PERFECT HAPPINESS?: GAME THEORY AS A TOOL FOR ENHANCING PATENT QUALITY

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ABSTRACT

Since its inception in 1790, the U.S. patent system has been inextricably linked to innovation, the dissemination of knowledge, and numerous other societal benefits. The adoption of a patent claiming system in 1836 has resulted in a series of historical trends, including: (1) the century-plus trend of yearly increases in applications, straining the agency beyond its capabilities; (2) a highly labor-intensive examination process; and, (3) the majority of patents issued have been valueless. Today the U.S. Patent and Trademark Office ("PTO") is in a self-described workload crisis and under attack for quality concerns.

Former Under Secretary and PTO Director James E. Rogan carefully articulated these problems. Through his leadership, Rogan successfully championed a series of initiatives to modernize the PTO. His central theme was modernizing the agency and transforming its nineteenth century business model for the twenty-first century. However, patent reform has become increasingly difficult recently due to the rigors of the legislative process and political considerations.

This Article applies game theory, a branch of applied mathematics, to propose a new patent reform whereby the PTO focuses more resources on more rigorous examination of fewer applications. Empirical patent scholars have concluded that only a small fraction of all patents are "valuable," and scarce examination resources are not properly allocated. Economists liken the patent system to a lottery--individuals seek windfall rewards for their efforts.

The Article's proposed examination paradigm avoids arbitrary and irrational resource allocation by applying a market-based mechanism: an auction. An auction will discourage lottery strategies and helps weed out worthless applications. Since our history and tradition encourage promoting innovation and entrepreneurship broadly, the proposal offers inventors a choice for the legal protection of their inventions. Through an auction, inventors could vie for an application's full-scale examination. Alternatively, they would be eligible for another

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type of protection (e.g., a petty patent). Nobel Laureate William Vickrey pioneered a sealed bid, second price variety of auction. It is an ideal mechanism for the allocation of scarce public sector resources, and is also appropriate in the patent context. It permits the more robust examination of a smaller set of applications. This will help ease the PTO's workload crisis, discourage specious applications, and hence enhance patent quality. The Vickrey auction does not seek to maximize revenue so as to punish new inventors, small businesses, and non-profits. Rather, it dynamically finds the most optimal price for government examination services.

This Article's new paradigm promises to break the century-plus cycle of dysfunction and offer public policy benefits for each of the participants and society at large.

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INTRODUCTION

> *"This [Patent Office crisis] is enough to make a person turn Bolshevik when we consider that the inventors are paying all of the Office expenses and that they are entitled to prompt action."*[1]

> *"As some have said in the past, we [Patent Office examiners] produce Chevys, not Cadillacs."*[2]

Since Congress first established the Nation's patent system with the 1790 Patent Act, the U.S. patent system has been inextricably linked to innovation, research and development investment, and controversy.[3] This Article is the first in a series to explore how the application of game theory[4] principles can improve the patent system through enhancing patent examination quality and Patent Office operations. The Article concludes that patent reform must focus on Patent Office operations. This conclusion is true whether one subscribes to the view that inventors deserve prompt action from the Patent Office or the view that too many specious patent claims are approved, and hence, overall quality is poor. This conclusion naturally flows from a number of uncontroverted assumptions about the role of the patent system in our society and the nation's economy. These assumptions focus on how the patent system's users and other players interrelate (e.g., patent applicants, the patent employee unions, and political entities), their behavior, and the application of certain game theory and applied economics principles. This Article proposes a new examination system based on economic and game theory as a means of breaking the century-plus cycle of dysfunction. Under this Article's proposed regime, the Patent Office may use its budget and resources for a more focused examination of a smaller, more valuable subset of

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[1] Ford W. Harris, Letter to the Editor, 3 J. PAT. OFF. SOC'Y 444, 446 (1921).

[2] *The Operations of the U.S. Patent and Trademark Office Including Review of Agency Funding: Hearing Before the Subcomm. on the Courts and Intellectual Property of the H. Comm. on the Judiciary*, 107th Cong. 27 (2001) (statement of Ronald J. Stern, President of the Patent Office Professional Association (POPA)). The Author notes that Ronald Stern's testimony is quoting former Deputy Assistant Commissioner for Patents William Feldman.

[3] Act of Apr. 10, 1790, 1 Stat. 109; William C. Rooklidge, *Reform of the Patent Laws: Forging Legislation Addressing Disparate Interests*, 88 J. PAT. & TRADEMARK OFF. SOC'Y 9 (2006) (outlining the centuries-old controversies surrounding the Patent Act).

[4] "In some ways the name 'game theory' is unfortunate, for it suggests that the theory deals with only the socially unimportant conflicts found in parlor games, whereas it is far more general than that." R. DUNCAN LUCE & HOWARD RAIFFA, GAMES AND DECISIONS, INTRODUCTION AND CRITICAL SURVEY 2 (1985). Game theory, for the purposes of this paper, is defined so as to include the process of maximizing the outcome of a conflict or the allocation of resources through the use of the mathematical and statistical methods.

applications, thereby enhancing overall quality, weeding out many patents with poor or defective claims, and eliminating wasteful practices.

This Article examines the recent history surrounding the problems, policies, and politics inherent in the Patent Office's operations. It then proposes a solution in the form of a new examination model derived from game theory and applied economic principles, particularly the Vickrey auction. Part I provides an introduction that summarizes the history of the issues at the heart of the matter. Part II examines the practical and political issues and obstacles facing the Patent Office and its mission to process an ever burgeoning workload while struggling with patent quality issues. Likewise, Part II briefly reviews some of the political and practical obstacles the Office has faced in the context of previous legislative patent reforms. Part III explains how game theory and applied economics can be a valuable tool for public institutions in a variety of contexts. Part IV outlines a proposal to use game theory, specifically a hybrid auction mechanism, to enhance Patent Office operations and enhance patent quality. Part IV also attempts to address some of the inevitable concerns that this novel reform proposal will elicit. Finally, Part V places this novel proposal into perspective in light of long-standing trends.

I. AN INTRODUCTION TO THE U.S. PATENT SYSTEM

The nation's intellectual property laws, as enacted by Congress, reflect the values imbued in the U.S. Constitution's grant "[t]o promote the Progress of Science and useful Arts by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[5] For more than two centuries, the nation's intellectual property system has balanced a set of policy objectives, including stimulating innovation, incentivizing financial investment, and promoting competition through a nationally uniform legal framework of rules.[6] The legal instruments that provide intellectual property protection under federal law are patents (for inventions),[7] copyrights (for original works of authorship),[8] trademarks (for words, slogans, or logos),[9] semiconductor

[5] U.S. CONST. art I, § 8, cl. 8.

[6] Note, *Patent Preemption of Trade Secret Protection of Inventions Meeting Judicial Standards of Patentability*, 87 HARV. L. REV. 807, 819 (1974) (explaining the purpose of intellectual property laws and the constancy of its policy objectives).

[7] Under the Patent Act, patentable inventions include "any new and useful process, machine, manufacture, or composition of matter . . . ." 35 U.S.C. § 101 (1952).

[8] The Copyright Act defines the scope of the subject matter of copyright for original works of authorship to include "literary works, musical works, dramatic works, pantomimes and choreographic works, pictorial, graphic, and sculptural works, motion pictures and other audiovisual works, sound recordings, and architectural works." 17 U.S.C. § 102 (1976).

chip masks,[10] and vessel hull designs.[11] State law provides protection for the rights of publicity and privacy (for famous personae)[12] and trade secrets (for proprietary information ranging from tangible inventions to compilations of information and databases). One noteworthy aspect of patent protection under the current U.S. system is that it requires an affirmative act by the state to obtain any protection, unlike many other species of intellectual property. In contrast, one may obtain a copyright, trademark, or trade secret merely upon creation and use. The additional step of federal registration provides the author or mark owner additional privileges under the copyright and trademark systems. A patent, on the other hand, is entirely a creature of federal law, and requires the government to examine an application.[13]

The Patent Office ("PTO") is thus interposed between the inventor and the public,[14] serving as a gatekeeper for the public's storehouse of knowledge[15] and the nation's economic investment.[16] The PTO examines patent applications, makes a determination regarding the patent's validity, and grants patents in accordance with the requirements of the Patent Act[17] and proffered evidence of the innovation's advancement beyond the

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[9] Trademarks "includ[e] any word, name, symbol or device or any combination thereof." 15 U.S.C. § 1127 (1946); *see also* Qualitex Co. v. Jacobson Prods. Co., 514 U.S. 159 (1995).

[10] 17 U.S.C. § 901 (1984).

[11] 17 U.S.C. § 1301 (1998).

[12] The right of publicity, generally a state right, is defined as: "The right of an individual, especially a public figure or celebrity, to control commercial value and exploitation of his name or picture or likeness to prevent others from unfairly appropriating that value for their commercial benefit." BLACK'S LAW DICTIONARY 1325 (6th ed. 1990).

[13] Property in patents exists solely by virtue of federal statute (the Patent Act) and accordingly defined under federal law. *See* Crown Die & Tool Co. v. Nye Tool & Mach. Works, 261 U.S. 24, 40 (1923) ("Patent property is the creature of [federal] statute law and [the] incidents [of that property] are equally so and depend upon . . . [those patent] statutes . . . in view of the policy of Congress in their enactment . . . ."); Wheaton v. Peters, 33 U.S. 591 (8 Pet.) (1834).

[14] Throughout this Article, the U.S. Patent and Trademark Office, an agency of the U.S. Department of Commerce, is also referred to as the "Patent Office," "PTO," and "the agency."

[15] *See* Chris J. Katopis, *Patents v. Patients: Policy Implications of Recent Patent Legislation*, 71 ST. JOHN'S L. REV. 329, 340 (1997) [hereinafter *Patents v. Patients*].

[16] *Id.* at 341 (discussing the "prospect" and "innovation" theories surrounding economic incentives for research and investment in terms of economic theory).

[17] 35 U.S.C. § 1 *et seq.* (2002).

existing prior art.[18] In essence, it assesses the breadth of the patent claims submitted.[19] Should the PTO grant too much patent protection to inventors, society is harmed by having the public domain reduced through an overbroad monopoly. Likewise, should the PTO insufficiently review the patent application and fail to grant the correct scope of protection, several negatives consequences follow: namely, the inventor will not receive the full quantum of rights sought, the level of investment will likely be less than optimal, and society will not benefit from the disclosure that results when a patent is eventually published.

A fundamental, and too often overlooked, benefit underlying the patent system is the quid pro quo of public disclosure in exchange for the limited patent monopoly.[20] The benefits of the patent system's disclosure requirement may be illustrated in many ways. The most tangible, if not notable, result is the fact that the PTO's electronic patent records of the more than seven million granted patents and published applications now comprise the world's largest transactional database.[21]

A patent applicant has a duty of disclosure and thus a duty "to put the public in possession of what the party claims as his own invention, so as to ascertain if he claims anything that is in common use, or is already known, and to guard against prejudice or injury from the use of an invention which the party may otherwise innocently suppose not to be patented."[22] Congress has required an applicant to state with particularity the claimed invention in the specification since 1836.[23] As the Supreme Court has observed, the public notice function of claiming one's invention with certainty is vital to the balance between individuals securing the

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[18] "Prior art" refers to the sum of publicly available scientific or engineering knowledge and literature surrounding an existing invention. *See generally* KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727 (2007).

[19] The late Giles S. Rich, longtime judge of the U.S. Court of Appeals for the Federal Circuit, expressed this phenomenon best: "The name of the game is the claim." Giles S. Rich, *The Extent of the Protection and Interpretation of Claims—American Prospectives*, 21 INT'L REV. INDUS. PROP. AND COPYRIGHT L. 497, 501 (1990)).

[20] *See* United States v. Dubilier Condenser Corp., 289 U.S. 178, 186-87 (1933) (distinguishing monopolies from patents and toting the patent's system's *quid pro quo*); United States v. American Bell Tel. Co., 167 U.S. 224, 239 (1897) (supporting the dual propositions that inventions ultimately add to sum of human knowledge and the grant of patent monopolies); Grant v. Raymond, 31 U.S. (6 Pet.) 218, 247 (1832) (noting that patent system design allows the public to benefit from new inventions in exchange for granting an inventor a temporary monopoly).

[21] *See, e.g.*, http://www.uspto.gov/patft/index.html.

