous it may be to stimulate the broader use of patents, is unlawful per se under the Sherman Act.

Id.

[204] *See* Andewalt, *supra* note 166, at 636.

[205] *See id.*; Vaughan, *supra* note 189, at 78.

[206] 323 U.S. 386, 406 (1945).

[207] *Id.* at 400.

[208] *Id.* at 406.

[209] *Id.* at 413-20.

[210] *See* MPEG-2 Letter, *supra* note 18, at 4 ("Pursuant to the Licensing Administrator Agreement, MPEG-LA . . . shall not discriminate among potential licensees."); MPEG-2 Letter, *supra* note 18, at 14 ("[The MPEG-2 Licensor's] undertakings to the ISO and/or the ITU-T obligate it to license on fair and reasonable terms.").

[211] *See* Section of Antitrust Law, American Bar Association, *The 1995 Federal Antitrust Guidelines for the Licensing of Intellectual Property: Commentary and Text* 4 (1996).

[212] *See id.* at 5; Andewalt, *supra* note 166, at 620.

[213] The Nine No-Nos were:

> (1) requiring a licensee to buy unpatented materials from the licensor;
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> (2) requiring a licensee to assign to the patentee any patent which may be issued to the licensee after the license agreement is executed;
>
> (3) attempting to restrict the purchaser of a patented product in the resale of that product;
>
> (4) restricting the licensee's freedom to deal in products or services not within the scope of the patent;

enforcement agencies have resulted in a great reluctance of companies to initiate pooling arrangements.[214] For example, the threat of an antitrust suit by a member of a patent pool could be used to influence negotiations for higher royalty rates, thereby compromising the integrity and advantages of the pool.[215] Alternatively, the threat of an antitrust suit by a licensee could pressure the pooling entity to reduce royalty rates.[216] Such threats of government antitrust action have caused a decline in the formation of patent pools despite the potential benefits and efficiencies brought by properly structured pools.

C. Current Treatment of Patent Pooling

However, the Justice Department has since renounced the "Nine No-Nos,"[217] and it seems that patent pooling arrangements may be primed for a resurgence.[218] With the joint release of the Antitrust Guidelines for the Licensing of Intellectual Property ("IP Guidelines")[219] in 1995 and the Antitrust Guidelines for Collaborations Among

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(5) agreeing with the licensee that the licensor will not, without the licensee's consent, grant further licenses to any other person;

(6) requiring the licensee to take a package license;

(7) requiring the licensee to pay royalties, including total sales royalties, in an amount not reasonably related to the licensee's sales of products covered by the patent;

(8) attempting to restrict a process patent licensee's sales of products made by the patented process; and

(9) requiring a licensee to adhere to any specified or minimum price in its sale of licensed product.

Bruce B. Wilson, Deputy Assistant Attorney General, Antitrust Division, Department of Justice, Remarks to Michigan State Bar Antitrust Law Section and Patent Trademark and Copyright Law Section (Sept. 21, 1972), *reprinted in* [Current Comment Transfer Binder, 1969-1983] Trade Reg. Rep. (CCH) ¶ 50,146; Bruce B. Wilson, Deputy Assistant Attorney General, Antitrust Division, Department of Justice, Law on Licensing Practices: Myth Or Reality?, Remarks to the American Patent Law Ass'n, Washington D.C. (Jan. 21, 1975).

[214] *See* Robert P. Merges, *Contracting Into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1355 (1996) ("[F]ederal antitrust policy is most likely the explanation for the small number of patent pools existing today.").

[215] *Id.*

[216] *Id.*

[217] *See* Abbot B. Lipsky, Jr., Deputy Assistant Attorney General, Antitrust Division, Department of Justice, *Special Considerations Concerning International Patent and Know-How Licensing and Joint Research and Development Activities: Current Antitrust Division Views on Patent Licensing Practices*, 50 ANTITRUST L.J. 515 (1981) ("Having buried the 'Nine No-Nos' individually, let me now perform a partial collective resurrection: I have analyzed each of these rules, and have found in almost every instance that they are overinclusive or contain at least some element of economic irrationality.").

[218] *See, e.g.*, Joel I. Klein, Acting Assistant Attorney General, Antitrust Division, Department of Justice, Cross-Licensing and Antitrust Law, Address Before the American Intellectual Property Law Association 3 (May 2, 1997) ("To put matters in perspective, I should make clear at the outset that I would expect that by far most cross-licenses and pools are, on balance, procompetitive."), *available at* http://www.usdoj.gov/atr/public/speeches/1123.htm; Brunetti, *supra* note 20.

[219] *See Antitrust Guidelines for the Licensing of Intellectual Property* (April 6, 1995), *available at* http://www.usdoj.gov/atr/public/guidelines/ipguide.htm [hereinafter IP Guidelines].

Competitors ("Collaboration Guidelines")[220] in 2000 by the Department of Justice and the Federal Trade Commission, the federal antitrust agencies now expressly recognize that patent pooling arrangements can have important pro-competitive benefits.[221] In contrast to positions adopted by the antitrust agencies in past eras, the IP Guidelines assert three general principles that suggest a more liberal stance on the antitrust enforcement of patent pools.[222] The three general principles are:

> (a) for the purpose of antitrust analysis, the federal antitrust agencies regard intellectual property as being essentially comparable to any form of property;[223]
>
> (b) the federal antitrust agencies do not presume that intellectual property creates market power in the antitrust context;[224] and
>
> (c) the federal antitrust agencies recognize that intellectual property licensing allows firms to combine complementary factors of production and is generally pro-competitive.[225]

In analyzing patent pool arrangements, the Department of Justice collapses the above principles into two main inquiries: (1) whether the proposed licensing program at issue is likely to integrate complementary patent rights; and (2) if so, whether the resulting competitive benefits are likely to be outweighed by competitive harm posed by other aspects of the program.[226] Applying this approach, the Department of Justice has recently approved three patent pools. The first, discussed later in more detail, was the approval of a patent pool for the MPEG-2 standard in 1997.[227] MPEG-2 is a complex standard approved by the ISO for the digital compression of video and audio for entertainment TV.[228] It is a fundamental technology upon which high definition television ("HDTV"), digital cable television systems, digital versatile discs ("DVD"), and other forms of digital video storage, transport, and display are based.[229] Unlike MPEG-2, the DVD standard specification is not the result of formal standard setting but of private collaboration resulting in a de facto industry

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[220] *See Antitrust Guidelines for Collaborations Among Competitors* (April 2000), *available at* http://www.ftc.gov/os/2000/04/ftcdojguidelines.pdf [hereinafter Collaboration Guidelines].

[221] While the Collaboration Guidelines, issued five years after the IP Guidelines, provides a general statement and analytical framework of the federal antitrust agencies' approach towards competitor collaborations, it remains consistent and defers to the IP Guidelines regarding intellectual property issues. *Id.* at 2 n.4.

[222] *See* IP Guidelines, *supra* note 219, at § 2.0.

[223] *Id.*

[224] *Id.*

[225] *Id.*

[226] *See* Toshiba Review Letter, *supra* note 19, at 9.

[227] *See* MPEG-2 Letter, *supra* note 18.

[228] *See* BRUCE G. HASKELL, ET AL., DIGITAL VIDEO: AN INTRODUCTION TO MPEG-2, at 3 (1997).

[229] *See* CLARK ET AL., *supra* note 173, at 13.

standard.[230] Nevertheless, after the approval of the MPEG-2 patent pool, the Department of Justice approved two more patent pools, both relating to DVD technology. In 1998, the Department of Justice approved a pooling arrangement formed by Sony, Philips, and Pioneer for the licensing of patents that are "essential" to comply with the DVD-Video[231] or DVD-ROM[232] standard specifications.[233] In 1999, the Department of Justice again approved another DVD pooling arrangement, this time formed by Hitachi, Matsushita, Mitsubishi, Time Warner, Toshiba, and Victor, for the licensing of patents essential for the manufacture of DVDs, DVD players, and DVD decoders. Indeed, the antitrust agencies are not the only federal bodies that have recognized the benefits of patent pooling arrangements. Most recently, the PTO issued a white paper recommending the formation of patent pools in the biotechnology field to address the lack of access to patented inventions based on genetic information for research and development.[234]

D. Retardation of Innovation Through Patent Pooling

As suggested by the foregoing, the more liberal position of federal agencies regarding antitrust scrutiny of patent pooling arrangements combined with the narrower interpretation of patent claims under *Festo* provide an environment in which companies may be encouraged to form more patent pools for at least two reasons. First, in a more tolerant antitrust regime, companies holding complementary patents are encouraged to eliminate the double marginalization effect of stacked monopolies by combining their patents into a pool. Companies will have the incentive to do this because, as discussed earlier, the package price of the pool can lead to higher profits for the companies. Second, the narrower interpretation of patent claims in *Festo* also increases the incentive of companies to form patent pools as it becomes increasingly possible for other companies to surround a narrowly construed pioneer patent with a multitude of small improvement patents.