[22] Evans v. Eaton, 20 U.S. (7 Wheat.) 356, 434 (1822).

[23] *See, e.g.*, Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 26-27 (1997); Keystone Bridge Co. v. Phoenix Iron Co., 95 U.S. (5 Otto) 274, 278 (1877); Phillips v. AWH Corp., 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc); *see also infra* note 35..

benefits of innovation and providing notice to the public of the property right:

> The statutory requirement of particularity and distinctness in claims is met only when they clearly distinguish what is claimed from what went before in the art and clearly circumscribe what is foreclosed from future enterprise. A zone of uncertainty which enterprise and experimentation may enter only at the risk of infringement claims would discourage invention only a little less than unequivocal foreclosure of the field.[24]

In sum, the PTO serves an incredibly important national public policy role, that of a gatekeeper for industry and the public. First, through its examination policy, it indirectly regulates the amount of scientific and technical information disseminated to the public. The theory is that the information disclosed by granted patents and other applications expands the public's storehouse of knowledge.[25] Second, the PTO can dictate the amount of economic investment flowing into all sectors of the U.S. economy, including high technology, media, health care, industrial research, and manufacturing.

II. THE 21ST CENTURY PTO

The PTO in the twenty-first century has the same principal mission as it had in the nineteenth century: examining the applications of members of the public seeking patents. Accordingly, the PTO's mission has three operational components shaping its mission goals: workload, quality, and infrastructure. These three areas are clearly related. Two commentators observed the relationship among these operational components merely a generation ago in 1973:

> Do the officials of the Patent Office really care about the validity of the patents which are issued from their agency, as long as the production goals which they set for the patent examiners concerning the disposal of patent applications are met? The official position of the Patent Office is that they desire the issuance of patents of the highest possible validity. But, in view of their actual conduct concerning production goals, this position must be viewed as at least open to question. As long as the officials of the Patent Office demand greater production of disposal each year . . . it is difficult indeed for anyone with an objective viewpoint to be convinced that they are paying

[24] United Carbon Co. v. Brinney & Smith Co., 317 U.S. 228, 236 (1942); *see also* Markman v. Westview Instruments, 517 U.S. 370, 390 (1996). Under a patent claiming system the applicant must "particularly 'specify and point' out what he claims as his invention," and the scope of the patent monopoly does not extend beyond the claim. Winans v. Adam, 56 U.S. (15 How.) 330 (1854) (Campbell, J.).

[25] *See* Katopis, *Patents v. Patients*, *supra* note 15, at 340.

> anything more than lip service to the concept of the highest possible patent validity.[26]

While the PTO's core mission remains the same today as it was two centuries ago, it is significantly more challenging due to the sheer number and the complexity of applications it must review. First and foremost, the PTO's management decisions continually raise resource allocation questions—e.g., whether the agency should invest its finite resources in human capital, such as hiring additional examiners, or whether acquiring superior computer systems should be a more important priority. Though highly labor intensive, the modern patent examination process heavily relies on computer systems and information technology ("IT") infrastructure to manage the hundreds of thousands of pending applications and enormous prior art databases. The PTO's electronic infrastructure is intended to help expedite the enormous workload facing the examiners and make the examination process more efficient. Today the quality of examination is therefore heavily dependent on the electronic infrastructure (which provides access to various prior art databases).

The PTO's heavy reliance on computer infrastructure proves to be mixed—both a blessing and a curse. In the Author's experience at the PTO earlier this decade, computer outages were a frequent occurrence. Malfunctioning systems can have a significant negative impact on the PTO's productivity. For example, a one-hour computer outage in an agency with only 2000 examiners results in the loss of one-person year of productivity. This represents numerous lost opportunities and contributes to persistent backlog and workload issues.[27] In contrast, today the agency has more than 5000 examiners and is growing steadily. Presently, a one-hour loss of computer systems would result in a loss of more than three person-years of productivity.

As the enormous workload issues increase, one can conclude that the resulting patent quality will inevitably suffer. The basic factors affecting the PTO's productivity were nicely summarized in a 1955 paper:

> (1) the rate at which new applications are received;
> (2) the size of the examining force;
> (3) the experience and capability of the examiners; and

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[26] Martin R. Horn & Saul Epstein, *The Federal Courts' View of Patents—A Different View*, 55 J. PAT. OFF. SOC'Y. 134, 134 (1973).

[27] Note, *The United States Patent Office: What it is. How it Functions. And What it Needs.*, 37 J. PAT. OFF. SOC'Y 769, 782 (1955) [hereinafter *The United States Patent Office*] ("The term 'backlog' means the total number of applications pending in the Patent Office. This total includes those applications which are awaiting action by examiners and those which await action by the applicant.").

(4) the complexity of the inventions disclosed in the application submitted.[28]

If one assumes that workload and quality are inextricably related, then these productivity factors will impact the resulting examination quality. Another factor that bears on resulting patent quality is the content of the applicant's submitted application (e.g., the completeness of any prior art search and the drafting of submitted claims).[29]

The state of the PTO today is dismal, as evidenced by its million-plus application backlog, employee morale problems, and the chorus of complaints concerning patent quality. While two critics recently charged that "[p]atent reform commentators can be . . . criticized for asserting the patent system is broken without solid supporting data,"[30] indeed, ample data supports this conclusion. A 2005 Government Accountability Office (GAO) report concluded, "USPTO's resources have not kept pace with the rising number and complexity of patent applications it must review."[31] Such disagreement concerning whether a problem even exists has resulted in a lack of patent reform. Many critics have called for various reforms over the decades, but the reforms spear-headed by agency officials have been met with disappointing results.[32]

History shows that the PTO's inability to contend with the rising tide of new patent applications has dramatically escalated in recent years. While many have discussed the recent growth in the PTO's new application filings and inventory, it is not well-known that the PTO's workload problems go back for more than a century. Figure 1, below, illustrates the rise of the PTO's total application backlog from a mere 4644 in 1883 to more than one million by 2006.

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[28] *Id.* at 780.

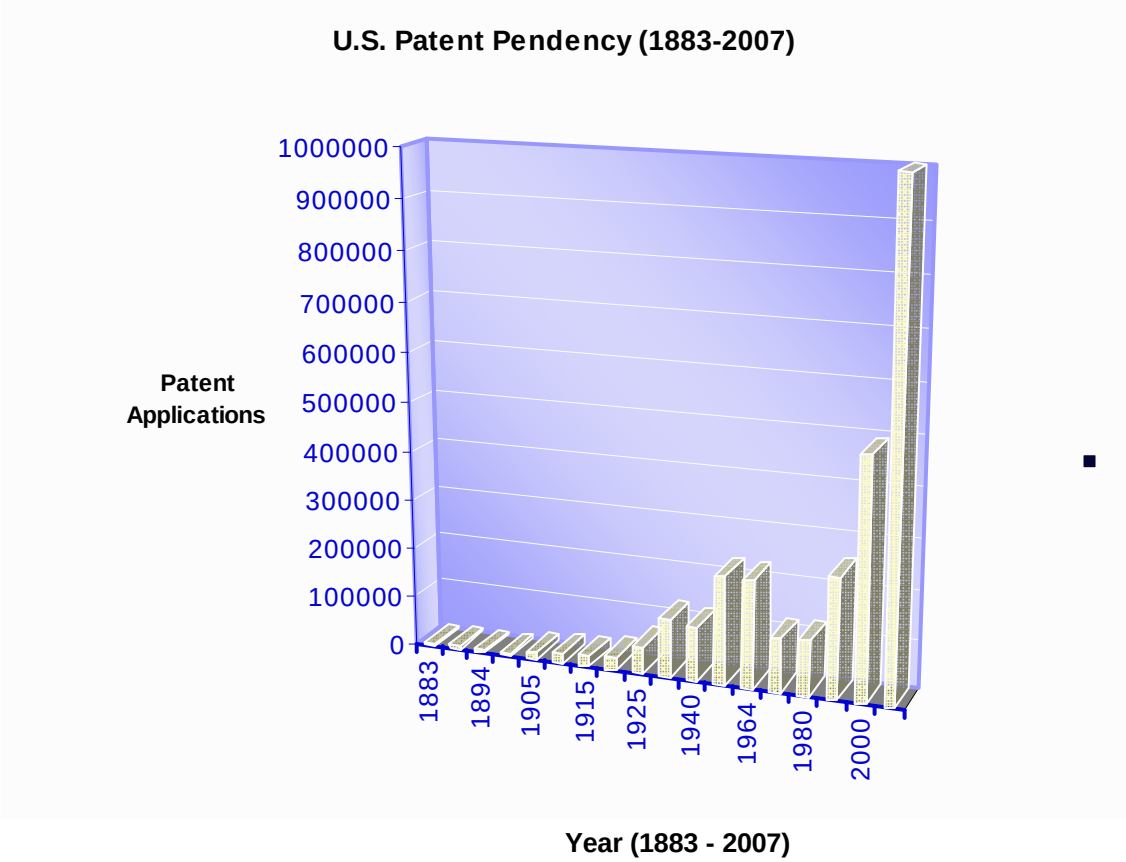
[29] A "prior art search" refers to one phase of the examination process. In this phase the inventor-applicant or the examiner reviews all past publicly known scientific and technical information that may bear on the patentability of the proffered invention. *See supra* note 18.

[30] Stephen T. Schreiner & Patrick A. Doody, *Patent Continuation Applications: How the PTO's Proposed New Rules Undermine an Important Part of the U.S. Patent System with Hundreds of Years of History*, 88 J. PAT. OFF. SOC'Y 556, 559 n.12 (2006).

[31] U.S. GOV'T ACCOUNTABILITY OFFICE, USPTO HAS MADE PROGRESS IN HIRING EXAMINERS, BUT CHALLENGES TO RETENTION REMAIN 1 (2005) (GAO-05-720) [hereinafter GAO REPORT].

[32] *See generally* PATENTS IN THE KNOWLEDGE-BASED ECONOMY (Wesley M. Cohen & Stephen A. Merrill eds., 2003); FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW POLICY (Oct. 2003), *available at* http://www.ftc.gov/os/2003/10/investmentrpt.pdf; NAT'L RESEARCH COUNCIL OF THE NAT'L ACADEMIES, A PATENT SYSTEM FOR THE 21ST CENTURY (2004), *available at* http://www.nap.edu/html/patentsystem/0309089107.pdf.

Figure 1 - USPTO Total Patent Application Backlog (1883 – 2007)[33]



The total application backlog may result from many factors, including inadequate resources, poor planning, significant national events (e.g., world wars), failure to develop efficient procedures, and the fact that applications have become larger (i.e., include an increasing number of claims) and more technologically complex over the past century.

The patent system is full of rich history and lore. Thomas Jefferson is credited by history as the first patent commissioner.[34] One can imagine him sitting at a desk in Monticello examining the Nation's first applications. Today's basic patent examination model, whereby a government patent examiner reviews the claims of a patent, dates back to

[33] For sources from which data was compiled, see *infra* note 130.

[34] *See* Craig Allen Nard, *Deference, Defiance, and the Useful Arts*, 56 OHIO ST. L.J. 1415, 1417 n.11 (1995) ("The first patent statute was enacted in 1790. Act of April 10, 1790, ch. 7, 1 Stat. 109 (1790). The 1790 Act established a group of executive officers (the Secretary of State, Secretary of War, and Attorney General) who were authorized to issue patents if the officers determined that the inventor was the 'first and true inventor' and that the invention was 'sufficiently useful and important.' Thomas Jefferson, the first Secretary of State, was primarily responsible for administering this patent statute.").

the Patent Act of 1836.[35] The Senate Report accompanying the Patent Act of 1836 cited various evils in the existing system of issuing patents extant at that time. Among the evils listed was that a "considerable portion of all the patents granted are worthless and void . . . [and this] opens the door to frauds."[36] The necessity of an examiner evaluating the claims of application for patentability certainly poses operational challenges. The PTO must allot an examiner adequate time to assess the claims, thereby balancing considerations of efficiency and quality. An imbalance in the time-per-application by each examiner may result in two species of dysfunction: (1) a backlog of unexamined applications; and/or (2) resulting poor examination quality.

The long-term historical data concerning the PTO's operational workload dysfunction has not been widely discussed in recent academic research or by congressional oversight committees. It is, however, well-known that the PTO has approximately one million unexamined applications in its current inventory. While some realize that this backlog did not occur overnight, the longevity of the problem is not generally known to the public, congressional overseers, or the patent community. The PTO backlog represents a systemic problem dating back to the beginning of the last century, as illustrated by Figure 1, above. In 1883, the PTO backlog was relatively small—a mere 4644 backlogged applications.[37] In the 1920s, the application backlog grew to more than 100,000 (by 1934, it was approximately 112,500).[38] As mentioned, today the troubling backlog has grown by an order of magnitude to seven digits. Though the problem has existed for more than a century, it has become so severe that it may be beyond repair.

One can only speculate as to the reasons why the PTO's backlog has not been squarely addressed over the past century. A 1966 paper by R.Y. Peters warned that unless there was a change in the PTO's "manpower" and the patent "laws," a backlog of one million applications

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[35] Act of July 4, 1836, ch. 357, § 6, 5 Stat. 117; *see also* Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 26 (1997) ("The 1952 Patent Act is not materially different from the 1870 Act with regard to claiming, reissue, and the role of the PTO."); *see generally* 8 CHISUM ON PATENTS § 8.02[2] (2007) ("The Patent Act of 1836 adopted the rule . . . that the inventor in the specification 'particularly specify and point out the part, improvement, or combination, which he *claims* as his own invention or discovery.' The Patent Act of 1870 further formalized the requirement of claims . . . .") (citation omitted).

[36] 8 CHISUM ON PATENTS § 3 n.10 (overview).

[37] *Condition of Work in the U.S. Patent Office*, 12 J. PAT. OFF. SOC'Y 167, 168 (1930). As a baseline for comparison to today's environment, in the 1910s, the PTO received approximately 71,000 new patent applications per year. *Id.*

[38] *The United States Patent Office*, *supra* note 26, at 787. Again, for a perspective of the system as it stood then, in the 1930s annual patent filings were approximately 60-66,000 per year. *Id*. at 781.

and ten-year pendency would occur by 1985,[39] a dire prediction that turned out to be only slightly premature in its timing. The foremost reason may be that U.S. industry did not view the situation as a serious problem until only recently. A backlog of this magnitude may not have been widely perceived as a problem because pendency was relatively low—e.g., in the 1920s it was approximately 5.9 months.[40] But it has steadily grown over time, and it is now a practical problem.

One must conclude that different industries perceive pendency in different ways, as a consequence of their respective industry business models. In order to obtain first mover advantage, many industries place their product or service in the stream of commerce prior to applying for a patent and long before the patent is granted. Some industries, such as the biotechnology and pharmaceutical industries, must await regulatory approval from agencies such as the Food and Drug Administration or Environmental Protection Agency. Under the provisions of the Hatch-Waxman Act,[41] some lost patent terms may be restored. A delay at the PTO of even several years may not be perceived as harmful for business purposes in such industries. In contrast, the modern software and semiconductor industries, for example, have products with relatively short lifecycles. As the burgeoning backlog has impacted patent pendency, with the pendency exceeding the product's life in some cases, the problem has become much more acute, if not critical. The 1955 *Journal of the Patent Office Society* discusses an optimal backlog of 100,000 applications.[42] This Article does speculate as to whether any backlog is desirable, useful, or optimal. A modest backlog may have traditionally served an institutional purpose: namely, guaranteeing years of work for the hundreds of federal employees serving as PTO examiners. But backlogs may contribute to abusive and wasteful patent continuation practices.[43] One can conclude that it is in the nation's best interest for patent applications to be processed as expediently as possible, so as to guarantee that inventions can be promptly commercialized and new technology disclosed to the

[39] R.Y. Peters, *Publication of Pending Applications*, 48 J. PAT. OFF. SOC'Y 553, 561 (1966).

[40] Harris, *supra* note 1, at 446.

[41] The Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417.

[42] *The United States Patent Office*, *supra* note 28, at 786. The article's conclusion that the ideal backlog for the PTO is 100,000 applications is predicated on the assumption of a staff of 850 patent examiners. *Id.* According to these assumptions, sthe article would suggest that today's PTO, with a workforce of 5000 examiners, would have an "ideal" backlog of approximately 588,000. In any event, the actual PTO backlog far exceeds the literature's suggested ideal.

[43] The Patent Act permits an applicant to file a continuation of a pending application. 35 U.S.C. § 120 (2006); *see also* Tafas v. Dudas, 541 F.Supp.2d 805 (E.D. Va. 2008).

public. While there may be a fear in some quarters that a nominal backlog may lead to reductions in the federal workforce, two points are offered to rebut this contention. First, the employment of the PTO examination corps should not be tied to the inventory. If the inventory were to shrink below a certain threshold, then examiners should be given the ability to spend additional time scrutinizing the pending applications. Second, the current state of the PTO and its enormous inventory make this only a theoretical concern.

In sum, the modern U.S. patent system, which has been based on a claiming system since 1836, has had an unexamined application backlog for almost its entire existence. Today, the PTO's seven-digit application backlog has reached epidemic proportions. Pressure from industry and Congress to address the backlog will influence the allocation of agency resources for decades. The inevitable diversion of agency resources to contend with a backlog of this magnitude poses a threat to patent quality, e.g., an insufficient workforce must contend with a growing amount of work over a given time interval.

At the PTO, patent workload and quality are interrelated. The workload and the productivity of the average patent examiner vary with her skill and grade. It is estimated that, on average, an examiner must examine eighty-seven applications per year, spending approximately nineteen hours on each application.[44] Some applications, due to their complexity, require longer review. The quality of an examination relates to the length of the review. In theory, the examination process should be prompt and efficient, such that one could apply for a patent in the morning, get some type of feedback from an examiner a few hours later, and finally be granted a patent a few hours after that. Today, the reality of the record backlog (one million unexamined applications)[45] and pendency (up to ten years) beg the question: "*Why must one wait ten years for nineteen hours of work?*" The case for the operational reform of the PTO is very strong. The solutions to these problems – which will require legislative amendments to the Patent Act and various resources – have been elusive to articulate, if not achieve.

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[44] GAO REPORT, *supra* note 31, at 28. Accordingly the average patent examiner is spending approximately 1700 hours per year on examination activity. This provides a rough estimate of the PTO's capacity to examine its pending and new workload.

[45] The Author's research demonstrates that the PTO has had a significant backlog for more than a century, surpassing 100,000 in the 1920s. The PTO's own annual reports show a backlog of approximately 162,000 applications in 1974. *See* Assistant Secretary of Commerce and Commissioner of Patents and Trademarks, *Annual Report Fiscal Year '93*, at 60, *available at* http://www.uspto.gov/web/offices/com/annual/1993/93annual.pdf.

A. THE PTO CANNOT SPEND ITS WAY OUT OF THE PROBLEM

The debate about the patent system, including quality concerns, has largely focused on the PTO's resources, or lack thereof, for most of the 1990s. Industry and the patent bar have long asserted that the workload and quality problems at the PTO were a result of the government's failure to provide the agency adequate funding. This blame-game chorus reached a crescendo in 2002 when Congress was formulating the PTO's annual budget.

Every year, Congress faces a multitude of difficult spending choices as part of the annual budget process, e.g., health care, defense, scientific research, and infrastructure. It does not take kindly to any federal agency squandering its budget. In the course of writing the annual spending bill that traditionally included the PTO (i.e., Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriation Bill), the then-Republican controlled House of Representatives and the then-Democratic controlled U.S. Senate squarely responded to critics who alleged that the PTO's problems were due to lack of funding and necessary resources. The House Appropriators observed the following in the report accompanying that year's appropriation bill, H.R. 2500:

> The [House] Committee [on Appropriations] remains concerned that the Patent and Trademark Office is unable to meet the demands of the increasing number of patent applications. The Committee is concerned that, with the increased funding the Office has received in the past, there is no measurable increase in performance. Every agency must set performance measures and strive to meet them. If these goals are not met, then the agency must be able to answer the questions from Congress and their customers as to why it was unable to meet its goals. The PTO and the patent user community have continually criticized the Congress and the Administration for not allowing full access to their fees in the year they are received, yet PTO has been unsuccessful in proving that increased funding will decrease the amount of time it takes an applicant to receive a patent. PTO bases its budget submission on anticipated fee income, which is derived from an estimation of its anticipated workload. However, there is no indication that the existing level of fees was developed based on any direct relationship to the actual costs of doing business.[46]

[46] H.R. Rep. No. 107-139, at 66 (2002 Fiscal Year) (Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Bill, 2002).

The very same year, the U.S. Senate Committee on Appropriations echoed these same concerns when approving the agency's 2002 fiscal year budget:

> While the agency has experienced significant growth in the recent years as a direct result of workload increases, PTO's corporate plan predicts that patent pendency will rise . . . to an unacceptable 38.6 months by fiscal year 2006. . . . The ability of the administration to formulate an adequate budget for the PTO is complicated [first due to failing to] provide the Committee with a thorough business plan that demonstrates how resources will be used and what results [the PTO] will obtain. Second, PTO management has not been sufficiently innovative. Although patent filings have increased dramatically over the past decade, PTO management chose to remain wedded to an archaic patent process and attempted to hire its way out of its workload problems. . . . Further, substantial amounts of funds have been expended on information technology projects over the last decade, but no significant increase in examiner productivity has been noted. Finally, the Committee [on Appropriations] lacks full confidence in the information provided to it by PTO management regarding its needs and performance.[47]

It is a truism in Washington, D.C. that when both the Republicans and Democrats agree that you have a problem, *in fact you really do*. This rare exercise in a public bipartisan scolding of a federal agency and its management, a task well within the prerogative of the Committee on Appropriations and its oversight function, highlights many lessons. One lesson is that the PTO cannot simply spend its way out of its problems. The second lesson is that any solution to the PTO's long-standing workload and quality problems demands a departure from its current business model and examination process. Simply put, if the PTO is to be an agency for innovation, it also must become an agency that is innovative in its mission.

B. SECRETARY ROGAN'S QUEST FOR A 21ST CENTURY PTO

The PTO's basic role, or in other words its business model, has remained the same for approximately 200 years.[48] The nation, technology, and the world have changed enormously since the PTO was created. Today, users of the patent system pursue a much more complex task.

[47] S. Rep. No. 107-42, at 84-85 (2001) (Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriation Bill, 2002).

[48] GAO REPORT, *supra* note 31, at 28.

Today's inventions often are of vast complexity, sometimes with commercial embodiments of products and processes that often require dozens, if not hundreds, of inventions. In addition, inventors often need to obtain patents in multiple foreign jurisdictions. Users of the system face heightened workload, pendency and quality issues, and a far more complicated, if not bureaucratic, set of substantive and procedural rules surrounding examination. Notwithstanding the fact that PTO officials and system users have engaged in an elusive quest to modernize the patent system for the twenty-first century, the current system still resembles the system of the eighteenth century.

During the Author's tenure on Capitol Hill as a legislative staffer, he was told that the mission of each under secretary and director of the PTO is the same: choose a problem to attack, develop and launch a series of initiatives, and then declare victory and leave the Office for the private sector. Earlier this decade, then-Under Secretary of Commerce and Director of the USPTO, James E. Rogan, made great strides in formulating a vision of reforming the PTO and implementing his plan. As a former U.S. Congressman, Rogan was expected to prevail upon his former congressional colleagues to enact his reform agenda. Rogan undertook the noble and elusive quest of reforming the PTO (and succeeded in large part) (In contrast to other PTO directors, after his tenure, Rogan returned to public service as a California state judge).

Rogan testified before the House Judiciary Subcommittee regarding the Office's operations:

> The 21st Century Strategic Plan is built on the premise that American innovators need to obtain enforceable intellectual property rights here and abroad as seamlessly and cost-effectively as possible. It provides a roadmap for creating an agile organization worthy of the leadership role American intellectual property plays in the global economy.[49]

Likewise, at the 2003 hearing, Rogan echoed his previous testimony before the Judiciary Subcommittee regarding the state of the PTO. In 2002, he testified:

> The increasing volume and complexity of our workload poses serious issues for the USPTO. Some might even use the word "crisis." Let me give one historical representation of how serious these challenges are. I mentioned that the patent system faced significant problems in the 1980s – this situation was highlight in a

[49] *United States Patent and Trademark Fee Modernization Act of 2003: Hearing on H.R. 1561 Before the H. Subcomm. on Courts, the Internet, and Intellectual Property, H. Comm. on the Judiciary*, 108th Cong. 23 (2003) (prepared statement of the Hon. James E. Rogan, Under Secretary of Commerce and Director of the USPTO).