However, although federal antitrust agencies now expressly recognize the potential pro-competitive benefits of patent pooling, their consideration of the effects

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[230] The DVD standard was developed and announced in 1995 by the DVD Consortium, an association of hardware and software manufacturers including Toshiba, Time Warner, Sony and Philips. In 1997, the Consortium was replaced by the DVD Forum, which, today, includes more than 200 companies. *See DVD White Paper, available at* http://www.toshiba.com/taecdpd/products/docs/dvdwhitepapers.html (last visited April 8, 2001).

[231] DVD-Video describes a high capacity, read-only format for the interactive playback of high quality video, audio and graphics designed for viewing movies and other visual entertainment. *See id.; DVD Primer, at* http://www.dvdforum.org/tech-dvdprimer.html (last updated Sep. 6, 2001).

[232] DVD-ROM describes a format similar to DVD-Video that also includes computer-friendly file formats. It is used to store data. *See DVD Primer, supra* note 231.

[233] The term "essential" is defined as "necessary (as a practical matter) for compliance with the DVD[-Video or DVD-ROM] Standard Specifications." Sony Review Letter, *supra* note 19, at Section II.A. In other words, essential patents are "inevitabl[y] infringed by compliance with the specifications." *Id.*

[234] *See* CLARK ET AL., *supra* note 173.

of such pools on future innovation is much stronger than in the past.[235] Under the IP Guidelines, if the number of companies with the required capabilities to develop technologies to compete with a patent pooled technology is relatively small compared to the number of pool members, a federal antitrust agency may utilize the concept of an "innovation market" to analyze the competitive effects of the patent pool.[236] Specifically, the antitrust agency will consider whether the patent pool would give pool members an anti-competitive incentive to collectively reduce investment in, or otherwise retard the pace or scope of research efforts.[237] The agency will balance such anti-competitive considerations with other pro-competitive considerations, such as the potential for combining complementary research of pool members in such a way as to make successful innovation more likely.[238] For example, using this approach, the Department of Justice concluded that the MPEG-2 patent pool did not discourage pool members from developing or supporting rival standards.[239]

However, when the patent pool is directed towards an accepted standardized technology within a network industry, the innovation analysis under the IP Guidelines does not seem to go far enough. As suggested earlier, the literature on standards suggests that once standardization is achieved in a network industry, network effects such as excess inertia can retard innovation by preventing the adoption of a newer, more efficient standard.[240] However, such literature is premised on the assumption that there has already been enough incentive for competitors to develop alternative choices to the current standard. The effects of patent pooling may weaken this assumption. That is, absent a patent pool arrangement, the cost to implement a patented incumbent standard may be prohibitive to certain companies. Thus, rather than develop products under the standard, these companies will commit their resources to researching new technologies that may possibly leapfrog over the incumbent standard. With patent pools, however, the significant reduction of transaction costs enables some of these companies to acquire package licenses and develop products compatible with the incumbent standard. As a result, the amount of resources invested in researching possible leapfrogging technologies is reduced and shifted towards product development under the incumbent standard. With fewer resources committed to researching leapfrogging technologies, innovation in the standards market may be retarded, and it is thus less likely that a beneficial leapfrogging technology will arise to replace the incumbent standard. Furthermore, it may be the case that the resources shifted to developing products within the incumbent standard may lead to more efficient methods of product development. Such an effect might be termed a "Japanification" effect, akin to the historic patterns of Japan where, as discussed earlier, improvements in industrial development flourished while the discovery of fundamental inventions lagged.

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[235] *See* Klein, *supra* note 218, at 11 ("Today, I believe that the impact on the members' incentives to innovate would receive at least a bit more attention.").