> 1981 U.S. News & World Report article entitled "Patent System a Drag on Innovation." What has led to such a dramatic pronouncement? In 1980, average patent pendency was 22.6 months. In FY 2001 it was 24.7 months, and absent a new course, it is projected to grow beyond three tears. In 1980, the backlog of applications was about 81,000. By the time I was sworn in a few months ago, the backlog of applications stood at more than 330,000. I believe the challenges the USPTO faces today, while similar to the situations in the mid-1960s and early 1980s, are on a much larger scale.[50]

Rogan's congressional testimony included the dire prediction that the PTO would face an application backlog exceeding one million applications within five years if Congress did not pass legislation to enact the Strategic Plan. In addition to Under Secretary Rogan, Congress also heard from a myriad of other voices, including the patent bar, the high tech industry, and the PTO employees' union.[51] Congress rejected the implementing legislation that the Administration – of the same political party – submitted. Instead, Congress enacted a scaled down version of the proposed legislation that essentially established a twenty-percent increase to the PTO user fee schedule, i.e., the fees that an applicant is required to pay for the examination of a patent application and the related maintenance fees. The additional resources primarily would go to hire additional patent examiners and develop the agency's electronic infrastructure ("e-government") initiatives. A few years later, Under Secretary and Director Rogan's cautionary predictions about a one-million patent application backlog and soaring patent pendency would become reality.

In brief summary, Rogan's leadership and hard work lead to successfully persuading Congress to enact a limited, modified version of

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[50] *U.S. Patent and Trademark Office: Operations and Fiscal Year 2003 Budget: Before the H. Judic. Subcomm. on Courts, the Internet, and Intellectual Property*, 107th Cong. 7 (2002) (prepared statement of the Hon. James E. Rogan, Under Secretary of Commerce and Director of the USPTO). Likewise, in 1963 *U.S. News & World Report* featured an article entitled *Invention – Is it Keeping Up?* U.S. NEWS & WORLD REPORT 70, July 15, 1963. David Lowell Ladd, the former Commissioner of Patents under President Kennedy, explained that "[there is a] real crisis at the Patent Office . . . [and] the crisis is here now." *See also* Peters, *supra* note 39, at 558 n.6 ("The Commissioner pointed out that there is a 'real crisis at the Patent Office' and 'the crisis is here now.").

[51] The hearing witnesses included Michael K. Kirk, Executive Director, American Intellectual Property Law Association (AIPLA); John K. Williamson, President, Intellectual Property Owners (IPO) (IPO is a trade association consisting of approximately 100 Fortune 500 companies); Colleen Kelley, National Treasury Employees Union (NTEU represents one of the PTO's employee unions); and the hearing record contained letters from groups such as National Association of Manufacturers (NAM represents approximately 14,000 member companies). *U.S. Patent and Trademark Office*, *supra* note 50, at III.

his PTO modernization legislation. Congress, however, rejected the proposed statutory provision permitting the PTO to obtain a search of the relevant prior art results from private entities,[52] as opposed to the federal examining corps. The original provision was opposed by the PTO's unions, many lawmakers on both the Republican and Democrat sides of the aisle, the patent bar, and industry. The reasons for opposition to the provision, though varied, should be obvious on their face. The PTO's unions were concerned, as is much of the U.S. workforce today, about the risk of good white-collar jobs being outsourced. Conservative lawmakers were concerned that national security could be jeopardized by foreign search companies reviewing patent applications and conducting prior art searches. The patent bar feared that the uncertainty and cost of patent prosecution would increase, as escalating PTO fees would eat into the budget for patent attorneys preparing patent applications. Instead of the proposed legislation, Congress enacted a very limited one-year pilot project for testing the proposal. The pilot project was never pursued by the PTO due to the agency's inability to comply with the limitations established by Congress.

The Rogan bill's principal benefit was that it modestly raised PTO application fees to generate additional revenues for the agency (approximately $200 million in the first year alone). A majority of this revenue has been invested in hiring additional patent examiners (e.g., approximately 1000 new examiners per year). Yet, the state of the PTO today is *still* dismal at best. It remains a bloated bureaucracy and is getting larger every year.[53] In 2005, the GAO explained, "USPTO officials acknowledge they have had difficulty competing with the private sector to attract and retain staff with the high degree of scientific, technical, and legal knowledge to be patent examiners."[54] It is estimated that it requires between four and six years of on-the-job training before a patent examiner is fully proficient at her task.[55] Yet the attrition rate of examiners hovers around nine percent for the corps overall, and it is estimated to run as high as fifty percent for new hires within their first two years of service at the agency.[56]

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[52] *See supra* note 29.

[53] The PTO's annual report to Congress explains that at the end of the 2006 fiscal year, the agency had 8189 federal employees, including 4779 patent examiners and 3817 contract employees. *See* U.S. Dept. of Commerce, *USPTO's FY 2006 Financial Statements, Audit Rep. No. FSD-18003-7-0002 (2006), available at* http://www.uspto.gov/web/offices/com/annual/2006/index.html.

[54] GAO REPORT, *supra* note 31, at 1.

[55] *Id.* at 24.

[56] *Id.*

C. LESSONS LEARNED

An essential insight of this Article is that patent reform, as is true with any legal reform in the U.S. legislative system, cannot occur without the support of certain political constituencies. In economic terms, constituencies can impose constraints on the system or the model. The patent system is largely a creature of Congress. In my experience over the past decade, the key political constituencies in the patent reform arena include:

The Patent Bar Associations. The attorneys and other users of the patent system, such as the American Intellectual Property Law Association ("AIPLA"), which represents 14,000 U.S. intellectual property lawyers. The patent bar associations have historically demonstrated the ability to work successfully with the PTO and Congress on patent law reform.

High-Technology Industries. As users of the patent system, high-tech industries, including the manufacturing, telecommunications, software, semiconductor, biotechnology, and pharmaceutical industries, have a strong interest in a healthy U.S. patent system and in enhancing patent quality. This is evidenced by the fact that many players in these industries are willing to pay higher patent fees if it ensures enhanced patent quality. It is in the interest of industry to have a well-vetted patent to pursue in the stream of commerce. Likewise, industry objects to frivolous litigation from aggressive patent plaintiffs that assert poor quality patents.

PTO Unions. The PTO has three unions representing its federal employees, including patent and trademark examiners and its other personnel. The largest of the three is the Patent Office Professional Association ("POPA"). POPA has demonstrated ability to influence both Republican and Democrat members of Congress. Its representatives have frequently testified on PTO reform. POPA's two primary goals are essentially to obtain higher pay and more examining time per application for its personnel.

Congressional Panels. Congress is known for its process and jurisdictional issues. In the debate over PTO resources, clashes developed between the authorizing and appropriations committees in each chamber. Accordingly the proposals to provide the PTO with more resources by taking "off-budget" or other such statutory reforms are unlikely to succeed.

An important and overlooked reality is the nature and processes of the institutions involved in the debate. The U.S. Senate is known as the world's greatest deliberative body. In advocating any legislative reform, any proponent must meet a very high bar in the U.S. system. It is naïve to think that an intellectual property legislative proposal can pass with the support of fifty-one Senators, or even the sixty Senators necessary for cloture, to overcome a filibuster. The reality of the modern era is that the Senate is a busy institution, and that the authorizing committee of primary jurisdiction, the U.S. Senate Judiciary Committee, is particularly busy with issues including judicial nominations, immigration, civil liberties, national security, and Department of Justice oversight on its agenda. Moreover, the Senate is renowned for the process whereby a single Senator can place a "hold" and stop a bill from floor consideration. As a result, any intellectual property legislative proposal must have the support of a virtually unanimous Senate for it to advance to the President's desk for signature and enactment into law. Any serious effort to enhance patent quality must be keenly cognizant of such political realities.

III. GAME THEORY AS A TOOL TO ENHANCE PATENT SYSTEM QUALITY AND OPERATIONS

Game theory is a field of applied mathematics that provides a tool for analyzing the behavior of a person or a system and for developing strategies.[57] It is a tool that permits one, inter alia, to optimally resolve a conflict or to make a decision based on one's knowledge of a situation, the choice of outcomes among alternatives, and the desirable amount of risk. It enables one to form a strategy regarding what choices to make, "or, better, the choices one should make."[58] When you think carefully before you act – when you are aware of your objectives or preferences and of any limitations or constraints on your actions and choose your actions in a calculated way to do the best according to your own criteria—you are said to be behaving rationally. Game theory adds another dimension to rational behavior—namely, interaction with other equally rational decision makers. In other words, game theory is the science of rational behavior in interactive situations.[59]

Accordingly, it makes sense that game theory should be explored as a method to help enhance the patent system. This is true because the patent system, like so many other systems, is compromised of multiple participants with limited knowledge who try to maximize certain results. This is the case regardless of whether one considers the PTO or its related

[57] *See* DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW (1994).

[58] LUCE, *supra* note 4, at 4.

[59] AVINASH DIXIT & SUSAN SKEATH, GAMES OF STRATEGY 5 (2d ed. 2004).

players as rational or irrational. Regardless of a given applicant's motivation, the system should work efficiently to serve the needs of the entire public through the timely and thorough disposition of applications.

A. STATEMENT OF THE PROBLEM

For the purposes of this Article, game theory and applied economics may be a useful tool to address the agency's problems, if not enhance its overall operations. Three historical trends frame the realities surrounding the U.S. patent system: (1) the century-plus trend of yearly increases in patent application filings, now of such high-volume that it is arguably beyond the capacity of the PTO (e.g., now at least 400,000 annually); (2) the highly labor intensive nature of the examination process; and (3) the small number of patents that appear to have value for their owners in litigated patent cases (e.g., today about 2000-3000 annually).[60] (In this context, the term "value" refers to the foreseeable economic power or industrial importance.)

These trends have a historical basis and long pedigree. A generation ago, the former Chief Judge of the U.S. Court of Appeals for the Federal Circuit, Howard T. Markey, observed: "Between 1953 and 1971 over 1,000,000 patents were issued. Only 1080 were litigated or 0.1%."[61] Litigation is not the sole measure of a patent's worth, of course, as shall be discussed in more detail. Yet the data inevitably indicates that all patents do not have identical value, at least in terms of importance or worth, when viewed in the context of litigation. A vast majority of patents are never licensed or litigated. As such, litigation may be a proxy for an economically valuable or otherwise socially important patent. Because most patents are never litigated, Congress, PTO officials, industry and academics face a question: how best to allocate the PTO's finite and clearly overtaxed examination resources.

To solve this problem, the PTO should examine patent applications in accordance with their foreseeable importance. In his seminal paper, *Rational Ignorance at the Patent Office*, Professor Mark A. Lemley answers the elusive question, "How much time should the PTO spend on examining patent applications?" as follows: "To judge by recent criticism of the office from academics, industry leaders, and the press, the answer is 'a lot more than it does now.'"[62] Professor Lemley, among many other

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[60] *See Improving Federal Court Adjudication of Patent Cases: Hearing Before the Subcomm. on Courts, the Internet, and Intellectual Property, H. Comm. on the Judiciary*, 109th Cong. 35 (2005) (prepared statement of Chris J. Katopis).

[61] Howard T. Markey, *The Status of the Patent System—"Sans Myth, Sans Fiction"*, 59 J.P.O.S. 164 (1977). In contrast, approximately one million patents have been issued in the past six years (2007-2001). Further, one can estimate that 18,000 of these patents were litigated, based on general litigation rates. Hence, a rate of 1.8 percent.

critics, argues that increased examination time would help weed out some of the bad patents that plague the system. While there is universal agreement that additional examination time would enhance patent quality, allocation of additional time is subject to practical constraints. The closest proxy for a patent application's "importance" may simply be its economic value. In a recent paper, *Patent Portfolios*, Professors Parchomovsky and Wagner describe a "patent paradox": "It is abundantly clear that firms act as though patents are important . . . [f]iling patterns and firms' attitudes toward patents have presented theorists with a puzzle: if patents are valuable, where does their value lie?"[63]

The true value of a patent is elusive to academics and other critical observers, regardless of whether one relies on empirical or theoretical analysis. A market mechanism does not exist to assign value to individual patents.[64] Patents must have value—otherwise the past 200 years of patenting-seeking activity and resulting seven million-plus issued U.S. patents has been an exercise in irrationality. The highest government officials testify to the critical importance of the patent system to the Nation's economy.[65] As *Patent Portfolios* concludes: "Given that virtually all the corporations that engage in intensive patenting operate in highly competitive industries, and that many of them are Fortune 500 companies, it is highly unlikely that such irrational behavior could persist for so many years without grave economic consequences . . . this is not borne out by reality."[66] The authors further theorize that beyond reaping huge damage awards through litigation, the value of patents can be found across the following categories:

(1) as providing information in terms of credible signals about a patented invention and the firm;[67]
(2) as internal metrics of an entity's performance, innovation, R&D or an individual employee's productivity;
(3) as a sort of lottery ticket, wherein a low relative cost buys one the possibility of a large payoff;

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[62] Mark A. Lemley, *Rational Ignorance at the Patent Office,* 95 NW. U. L. REV. 1495, 1495 (2001) [hereinafter *Rational Ignorance*].

[63] Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 5 (2005).

[64] The firm Ocean Tomo is pioneering new financial opportunities in creating markets for patents. It describes itself as the leading "Intellectual Capital Merchant Banc® firm." *See* Ocean Tomo, http://www.oceantomo.com (last visited Apr. 17, 2008).

[65] *See* Pauline Newman, *The Origins of the Federal Circuit: The Role of Industry*, 11 FED. CIR. B.J. 541 (2002).

[66] Parchomovsky & Wagner, *Patent Portfolios, supra* note 63, at 18.

[67] *Id.* at 20 (citing Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 627 (2002)).

(4) as providing a firm a defensive tool against patent infringement suits;
(5) as increasing a firm's voice in the politics of the patent system; and,
(6) as enhancing the ability of a firm to attract and retain capital.[68]

The subsidiary question is whether the current PTO examination model makes sense in light of these trends and modern criticism. Roughly speaking, the PTO charges the same examination fee[69] and devotes the same amount of examination resources to every application. For the nearly past decade, the PTO has attempted, and failed, to become "efficient," although this may be an inapt term. One cannot say that the PTO was really trying to become more efficient, as it realized that only so much could be done with a given unit of an employee's time. Computerization would only aid the situation to a limited degree. Instead the PTO tried to become more productive by attempting to "devolve" the applications process, so that the examiner did not have as large as a job per application in the course of the examination routine. As part of its original "21st Century Strategic Plan,"[70] the PTO proposed outsourcing the search portion of the examination. This proposal was based on two rationales: (1) the private sector could accomplish the search function more efficiently than the government; and (2) the other major world patent offices (e.g., the Japan Patent Office and the European Patent Offices) could share the search results for co-pending applications.[71] In response to the concerns expressed by PTO union members, Congress did not permit this proposal to advance in a way that could be meaningfully implemented.

The PTO's current view concerning the reform of the examination process is that it requires a "shared burden" by applicants. For example, the PTO advocates a legislative proposal requiring applicants to provide a patentability report (i.e., Applicant Quality Submission, or "AQS").[72] In

[68] *Id.* at 20-38.

[69] To be precise, certain small entities and non-profits are charged a 50% discount on some patent filing fees, 35 U.S.C. § 41(d) (2002).

[70] U.S. PATENT AND TRADEMARK OFFICE, THE 21ST CENTURY STRATEGIC PLAN (2003), *available at* http://www1.uspto.gov/go/com/strat21/stratplan_03feb2003.pdf.

[71] It is estimated that ten million patent applications are co-pending around the world. "The current world backlog stands at over 10 million unexamined patents. However there is a lot of redundancy within the current system and it needs to be addressed. . . ." EUROPEAN PATENT OFFICE, SCENARIOS FOR THE FUTURE 36 (2007) (quoting Jon W. Dudas), *available at* http://www.epo.org/topics/patent-system/scenarios-for-the-future.html.

[72] Patent Reform Act of 2007, H.R. 1908 at § 12; Patent Reform Act of 2007, S. 1145, 110th Cong. § 12 (2007).

2007, the PTO promulgated a flurry of new rules aimed at changing the balance in the long-standing examination model, e.g., limiting the number of continuations and claims and requiring applicants to submit a search report as part of the application.

In *Rational Ignorance at the Patent Office*, Professor Lemley argues that this is the central problem facing the PTO: "How much time and money should the Patent and Trademark Office spend deciding whether to issue a patent?"[73] His paper concluded that the PTO is "rationally ignorant" because the examination of patents is too costly.[74] It seems likely that the patent system would be more efficient and patent quality enhanced if certain patent applications were more rigorously scrutinized than others. This would entail a shift in agency resources and would impact the workload of the agency.

The inquiry, then, is defining the appropriate reform of the current examination process. More specifically, the question is what new processes might be implemented to improve the system that can balance workload and quality issues. Professor Lemley reminds us that that any enhanced examination system has its own problems; inter alia, "[it] will necessarily increase the delay in issuing patents, and therefore the uncertainty associated with the ownership of legal rights in an invention."[75] Another concern is that increasing the scrutiny of some applications may be perceived as a form of harassment or otherwise unfair treatment.

B. THE TRIAGE OF VALUABLE PATENTS

In the seminal article *Valuable Patents*, John Allison, Mark Lemley, Kimberly Moore, and R. Derek Trunkey combined empirical data analysis with patent research and analysis of the patent system, concluding that "the patent system should pay more attention to the small subset of patents that have proved themselves valuable."[76] This Article agrees that the patent system could be vastly improved by having a more rigorous examination of certain patents (the important or otherwise valuable inventions), requiring that a smaller, limited set of applications be reviewed. The difficulty in implementing a varying standard of

[73] Lemley, *supra* note 62, at 1495.

[74] *Id.* "The basic idea of rational ignorance is that any person will spend only a certain amount of time or money to obtain a piece of information. If obtaining that information costs more than the information is worth, an individual will (or should) rationally choose to remain ignorant of it." *Id.* at 1497 n.6.

[75] *Id*. at 1521.

[76] John R. Allison et. al.,. *Valuable Patents*, 92 GEORGETOWN L.J. 435, 437 (2004). "We conclude that the easiest way to discover the characteristics of valuable patents is to study litigated patents." *Id.* at 437.

examination scrutiny is the challenge of selecting which applications are significant either because they are valuable economically, industrially significant, or important societally. Such applications demand greater examination resources. The patent system thus requires a filter, or triage mechanism, to determine the appropriate set of applications to review. This Article will now turn to the various methodologies that the literature has set forth regarding how this determination should be made.

In *Valuable Patents*, the authors reach two conclusions: (1) certain valuable patents can be identified retrospectively; and (2) predictions can be made concerning which of the "valuable patents" are likely to be litigated.[77] The authors in essence employ a game theory approach to assess which granted patents are actually valuable. They conclude that the easiest way to discern the characteristics of valuable patents is to study patents that have already been litigated and to thereby develop a model for ascertaining valuable patents.[78] Even though the relative ease of this method is appealing, the litigation factor has recently been challenged by other academic researchers.

Valuable Patents also suggests the following: it is incontrovertible that all patented inventions do not share the same destiny: some will be litigated or licensed, some merely will be held as trophies, and some will never be used and will sit in the proverbial dusty attic. Because only a minority of patents will be either litigated or licensed, the equal treatment of all applications seems highly inefficient. The PTO should be able to discriminate among incoming patent applications and devote examination resources as optimally necessary.

Yet, upon closer review, the *Valuable Patents* reasoning has flaws. For example, the analysis concludes that a patent's value is a function of its propensity to be litigated. Thus, a key factor in the patent value (or worth) analysis for Allison et al. is estimating the probability that a patent is litigated.[79] Professor Allison, along with Professor Sager, recently elaborated upon his proposal:

> [*Valuable Patents*] did not, in fact, advocate triage classification. . . [t]he only relevant metrics the PTO could use for this purpose would be number of claims and prior art references. . . . *[Valuable Patents]* suggested, instead, that the number of claims and prior art references could serve as part of a complexity index that might

[77] *Id.* at 437-38.

[78] *Id.* at 437.

[79] *See* John R. Allison & Thomas W. Sager, *Valuable Patents Redux: On the Enduring Merit of Using Patent Characteristics to Identify Valuable Patents*, 85 TEX. L. REV. 1769, 1781 (2007).

> assist the PTO in sorting applications for the purpose of more optimal allocation of examiner time to applications.[80]

Professors David Adelman and Kathryn DeAngelis recently concluded that Allison et al. "do not disclose whether more time is actually spent on certain classes of patents," and that this failure results in an "empirical haze."[81] Adelman and DeAngelis submit that the *Valuable Patents* analysis is flawed because Allison et al.

> gloss over several significant limitations of their findings. . . . For example, [Allison et al.] investigate average patent prosecution times for the fourteen technology fields defined in their study and from these results claim that the 'patent prosecution system . . . spends much more time and attention of some sorts of patents than others.'[82]

The Adelman-DeAngelis article presents the following parameters for identifying valuable patents. In developing an algorithm or any heuristic for a new examination paradigm, these parameters may be of use according to its authors:

(1) the distribution of the valuable patents is highly skewed, with most of having little or no value and only a relatively small portion having any value at all;[83]

(2) the distributions of the several patent characteristics (called patent metrics) often viewed as indicators of value are skewed, thus rendering them unreliable as relevant value metrics;[84]

(3) *Valuable Patents*' findings of statistically significant differences in the characteristics of litigated and unlitigated patents that does not mean that the differences are of a practically significant magnitude;[85] and

(4) the "base-rate" problem, which may occur when attempting to predictively identify a small subset of a population, prevents Valuable Patents' result from having any predictive power.[86]

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[80] *Id.* at 1788.

[81] David E. Adelman & Kathryn L. DeAngelis, *Patent Metrics: The Mismeasure of Innovation in the Biotech Patent Debate*, 85 TEX. L. REV. 1677, 1714-15 (2007).

[82] *Id*. at 1714 (footnote omitted).

[83] *Id.* at 1707-08.

[84] *Id.*

[85] *Id.* at 1724.

[86] *Id.* at 1724-29.

One can theorize that a more efficient PTO would perform some triage or filtering of incoming applications. In theory, this could be achieved by a random selection of incoming applications (which is clearly unfair and arbitrary) or some filtering based on predetermined criteria (e.g., foreseeable value). A choice based on value would overcome the inherent disadvantages of a randomly based selection, but the dilemma is how to ascertain that foreseeable value. Two schools of thought have emerged concerning how best to predict the value of patents. In the first camp, Allison and Lemley focus on a number of criteria that can predict the patent's probability of being litigated. For Allison and Lemley, this is a sufficient proxy for a valuable patent. The Allison and Lemley camp appears to ignore the other useful purposes underlying a patent's importance previously discussed (e.g., signaling, defensive portfolios, etc.). In the second camp are the Kierkegaards, or the nihilist economists who believe that the data surrounding patent filings do not enable any appropriate predictions regarding a patent's value. It is well-known that economists and statisticians often disagree about how to measure or otherwise evaluate the world. As will be shown next, it is fortunate that one need rely neither on economists nor the development of a predictive heuristic to ascertain valuable patents – regardless of whether their value lies in litigation, serving as a trophy – and weeding out the poor patents by discouraging applications of dubious quality. This Article proposes that patent applicants can rely on a market mechanism to determine value, whether or not that value is economic.

C. THE PATENT SYSTEM AS A LOTTERY

In many ways, the patent system functions as a lottery. Economist F.M. Scherer is credited with the lottery analogy, which compares a patent application to a lottery ticket with a low entrance cost and a very small chance of a very large payoff.[87] Critics of the current patent regime assess the potential value of a patent using the damages predicted upon successful infringement litigation. Allison and Sager write: "We have good predictors to identify [those patents] . . . other patents [] are like lottery tickets. Some of those, though fewer, are litigated."[88]

Economics and game theory are useful tools with which to judge the propriety of such a rationale. Nobel Laureate and Columbia University Professor William Vickrey explains:

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[87] F.M. Scherer, *The Innovation Lottery*, *in* EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 3 (Rochelle Cooper Dreyfuss et al. eds., 2001); *see also* Jonathan A. Barney, *A Study of Patent Mortality Rates: Using Statistical Survival Analysis to Rate and Value Patent Assets*, 30 AIPLA Q.J. 317, 328 n.30 (2002) ("A patent is not unlike an expensive lottery ticket; you pay your money up front and hope for a big payoff.").

[88] Allison & Sager, *supra* note 79, at 1771-72.