[236] *See* IP Guidelines, *supra* note 219, at § 3.2.3, Example 3.

[237] *See id.* Example 4.

[238] *See id.*

[239] *See* MPEG-2 Letter, *supra* note 18, at 12.

[240] *See* Farrell, *supra* note 22, at 37; Farrell & Saloner, *supra* note 46, at 72; Hinshaw, *supra* note 23, at 307.

While the "Japanification" effect from patent pools may reduce innovation in the standards market, innovation within the incumbent standard may still benefit from pooling arrangements. As noted earlier, pooling arrangements enable pool members to combine resources and technologies for further research. However, such research seems inevitably skewed towards retaining the incumbent standard and may lead to future technologies that are constrained by concerns for backwards compatibility with the incumbent standard.[241] As such, a leapfrogging standard also seems less likely to emerge from such research to replace the incumbent standard. Thus, as can be seen, patent pooling arrangements may lead to more efficient development of standardized products, but such arrangements may also lead to further retardation of research and invention in the standards market by increasing the incentive to create standards-compliant products.

E. Analysis of the MPEG-LA Pool

The patent pool for the MPEG-2 standard administered under the MPEG-LA provides a good real-world example to further explore some of points made in this article. A scheme for the digital compression of video and audio for entertainment TV, the MPEG-2 standard is perhaps one of the most versatile and complicated communication standards ever written.[242] It was approved as a formal standard by the ISO on November 11, 1994.[243] Since then, the ISO endorsement has helped it become a widely accepted technology that serves as a fundamental technology for HDTV, digital cable television systems, DVD, and other forms of digital video storage, transport and display.[244] The MPEG-2 standard is widely recognized as a great technical achievement in digital video compression.[245] Commenting scientists have maintained that its technical success can be attributed, in part, to the recognition of MPEG-2 patent rights by the ISO/IEC JTC 1 standard setting body.[246]

As noted earlier, an MPEG-2 patent pool formed by the Trustees of Columbia University, Fujitsu Limited, General Instrument Corp., Lucent Technologies Inc., Matsushita Electric Industrial Co., Ltd., Mitsubishi Electric Corp., Philips Electronics N.C., Scientific Atlanta, Inc., and Sony Corp. was approved by the

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[241] *See* Katz & Shapiro, *supra* note 35, at 95 ("Although compatibility has obvious benefits, obtaining and maintaining compatibility often involves a sacrifice in terms of product variety or restraints on innovation.").

[242] *See* Haskell, *supra* note 228, at xiii.

[243] *See id.*

[244] *See* CLARK ET AL., *supra* note 173, at 13.

[245] In 1996, the ISO and IEC received an Emmy Award for Outstanding Achievement in Technological Development for their development of the MPEG-2 standard. *See ISO, IEC Awarded Emmy for Standards that Provide High Quality Audio and Video Programming to Consumers*, *available at* http://www.mpeg.org/MPEG/award.html (last visited April 4, 2002).

[246] *See* Eric D. Scheirer, *MPEG, Patents, and Open Source*, WEBNOIZE MAGAZINE (May 10, 1999) ("If MPEG had not allowed standards to contain patented technology (this is the approach taken by, for example, the W3C), then the open standard would simply not be as good as the proprietary standards. In the long run it was viewed that this would fracture the market, and would inspire development of multiple independent and incompatible solutions."), *available at* http://www.webnoize.com/.

Department of Justice in 1997.[247] Under the MPEG-2 patent pool arrangement, MPEG-2 patent owners commit to license their patents jointly through a common license administrator ("MPEG-LA").[248] MPEG-LA assumes the tasks of granting portfolio licenses to users in a nondiscriminatory manner and collecting and distributing royalty income.[249] Under the arrangement, the patents in the pool have to be "essential," meaning any patent that is necessary for compliance with the MPEG-2 standard.[250] Assessment of the "essentiality" of patents is made by an independent patent expert familiar with the standard and the relevant technology.[251] Moreover, MPEG-LA is required to grant licenses to any potential licensees, without discrimination and at a reasonable royalty rate.[252] Additionally, the license has a grant-back provision that requires the licensee to grant to the licensor and other portfolio licensees a nonexclusive license, under fair and reasonable terms and conditions, on any essential patent that the licensee has a right to license.[253]