> The purchase of tickets in lotteries, sweepstakes, and "numbers" pools would imply, on such a basis, that the marginal utility of money is an increasing rather than a decreasing function of income. Such a conclusion is obviously unacceptable as a guide to social policy. A small fraction of such gambling can be attributed to the presence of an eleemosynary element. But for the bulk of such gambling the explanation must be sought elsewhere. One explanation that is consistent with maintaining the assumption of rationality in other dealings would be that the purchase of lottery tickets represents the purchase of a right to hope, however forlornly, in a situation otherwise intolerably barren of this psychological necessity. Other forms of gambling can perhaps be ascribed to the persistence of an egoistic delusion that one's own skill or judgment is better than the opponent's, or to utilities derived in the process rather than from the end result.[89]

IV. PROPOSAL: A HYBRID EXAMINATION MECHANISM

> *"It is difficult to predict, especially about the future."*
> *--Danish Physicist Niels Bohr*[90]

The goal of the following proposal is to define a mechanism that will improve the patent system's examination capabilities and enhance patent quality. The proposal relies on reforming PTO operations by permitting a more focused examination of some patent applications. The PTO's current fundamental "business model," viz., examination of patent applications, is the same today as it was in the nineteenth century. As the PTO increasingly struggles to face the challenges and the realities of the twenty-first century, it continues to fail, if not severely lag behind in its mission. The failure is increasingly evident in the poor quality of its examination and the backlog crisis. Any solution must permit the PTO to devote *more* resources for a *more rigorous* examination of a *fewer* number of applications. This requires a prioritization to filter and triage the incoming applications.

This Article described how the last major legislative change of the patent system faced fierce political opposition from a variety of quarters.[91]

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[89] William Vickrey, *Measuring Marginal Utility by Reactions to Risk*, *in* PUBLIC ECONOMICS: SELECTED PAPERS BY WILLIAM VICKREY 15, 23-24 (Richard Arnott et al. eds., 1994).

[90] *See* THE YALE BOOK OF QUOTATIONS 92 (Fred R. Shapiro ed., 2006); *see also*, http://en.wikipedia.org/wiki/Neils_Bohr ("It is very difficult to make an accurate prediction, especially about the future.").

[91] *See supra* notes 46-56 and accompanying text.

In light of these political guideposts, it is clear that any proposal for PTO operational reform must satisfy these constituencies:

(1) PTO unions' concerns about how time and workload impact the examiner's mission;
(2) industry's concerns about patent quality; and,
(3) general concerns about receiving patent protection for an invention that is unlikely to ever be litigated or licensed.

Accordingly, this Article proposes a hybrid, multi-tiered patent system in which an applicant is guaranteed legal rights for her invention (e.g., either through the grant of limited exclusivity for her invention after a very restricted examination) or the traditional panoply of exclusive rights after a more robust PTO examination than is the current practice. In fact, today many nations already grant inventors what is known as a "petty patent." A "petty patent" refers to a grant of legal protection providing limited exclusive rights and perhaps a shorter duration of protection for an invention than the current patent grant.[92]

At the heart of this reform proposal, I suggest that the PTO's quest for rationality may be achieved through a widely accepted practice. The PTO should alter its current examination policy and operations to function as other organizations do in the course of allocating a scarce resource—the patent examiner's time. The PTO should thus engage in a type of filtering, if not application triage.[93] Other key governmental agencies allocate their resources through the means of an auction (e.g., the Federal Communications Commission auctions off radio spectrum, the Federal

[92] The United States has considered the implementation of a petty patent for decades, though the proposal has not been endorsed by Congress. A registration system for inventions was considered as part of the Carter Administration reforms that lead to the establishment of the U.S. Court of Appeals for the Federal Circuit and the patent reexamination system. *Final Report of the Advisory Committee in Industrial Innovation* 162 (1979). *See also* Lee A. Hollaar, *A New Look at Patent Reform*, 87 J. PAT. & TRADEMARK OFF. SOC'Y 743 (2005) (arguing for a new lower-cost, intermediate and limited form of patent protection); Mark D. Janis, *Second Tier Patent Protection*, 40 HARV. INT'L L.J. 151 (1999) (explaining how more than sixty nations now provide some alternative legal mechanism for the protection of inventions).

[93] *See e.g.*, Jerry Brito, *The Spectrum Commons in Theory and Practice*, 2007 STAN. TECH. L. REV. 1 (2007) (arguing the efficiency of radio spectrum allocation by economically efficient means); Michael J. Doane & Daniel F. Spulber, *Municipalziation: Opportunism and Bypass in Electric Power*, 18 ENERGY L.J. 333, 355 (1997) (arguing that innovation in electricity pricing structures (e.g., peak and off-peak pricing) will promote energy efficiency, responsiveness, and reliability in energy markets); Daniel R. Polsby, *Airport Pricing of Aircraft Takeoff and Landing Slots: An Economic Critique of Federal Regulatory Policy*, 89 CAL. L. REV. 779 (2001) (proposing a new pricing structure for air travel to maximize the use of airport resources and minimize congestion); Christopher S. You, *Network Neutrality and the Economics of Congestion*, 94 GEO. L.J. 1847 (2006) (proposing a new analytical framework for the allocation of broadband network access).

Aviation Administration has airports allocate flights through the use of slotting, etc.).[94] Even at the local level, lawmakers such as New York City Mayor Michael Bloomberg have proposed congestion pricing in an effort to promote efficient transportation patterns and fight climate change and air pollution.[95]

Because the current PTO examination system permits the filing of an unlimited number of applications upon payment of a statutory fee, it has led to a number of long-standing problems (e.g., poor patent quality, a crisis-level workload, abusive continuations, etc.) that for the most part are now considered to be the norm. In contrast, the establishment of a finite ceiling on the number of patent applications that the PTO can examine in a given year, combined with some type of alternate patent rights system (e.g., a registration or a petty patent system), would provide several important advantages. Such a system would spur competition among applicants, encouraging them to pursue only truly valuable patents and weeding out the otherwise inferior or "poor quality" or "defective" patents and claims. It would thus resolve many of the problems plaguing the current system. In particular, a mechanism that limits the number of applications for full patents permits the PTO to better focus its resources, thereby alleviating the long-standing workload problems of backlog and pendency, and enhancing the overall quality of patents granted.

Consider the following hypotheticals. As previously explained, the PTO has suffered with a backlog for nearly a century because it receives more work than it can adequately process in a given fiscal year. Since we know from the recent 2005 GAO Report that the average PTO examiner reviews eighty-seven applications each year and that there are currently about 5000 examiners, the agency should be able to review 435,000 applications annually. If the PTO only allocates a number of "slots" (i.e., opportunities for an application's examination) equal to half of the number of patents it examines each year (i.e., 217,500), then its current corps of examiners could increase the time they spend examining patents by a factor of two (e.g., 38 hours per case on average). If the PTO further cut

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[94] In aviation, "slots" refer to the flight caps at airports pursuant to the "High Density Rule," 37 Fed. Reg. 25, 508 (1982). In 1969, slotting was instituted at four of the nation's busiest airports (O'Hare, JFK, LaGuardia, and Washington Reagan-National). In 1995, the Department of Transportation issued a report to Congress which predicted that if airport flight caps were removed, widespread delay and congestion would result. U.S. Dep't of Transp., *Report to the Congress: A Study of the High Density Rule* (1995). After Congress repealed the caps in 2000, the prediction regarding these delays came true.

[95] Anahad O'Connor & Danny Hakim, *Bloomberg Lashes Out at Lawmakers*, N.Y. TIMES, July 17, 2007 (quoting Mayor Bloomberg: "I heard a lot of talk about the politics of congestion pricing and all I kept thinking about was some people have guts, and some don't."). The New York state legislature ultimately rejected the Mayor's plan. *Id.; see also* Nicholas Confessore, *$8 Traffic Fee For Manhattan Gets Nowhere*, N.Y. TIMES, Apr. 8, 2008, at A1; Keith B. Richburg, *Slow Going for N.Y. Traffic Plan*, WASH. POST, Apr. 6, 2008, at A2.

the allocated examination slots to one-third or one-quarter of what is presently available, then the examiners could further increase the number of hours spent per case and also increase their facility to process the enormous backlog. In practice, the PTO could hold periodic examination slot auctions throughout the course of the year, perhaps as many as one per week or even one per business day. The more frequent the opportunities to obtain an application filing date, the less severe the negative effects of missing a particular priority date. Under the United States' long-standing "first-to-invent" system, this is a lesser concern than the alternative of a "first-to-file" regime.[96] As auctions become more consistent, the bidding pressure will be relieved. In game theory jargon, the outcome of this upward bidding pressure is known as the "winner's curse." It refers to the tendency of a winner to bid more for a prize than the prize is actually worth. This tendency often results when bidders have incomplete information about the prize and about other bidding competitors' expectations, and when there are too many bidders. Likewise, the more frequently a good or commodity is subject to trading, the more the market forces best approximate its true value. Accordingly, the price or user fee for examination must bear a relation to the expected value of an issued patent.

A. AUCTIONS AND BIDDING GAMES

Game theory is a useful tool to enhance the operations and processes of individuals and organizations in a variety of contexts, including public institutions. Its value lies in improving decision-making by assessing the consequences of actions by evaluating information and risk. The best known illustration of a game theory application is the Prisoner's Dilemma.[98] In that example, two criminal suspects are apprehended by the police. The police detain and question them separately. Each faces the potential of a long or short prison sentence, depending on whether or not the other suspect confesses. It is assumed that each will have no knowledge of what the other will say. Accordingly, each has to engage in a calculus of the best strategy in light of limited information. The choices can be represented by the following matrix:

[96] This policy relates to the concern that the price for an auction slot would be inflated by a "rush to the PTO" and pressure to file. The United States is alone in the world in having a patent system that recognizes the date of the invention's creation for priority rather than its application filing date. *See* 35 U.S.C.§ 102 (2006). While this system has been in place for more than two hundred years, a strong desire exists to adopt a "first-to-file" system for harmonization purposes. *See* Patent Reform Act of 2007, S. 1145, 110th Cong. (2007); Patent Reform Act of 2007, H.R. 1908, 110th Cong. § 3 (2007).

[98] The Prisoner's Dilemma is attributed to A.W. Tucker. *See* LUCE & RAIFFA, *supra* note 4, at 94.

		Prisoner 2:	
Prisoner 1:		Not Confess	Confess
	Not Confess	1 year prison sentence each	10 year prison sentence for Prisoner 1 and 3 months for Prisoner 2
	Confess	3 month prison sentence for Prisoner 1 and 10 years for Prisoner 2	8 year prison sentence for each

The dilemma for the suspects is choosing the most appropriate course of action: whether or not to confess to the crime.[99] The consequences range from a light charge to having "the book thrown at them." Ideally, one individual's best course of action depends on cooperating with the other. The rub is that the nature of the situation, here imposed by the district attorney, precludes cooperation. This game is well-known, in part because it is relatively simple: two players, two sets of choices, and a relatively simple set of results. Game theory has a variety of applications today, including economics, parlor games (e.g., chess), military simulations,[100] and law and public policy.[101]

Game theory has generated a prolific amount of analytical research and theories regarding the processes behind auctions and bidding games. This research attempts to explain the best competitive strategies for sellers and buyers, as well as how to allocate goods efficiently. These mechanisms are considered "games" in the economic sense because, inter alia, they represent a competition among bidders who seek to maximize their gain while relying on varying amounts of information and expectations (e.g., the true value of the prize, the bids of their competitors). Accordingly, auctions may be designed in a number of

[99] *Id.*

[100] *Id.* at 6.

[101] *See, e.g.*, DOUGLAS G. BAIRD, ROBERT H. GERTNER & RANDAL C. PICKER, GAME THEORY AND THE LAW (1994); Viet D. Dihn, *Codetermination and Corporate Governance in a Multinational Business Enterprise*, 24 J. CORP. L. 975 (1999); Frank H. Easterbrook, *Workable Antitrust Policy*, 84 MICH. L. REV. 1696 (1986); F. Scott Kieff & Troy A. Paredes, *Engineering a Deal: Toward a Private Ordering Solution to the Anticommons Problem*, 48 B.C. L. REV. 111 (2007); Richard A. Posner, *Legal Scholarship Today*, 115 HARV. L.R. 1314, 1325 (2002) ("[I]t might be the case that no practicing lawyer ever reads articles applying game theory to bankruptcy law but that treatise writers and other doctrinal bankruptcy scholars read them and incorporated their insights into their own, practitioner-friendly works."); Stephen W. Salant & Theodore S. Sims, *Game Theory and the Law: Ready for Prime Time?*, 94 MICH. L. REV. 1839 (1996).

ways. The maximization of sale revenue may be one goal, but may be secondary to the quick disposition of goods or public policy. Likewise, the auction may be designed in a number of ways that permit the bidders to have varying degrees of information. Bids may be announced to a number of people seated in the same room or submitted sealed and in writing. The design of the auction - the game's rules - will determine the conditions of bidding and the resulting efficiency of the outcome.

Auctions are regularly used by private entities and the government to sell goods and services ranging from treasury bonds, radio spectrum, initial public offerings of equities, Internet keyword advertising, antiques, flower bulbs, to Pez™ candy dispensers. For brevity's sake, here are some of the best known species of auctions:

> *Simple Auction*. (a.k.a. *English Auction* and *Single-out-cry Auction*). This is probably the best known type of auction (especially to addicts of the online auction site, eBay). In this scenario, the simplest example of an auction is a single unique indivisible object (e.g., an antique or painting or tulip bulb) offered for sale to a number of potential buyers.[102] The bidding is generally progressive—in other words, the bids are continuously made in increasing value amounts, announced, and repeated until no potential purchaser bids further.[103] Depending on the communication among the bidders and the information exchanges (e.g., the amount of the bids, the value of the object), the revenue generated can either be much higher or lower than the true value of the object for sale. This problem can be prevented by the establishment of a minimum reserve price.
>
> *Dutch Auction*. The Dutch Auction is regarded as very economical in terms of both time and effort.[104] As with most popularly known auctions, the winner is the bidder who makes the highest bid. However, this type is a regressive game, since here the auctioneer starts off by announcing a high price (perhaps an astronomically high price). The auctioneer then announces successfully lower prices in sequence until some buyer accepts. The remaining potential buyers receive nothing.[105] This type of auction is useful

[102] William Vickrey, *Counterspeculation, Auctions, and Sealed Tenders in Public Economics, in* PUBLIC ECONOMICS: SELECTED PAPERS BY WILLIAM VICKREY 55, 60 (Richard Arnott et al. eds., 1994).

[103] *Id.* Vickrey concludes that the results of such auctions are Pareto-optimal. *Id*. at 61.

[104] *Id.* at 62. The Dutch auction takes its name from the fact that it is sued in the wholesale flower marketing industry in the Netherlands. *Id*. In the Netherlands, it is apparently known as a "Chinese auction."

[105] *Id.* at 62.

when a seller desires to sell goods quickly because it results in a single bid. Economists contest whether it maximizes the sale price of the goods. Today it is used in a variety of practical contexts, including by the U.S. Treasury Department, and through the Federal Reserve Bank of New York, which uses this type of auction to sell financial instruments.

Tullock Auction (Tullock Lottery). In this type of auction, everyone who submits a bid, including the losers and the winners, pay their submitted bids. Bidders are likely to invest (or bid) based on how they believe their rivals will act. As a result, this tends to result in an escalation of bids, or bidding war. In turn, the pattern of bidding may result in social waste—there may be excessive quantities of investment (or bids) such that the aggregate amount may exceed the value of the prize.[106] Today, the Tullock Auction is rarely applied to modern legal problems.

Vickrey Auction. (Sealed bid, Second-price Auction). This variation on the simple auction is attributed to William Vickrey.[107] It was intended as a mechanism to auction a single, indivisible good. Here potential bidders submit sealed written bids. While the highest bidder wins the good, she only pays the next highest bid. Thus all bidders have an incentive to bid closer to the true value of the good, but do not risk paying that full value. This type of auction is not widely used. Furthermore, it is subject to, inter alia, the following defects: manipulation by shill bids or collusion among parties.

Reverse Auction (Procurement Auction). In this type of auction, the traditional roles of the seller and the buyer are reversed. Here the goal is to minimize the price of the object—for example, a government procurement contract. The bidders compete, on the basis of price, to win the seller's business by offering the lowest price.[108]

Although we may generally think of auctions as a means to sell a single, indivisible object, auctions also make possible the sale of multiple

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[106] Jonathan Turley, *The RICO Lottery and the Gains Multiplication Approach: An Alternative Measurement of Damages Under Civil RICO*, 33 VILL. L. REV. 239, 253 (1988).

[107] *See generally* Vickrey, *supra* note 101.

[108] Patent attorneys are becoming increasingly familiar with these auctions, as some major companies now bid proposals for work assignments (e.g., patent prosecution) through this process.

identical items (e.g., the government's sale of treasury bonds). The auction scenarios when there are some number ("*N*") of bidders and multiple ("*m*") objects lend themselves to some highly interesting variations. The rules of the game may be designed to permit varying degrees of communication among the bidders, efficiency of the transaction, or revenue goals, as with any auction. Since numerous bidders and multiple objects may result in more than one winner, the question is what price each successful bidder pays. This price may be determined in several ways, including the Tullock Auction's paradigm of every winner paying their respective bids or Vickrey's methodology of all winning bidders paying the next highest bid. Another viable variation is for all of the winning bids to pay the same price, namely the lowest accepted bid.[109] It may seem counterintuitive to envision an auction system where the lowest bid wins the goods offered for sale. Yet in the context of an auction for a public service, where the primary goal is not necessarily to generate the most revenue, it is a viable alternative.

With this brief background in game theory, one can endeavor to design a set of rules concerning an auction of PTO examination slots for an enhanced examination regime. The following is a scenario of applicants who are submitting numerous applications ("*N*") and competing for multiple objects ("*m*"), namely examination slots. In the circumstance where $N \leq m$, no auction would be necessary. The number of examination slots is equal to or surpasses the number of applications submitted. In other words, the supply does not exceed the demand. In contrast, in the circumstance where $N > m$, the demand does exceed the available supply. Under my proposal, if demand exceeds supply, the PTO should conduct an auction to allocate the finite number of available examination slots among applications.

For the purposes of this hypothetical example, the number of examination slots should be allocated according to fields of technology. If all inventors must compete with inventors in all other fields of technology for auction slots, an auction could result in an undesirable allotment of slots to a particular type of technology. Stated slightly differently, if inventors of mechanical inventions have to compete with inventors of pharmaceutical inventors, and if pharmaceutical inventors have more cash, too many slots may be assigned to pharmaceutical inventors. Hence, one must focus on the capacity of the Technology Center ("TC") or its constituent art units, rather than the PTO as a whole, when determining the number of slots available.[110] Because the PTO has divided its examination corps and operations among the current TCs, each with their own

[109] For a general discussion of this variety of auction, see Vickrey, *supra* note 101, at 93-96.

[110] A "technology center" is an organizational division of the PTO wherein its assigned employees all examine patent applications in a similar field of science and technology.

technological focus, it seems appropriate for each TC to conduct its own auction.[111] It is interesting that, for the most part, all of the TCs experience similar workload problems. This conclusion is evident from the Chart 1, below:

CHART 1.[112]

	TC 1600	TC 1700	TC 2100	TC 2600	TC 2800	TC 3600	TC 3700	Total	Design
New Applications 9/30/2004	55,402	63,923	71,778	97,380	77,651	56,738	65,005	508,878	18,451
New Applications 9/302005	62,644	72,697	76,529	115,585	94,425	70,354	83,225	586,580	24,534
Overall Pending Applications 9/30/2004	95,006	105,447	102,440	138,822	137,458	101,097	108,039	809,323	27,599
Overall Pending Applications 9/30/2005	107,647	120,767	117,728	167,721	159,687	117,045	130,168	932,300	38,104

The capacity of a PTO TC depends upon a variety of factors, such as the number of examiners and their level of experience.[113]

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[111] These Technology Centers include "1600 – Biotechnology and Organic Chemistry," "1700 – Chemical and Materials Engineering," "2100 – Computer Architecture, Software, & Information Security," "2600 - Communications," "2800 – Semiconductors, Electrical and Optical Systems and Components," "2900 – Designs," "3600 - Transportation, Construction, Electronic Commerce, Agriculture, National Security and License and Review," and "3700 – Mechanical Engineering, Manufacturing, and Products." *See* U.S. Patent and Trademark Office, Patent Examination, http://www.uspto.gov/web/offices/com/sol/og/patexam.htm.

[112] This chart was developed by U.S. PTO Commissioner John Doll in 2006. *See* http://www.uspto.gov/web/offices/pac/dapp/opla/presentation/chicagoslides_back.ppt#1. "New Application inventory" is the number of new applications designated or assigned to a technology center awaiting a first action. "Overall Pending Application inventory" is the total number of applications designated or assigned to a TC in an active status. The numbers include new applications; rejected applications awaiting an examiner's response; amended applications; applications under appeal or interference; suspended applications; reexams and allowed applications awaiting grant publication. Total inventory includes applications not assigned to a particular TC, awaiting processing either pre- or post-examination.

[113] Under PTO operational procedures, it is assumed that an experienced examiner can accomplish their task in fewer hours than a junior examiner, and an individual's goals are adjusted accordingly. *See* GAO REPORT, *supra* note 31, at 29.

Following is an example of how my proposal could work in practice. Let us suppose that the PTO determines that for a given time period, a given TC has the ability to accept and the capacity to examine a preset number of applications. The preset number of application slots will be allocated efficiently through an auction process. A minimum reserve bid of $310 is established by the PTO.[114] If demand for slots equals or does not exceed the supply, all of the applications could be accepted for examination, and each bidder would pay the basic application fee currently in place. However, if demand for the slots exceeds supply, each bidder will submit bids for application slots that range from $311 (for this example) to one-million dollars. If the preset number of slots is forty, the top forty bidders will have their applications examined. Under the rule of the lowest bid accepted, each will pay the lowest bid of the lot.[115] One could speculate how high these bids could be in light of the fact that the cost of obtaining a patent, measured in terms of legal fees, appears to range from $10 - $30,000 per patent and beyond.[116] The answer will depend on the type of technology at issue and the strength of the invention in the eyes of the applicant. Again, the goal of the auction process is to filter the inferior applications so as to permit a more focused examination, not to generate the most revenue for the federal treasury.

Numerous advantages arise from this focused system of examination. The efficient allocation of examination slots distributes scarce examination resources in a superior way. This optimization will immediately focus scarce examination resources on a smaller set of more worthy applications and will in turn enhance overall patent quality. The auction helps weed out those patents of foreseeably little economic value or industrial importance. In a similar fashion, it dissuades the users of the

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[114] As a basis for comparison, the current PTO fee schedule prescribes the following initial patent filing fees: utility patents, $310, design patents, $210, and plant patents $210. *See* U.S. Patent and Trademark Office, Fee Schedule, http://www.uspto.gov/web/offices/ac/qs/ope/fee2007september30_2007dec17.htm. Additionally, various other application fees and surcharges apply based on the size and complexity of the application. For the purposes of this example, these additional fees are immaterial as the goal of the auction is to determine the basic number of applications that the PTO will review.

[115] The obvious criticism is the case where there is a tie among the set of bidders, e.g., the top forty-one bidders in a competition for forty slots all submit the same bid. This might occur due to collusion or some extraordinary coincidence. The auction rules could be designed in a number of ways to deal with such a scenario, e.g., using a random coin flip as a tie breaker. Since the goal of the auction is not to maximize revenue, but rather to ration examination resources, the most prudent rule would be for all of the bidders to lose the auction. The unused slots would be carried over to the next cycle, arguably lowering the bidding pressure during the next periodic auction. This has the additional benefit of dissuading collusion among bidders.

[116] Lemley, *supra* note 62, at 1498.

patent system from making it into a lottery with applications with specious claims for worthless inventions.

Another virtue of this proposal is that it limits the growth of the PTO by foregoing the need to hire additional examiners. The PTO has made it clear that the effort to recruit, hire, and retain these employees is a strain on the organization.[117] The continuing need for new examiners is unsustainable for a variety of other reasons. First, all examiners must be qualified in their art unit. In some categories of technology, for example semiconductor technology, an insufficient number of recent U.S. citizen engineering graduates are available. The PTO is reported to hire one-third of all recent graduates in this field. This massive government hiring of these engineers and scientists results in an enormous societal cost. As a society, we certainly would prefer for young scientists and engineers to be inventing new technologies and starting entrepreneurial ventures rather than becoming bureaucrats examining the inventions and granting the patents of foreign technologists. The PTO's practice of massive hiring also results in additional costs to the federal treasury (e.g., pension liability), as well as other state and local costs (e.g., highway congestion).