In approving the MPEG-2 patent pool, the Department of Justice noted several important aspects of the arrangement. First, the limitation of the pool to complementary essential patents determined by an independent expert helped to ensure that no non-essential competitive patents would be bundled together, thereby foreclosing competitive implementation options left open by the MPEG-2 standard.[254] Second, the commitment to offer licenses on fair, reasonable and non-discriminatory terms minimized the ability to use the pool as a vehicle to disadvantage competitors in downstream markets or to collude on the prices of downstream products.[255] Finally, the Department of Justice noted that the MPEG-2 patent pool would not restrain innovation. That is, pool members were not discouraged, either through outright prohibition or economic incentives, from developing or supporting a rival standard.[256] Additionally, licensees were free to independently make products that did not comply with the MPEG-2 standard.[257]

While the Department of Justice's approval of the MPEG-2 patent pool was an important step in encouraging pro-competitive patent pooling arrangements, certain aspects of its analysis deserve discussion. First, the Department of Justice's conception of the "essentiality" of a patent seems misguided. For example, MPEG-2 encoders are not specified by the MPEG-2 standard.[258] Thus, patents involving MPEG-2 encoders are not deemed to be "essential" by the MPEG-LA. However, a manufacturer desiring to build a suite of MPEG-2 products including both encoders and decoders, despite taking a portfolio license from MPEG-LA, might still have to incur high transaction costs to obtain licenses from various MPEG-2 encoder patent owners. As described earlier, such MPEG-2 encoder patents surround the landscape

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[247] *See* MPEG-2 Letter, *supra* note 18.
[248] *Id.* at 3.
[249] *Id.*.
[250] *Id.* at 10 n.4.
[251] *Id.* at 4.
[252] *Id.* at 5-7.
[253] *Id.* at 7.
[254] *Id.* at 10.
[255] *Id.* at 10-11.
[256] *Id.* at 12.
[257] *Id.*
[258] *See* Haskell, *supra* note 228, at xii.

of the MPEG-2 standard and may nevertheless be "essential" from the perspective of certain manufacturers. Furthermore, the Department of Justice's conclusion that innovation is not restrained by the MPEG-2 patent pool does not seem to consider the positional strength of an accepted standard. That is, as noted earlier, the reduction of transaction costs by the MPEG-2 patent pool may indeed lead to a retardation of innovation in the digital video compression market, because the lower cost of access to MPEG-2 may convince manufacturers to take a portfolio license rather than invest in new lines of research. This reduction in research may make it less likely that a potentially beneficial new digital video compression technology will emerge to leapfrog over the MPEG-2 standard.[259] Innovations in digital video compression may still emerge, but they will more likely be skewed towards backward-compatible (but potentially cumbersome) technologies developed and driven by continued collaboration among pool members and buoyed by their desire to maintain the standard in the industry.[260]

V. CONCLUSION

Patent pooling should generally be regarded as a practice with potentially strong pro-competitive benefits. With encouraging federal antitrust agencies and narrower claim interpretations under *Festo*, patent pooling arrangements seem ready for a resurgence. However, where the pooling involves a standard within a network industry, further research is needed to determine its effect on the standards innovation market. The current literature on standards typically begins its analyses from a presumption that that there are already *existing* alternative technologies trying to dethrone an incumbent standard. However, a patent pool arrangement for an incumbent standard may strengthen its position and actually result in fewer competing technologies. By decreasing access costs to participate in the standard, patent pooling increases the amount of participants in the standard, thereby spurring further efficiencies and improvements in the development of standardized products. However, at the same time, participants who would have otherwise researched new technologies to overcome the incumbent will now select the less risky choice of developing standardized products. This effect has the potential to reduce the level of research and invention in new technologies that can compete with the incumbent standard. Depending on the strength of this effect, the end result may be backward-compatible (and potentially cumbersome) innovations driven predominantly by the patent pool members who have strong incentives to maintain their position as the industry standard.

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[259] In contrast, it seems clear that development and improvements in MPEG-2-related technologies are stronger than ever. *See generally MPEG-2 and Video Services*, The Insight Research Corporation (April 1999).

[260] For example, the newer MPEG-4 technology, which was finalized by the ISO/IEC JTC 1 in 1999, was intended to be backwards-compatible with MPEG-2. Haskell, *supra* note 228, at 369.