An additional benefit arises through the course of the auctions: the market will inevitably set the patent application fee closer to the actual value of examination, rather than what an antiquated, bureaucratic fee schedule determines.

B. OBJECTIONS

This Article's proposal will inevitably engender a number of objections. It is admittedly a significant departure from the patent system that has existed for the last two hundred years. As with any system of such longevity, any proposed change will be resisted by the various constituencies that have become entrenched around the status quo. The case that the status quo is unsustainable cannot be emphasized enough. For brevity's sake, the Article will now attempt to rebut the three most likely objections to the proposal herein.

1. RATIONING INNOVATION AND CREATIVITY?

The first and most obvious objection to this Article's proposal is that it may appear to stifle inventors or to ration creativity through the auction and bidding process. In truth, a patent system that takes more than ten years to grant an application is of limited real use to inventors and the public. Similarly, a patent system that grants a substantial number of poor quality patents is not of very much benefit to the public or industry. I offer the following additional feature in the interest of mitigating any perceived harshness of the proposal. As one of the initial conditions of the

[117] *See USPTO Modernization Act of 2003*, *supra* note 49, at 10.

auction, every bidder, whether winner or loser, will obtain intellectual property rights, albeit in a vehicle more limited than the traditional patent (e.g., a petty patent). As a consolation prize for the applicant who does not obtain an examination slot through the auction process, he or she would obtain an alternative form of protection for the invention at stake by registering for inventive protection (e.g, a petty patent). While critics who believe that issuing too many patents makes them worthless do not endorse a "pure registration" system,[118] many accept that a viable compromise solution is a hybrid registration-examination system.[119]

2. THE FAIRNESS OF BIG VS. SMALL ENTITIES COMPETING

This Article's proposal will inevitably prompt some critics to question the fairness of a market-based approach, specifically that it potentially pits entities of vastly disparate resources raises against small entities. Under the current patent system's fee schedule, small entities are given a generous benefit. The Patent Act permits certain "small entities" – i.e., small businesses, independent inventors, and non-profit organizations – to receive a fifty percent discount on many of PTO fees.[120] Today this discount is utilized by a wide array of entities, such as small companies, universities, and the independent inventor working out of her garage. The fact of the matter is that this discount is also widely abused. According to the definition used by the PTO, for example, any organization with 500 employees or less, including a small dot-com with a billion dollars in revenues, can receive the preferred treatment intended for the benefit of a small college or the true independent garage-based inventor.

It must be emphasized that this Article's proposed system is not primarily intended to increase revenue; rather, it is to optimize operations. The spirit of the current fee reduction can be imported into the hybrid-slotting system. The number of examination slots can be allocated between the "big guys" and the "small entities." This dual-track thus prevents a large corporation (e.g., General Electric or IBM)[121] and a small start-up or an independent inventor from bidding against one another. Again, I contend that this proposal in fact greatly benefits the small business and independent inventor because the current system is badly

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[118] F. Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55 (2003).

[119] *See* Lemley, *supra* note 62, at 1527 (citing the Japanese system of deferring examination).

[120] 35 U.S.C. § 41(h)(1) (2006).

[121] IBM is used as an example here because it has ranked as the number one recipient of U.S. patents for from 1993-2005. *See* U.S. Patent and Trademark Office, Calendar Year 2005 Preliminary List of Top Patenting Organizations, http://www.uspto.gov/go/oeip/taf/top05cos.htm (last visited Apr. 17, 2008).

overtaxed to the point of being futile, if not absurd, in many cases—namely, waiting ten years for a patent is not a rational investment of one's entrepreneurial efforts.

3. POLITICAL EXPEDIENCY

The next objection to this proposal will likely come from the political sphere. Recall that a central theme of this Article is that any viable legislative patent reform must be able to survive the scrutiny of the political process. Recent congressional attempts at patent reform illustrate the lesson that *all politics are local*. Each member of Congress desires to be a champion of their local political constituency, whether it is a small manufacturing company or a research university. Research universities and foundations have played a large role in the patent reform debate. Today, universities have sophisticated patent programs and technology transfer programs often receiving substantial numbers of patents on a yearly basis and millions of dollars in licensing revenue. Yet, they are politically sacred cows. Universities are likely to insist that the proposal will significantly add to the expense of their patent prosecution budgets. This objection is easily resolved by reserving a number of examination slots for every private and public university and research foundation each year.[122] Likewise, a number of examination spots could be reserved for entities of different categories (e.g., the "micro-inventor") while preserving the overall bidding system structure.

Similarly, just as this changes the patent system, it could also impact the market for legal services. During the consideration of the proposed fee bill, the patent bar was especially vocal in its opposition. Many concluded that the patent bar considers it to be a zero-sum game—the higher the fees charged by the PTO, the less money available in corporate patent department budgets for legal fees. This is a short-sighted argument in light of the fact that the current application inventory is so heavily strained and only getting worse. The Author argues that this proposal is politically expedient because the key political constituencies within the system (i.e., the patent bar, the PTO unions, and the technology industry) will be no worse off, if not in a better position. The patent bar can still charge clients to prepare applications; the unionized examiners will have more time for each application reviewed; and industry will have more thoroughly reviewed applications reviewed in a shorter amount of time. Many poor applications will be discouraged from entering a greatly

[122] The USPTO website has traditionally published a list of the top ten U.S. universities receiving patents each year. *See, e.g.*, http://www.uspto.gov/web/offices/com/speeches/06-24.htm. The very mature technology transfer programs such as the University of California receive more than 250 patents each year. Outside of the top ten recipients, however, most U.S. universities receive fewer than a few dozen patents each year, if any at all.

stressed system. Most importantly, the plague of impractically large backlogs and long patent pendency may finally be eliminated.

Obviously this is not an exhaustive list of concerns and objections. Another relevant question is whether this change to the system risks a violation of the United States' international obligations under various treaties (e.g., Trade Related Aspects of Intellectual Property[123] ("TRIPs")), as many foreign nations and trading partners with strong industrial policy and faithful TRIPs signatories have "petty patent" or other registration systems.[124]

V. CONCLUSION

Economists often theorize about the state of the world or a given economic system in terms of "perfect happiness" or "perfect misery." Certainly the chorus of voices surrounding the PTO's current woes -- ranging from allegations of an unfortunate patent quality quagmire to its self-professed workload crisis -- places it far from the state of "perfect happiness." The patent system and its diverse participants, including inventors, infringers, government regulators, and PTO employees, comprise an enormously complex system. Game theory cannot guarantee a panacea.[125] But it will very likely help in the long and elusive quest for a twenty-first century patent system. Without a doubt, less is more, and, accordingly a more perfect patent system is one that is more efficient and provides for the superior examination of fewer, more worthy applications. Tools from applied economics and game theory might be used to engineer a more optimal, if not perfect, patent system.

This Article presents a new patent examination paradigm. In order to cross the threshold from a quaint proposal to a reality, the Article also articulates the proposal's inherent benefits so as to pass the scrutiny of the political process. Despite the elegance of auctions for certain public sector uses and their proponents from the economics and game theory academy, some may have objections to my proposed model in this domain. As the status quo at the PTO is clearly untenable, the question is which, if any, of the proposed alternatives can rehabilitate a system replete with serious patent quality and workload issues. Most importantly, the socio-economic

[123] Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, Apr. 14, 1994 (GATT Secretariat 1994), Annex 1C: Agreement on Trade-Related Aspects of Intellectual Property Rights. For the adoption of TRIPS by the United States, see Uruguay Round Agreements Act, Pub. L. No. 103-465 (H.R. 5110), Dec. 8, 1994.

[124] *See generally supra* note 92.

[125] Game theorists point out that "[n]o one of these theories should be expected to be a panacea, but their cumulative effect promises to be significant." Vickrey, *supra* note 101, at 62.

goals that are at the heart of the nation's economy are at stake when it comes to the functionality of the patent system. Economic theory can help private and public institutions implement more efficient processes, better allocate resources, minimize waste, and develop better patterns of use. Whereas most of the economic analysis regarding the patent system focuses on value in terms of profit for the patentee, rather than societal benefits, improved operation of the patent system is likely to enhance welfare for all participants, improve the nation's economy, and provide new societal benefits (e.g., externalities) flowing from patenting activity.

The use of game theory in the public sphere is well-established and has a long pedigree. One of the key tools in the current public law and economics arsenal is the Coase Theorem. This game theory principle states, in essence, that a system will ultimately organize in an economically efficient manner in the presence of externalities.[126] History confirms that game theory principles, such as the Coase Theorem, can play a role in improving public policy. In the 1950s, the FCC evaluated the era's bureaucratic and ineffective allocation mechanism of radio spectrum. Professor Coase testified before the FCC and proposed a theorem based on economic allocation. In response, a perplexed FCC Commissioner, Philip S. Cross, asked: "Is this all a big joke?"[127] Not only did Professor Coase eventually win the Nobel Prize for economics—ultimately, the FCC adopted his system for the market allocation of radio spectrum rights.[128]

As with many elements of modern society, the patent system may be viewed through an economic prism: a representation of a set of choices and investments (e.g., resources, time, money, and risks). The touchstone of the patent system is innovation. The PTO is interposed between the public and the frontiers of knowledge and industry. If the body politic cannot host an honest discussion about the defects of the patent system and accept the case for necessary reform, even if it is a significant departure, the system will remain broken for at least the next generation, if not beyond. The challenge is keeping the PTO from becoming a bigger federal agency or spending more appropriated funds as a way out of its problems. Rather, it is about being smarter in its constitutionally-based

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[126] R.H. COASE, ESSAYS ON ECONOMICS AND ECONOMISTS 8 (1995) ("I argued that in a competitive system there would be an optimum of planning since a firm . . . could only continue to exist if it performed its coordination function at a lower cost that would be incurred if co-ordination were achieved by means of market transactions and also at a lower cost than this same function being performed by another firm. To have an efficient economic system it is necessary . . . we find as a result of [such] competition . . . This is what I said in my article of 1937 . . . I could never have imagined that these ideas would some sixty years later become a major justification for the award of a Nobel prize.").

[127] Gerald R. Faulhaber, *The Question of Spectrum: Technology, Management, and Regime Change*, 4 J. TELECOMM. & HIGH TECH. L. 123, 128 (2005).

[128] *Id.*

mission to advance the useful arts and sciences for the public and the nation.[129]

[129] U.S. CONST. art. I, § 8, cl. 8 (the Patent and Copyright Clause); *see also supra* note 5.

APPENDIX: USPTO PATENT PENDENCY (1883 – 2007)[130]

Year	Number of Pending Applications
1883	4644
1884	9786
1885	5786
1886	6772
1887	7601
1889	7073
1890	8911
1891	6585
1892	9447
1893	8381
1894	6261
1895	4312
1896	9545
1897	8389
1898	11,282
1899	5467
1900	5817
1901	4924
1902	8562
1903	11,511
1904	10,810
1905	14,596
1906	17,256
1907	10,602
1908	18,540
1909	16,571
1910	20,274
1911	16,840
1912	18,559
1913	27,865
1914	31,591
1915	22,036
1916	17,772
1917	18,691
1919	16,065
1920	27,060
1921	41,182
1922	61,521

Year	Number of Pending Applications
1923	71,173
1924	67,135
1925	56,124
1926	41,614
1927	53,494
1928	85,824
1929	111,069
1930	118,730
1935	106,335
1940	110,743
1945	116,981
1950	219,334
1955	221,872
1964	218,000
1975	146,464
1985	215,512
1988	215,280
1990	244,964
1991	254,507
1992	269,596
1993	244,646
1994	261,249
1995	298,522
1996	303,720
1997	275,295
1998	379,484
1999	414,837
2000	485,129
2001	542,007
2002	636,530
2003	674,691
2004	756,604
2005	885,002
2006	1,003,884
2007	1,112,517

[130] Data from the years 1883 to 1930 was compiled from the following source: *Condition of Work in the U.S. Patent Office*, *supra* note 37, at 168. Data from years 1931 to 2007 was compiled from USPTO Annual Performance and Accountability Reports, available at http://www.uspto.gov/web/offices/com/annual/index.html.