Patent Reform

Unleashing Innovation,
Promoting Economic Growth &
Producing High-Paying Jobs

A White Paper from the U.S. Department of Commerce

April 13, 2010

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Executive Summary

Stimulating economic growth and creating high-paying jobs are key priorities for the Obama Administration. This paper provides data demonstrating that technological innovation is a key driver of a pro-growth, job-creating agenda. It further demonstrates that patent reform legislation, by accelerating the pace of growth and of job creation, will be a powerful and deficit-neutral mechanism for expanding America's ability to innovate.

- Technological innovation is linked to **three-quarters of the Nation's post-WW II growth rate**. Two innovation-linked factors – capital investment and increased efficiency – represent 2.5 percentage points of the 3.4% average annual growth rate achieved since the 1940's.

- Innovation produces high-paying jobs. Average compensation per employee in innovation-intensive sectors increased 50% between 1990 and 2007 – nearly **two and one-half times** the national average.

- Highly innovative firms rely heavily on timely patents to attract venture capital -- **76% of startup managers** report that VC investors consider patents when making funding decisions.

- **Delay in the granting of rights has substantial costs.** Recent reports conclude that the U.S. backlog (currently at 750,000 applications) could ultimately cost the U.S. economy billions of dollars annually in "foregone innovation."

- The fee-setting authority patent reform gives to the USPTO will contribute significantly to the agency's planned **40% reduction in patent pendency**.

- The enhanced post-grant review provided by patent reform will substantially reduce the need for inefficient court challenges. **The cost of such proceedings is expected to be 50-100 times less expensive than litigation and could yield $8 to $15 in consumer benefit for every $1 invested.**

Discussion

Stimulating economic growth and creating high-paying jobs are key priorities for the Obama Administration. This paper sets forth some of the empirical data demonstrating that technological innovation is a key driver of a pro-growth, job-creating agenda and that patent reform will be a powerful, deficit-neutral mechanism for expanding America's ability to innovate.

Patent reform legislation has been before Congress in one form or another for much of the last decade. As of this writing, the legislation appears to have a significant chance of passing during the 111th Congress. We believe this overview of the economic literature and other evidence will advance the discussion about patent reform and its impact on the economy.

This country's economic progress has long depended on technological innovation. Innovators, in turn, have depended in significant part on patents to undergird their business plans, including their hiring plans and their plans to invest in additional research and development (R&D). Such investment can generate additional patentable ideas, creating a virtuous cycle of innovation, growth, and additional innovation. Patent reform legislation will accelerate that process and speed the pace of growth and of job creation.

Section I of this paper briefly recaps the linkage between innovation and growth, and between innovation-centric growth and the creation of high-paying jobs. The subsequent two sections discuss the abundant evidence demonstrating that timely, high-quality patents drive innovation and, conversely, that delay, uncertainty, poor quality, and inefficiencies in existing legal processes impede innovation. Section IV specifies what patent reform will do to address delay, uncertainty, poor quality, and inefficiency in the system.

I. Innovation Fuels Economic Growth and Produces High-Paying Jobs

A. It is Now Clear that Innovation is the Leading Driver of Economic Growth

All major strands of economic thought now recognize that technological change is the primary driver of growth.[1] In fact, modern economic theory holds that without technological innovation, accumulation of wealth could not be sustained and per capita growth would trend to zero.[2]

Through ongoing academic work, the contribution of innovation to economic growth has become less and less of an abstract assertion. Today, as an empirical matter, we have strong evidence that the introduction of both new products and new processes is responsible for the lion's share of the 3.4% average annual growth rate the U.S. has enjoyed since World War II. While 0.9 percentage point of this annual growth has come from expansion of the labor force, the remaining 2.5 percentage points have come from factors intimately linked to innovation – capital investment (1.1%) and increased efficiency (1.4%).[3] In other words, factors linked to innovation are responsible for almost three-quarters of the Nation's post-WW II growth rate.

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[1] *See generally* Christopher Freeman & Luc Soete, THE ECONOMICS OF INDUSTRIAL INNOVATION 1-26 (3d ed. 1997) (reviewing the substantial economic literature on this point).
[2] *Id.*
[3] *See* Dale W. Jorgenson, Mun S. Ho, Jon D. Samuels & Kevin J. Stiroh, *Industry Origins of the American Productivity Resurgence*, 19(3) Economic Systems Research 229 (2007). In the economics literature, "efficiency" is often referred to as total factor productivity. *See also* Michael J. Boskin and Lawrence J. Lau, *Generalized Solow-Neutral Technical Progress and Postwar Economic Growth*, (Nat'l Bureau of

With respect to capital investment, innovation helps decrease the price of many existing products, and it improves their quality. Innovation thereby enhances the desirability of investing in innumerable capital goods, including computers, telecommunications equipment, and machinery. Innovation also creates opportunities for investment in altogether new types of capital equipment, such as robotics. Innovation promotes efficiency by generating better ways of working, manufacturing, selling, including electronic inventorying, e-commerce, computer-driven manufacturing, and advertising linked to Internet search queries.

The many specific examples of innovations that contribute to growth are so numerous and diverse as to be beyond cataloguing. At the aggregate level, however, it is clear that innovation's impact on growth is profound.

B. Innovation Produces High-Paying Jobs

As it fuels economic growth, innovation also produces high-paying jobs. Recent studies by the Federal Reserve show that innovation in capital goods is the primary driver of increases in real wages. Without innovation, wages would be much lower.[4] Additionally, across countries, 75% of differences in income can be explained by innovation-driven productivity differentials.[5]

Within the U.S, the average rate of real compensation per employee in the private sector increased 20.2% between 1990 and 2007 (Table 1 of Appendix). But in several of the most innovative industries, including computers, electronics, and chemicals, real compensation per employee increased more than 50% -- nearly two and one-half times greater than the average.

II. Timely, High-Quality Patents Drive Innovation

A. Innovative, Venture Capital-Backed Startups Rely on Timely Patents

Venture-backed startups disproportionately generate the new technological improvements upon which growth depends.[6] Many of these firms rely heavily on patents to attract venture capital (VC). For example, in a large-scale survey conducted in 2008, 76% of startup managers reported that VC investors consider patents important to funding decisions.[7] Similarly, analyses of VC funding databases demonstrate that owning patents is significantly correlated with success in acquiring first and additional rounds of VC financing.[8]

Econ. Research, Working Paper No. 8023, 2000) (finding that physical capital and technical progress contribute 75% of U.S. growth 1960-1997).

[4] *See* Susanto Basu and John G. Fernald , *What Do We Know (and Not Know) about Potential Output?*, 91(4) FRB of St. Louis Review 187 (2009).

[5] Robert E. Hall and Charles I. Jones, *Why Do Some Countries Produce So Much More Output Than Others?*, 114(1) Quarterly Journal of Economics 83 (1999).

[6] Samuel Kortum & Josh Lerner, *Does Venture Capital Spur Innovation?,* (Nat'l Bureau of Econ. Research, Working Paper No. 6846, 1998), *available at* SSRN: http://ssrn.com/abstract=10583 or doi:10.2139/ssrn.10583.

[7] Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, Berkeley Tech. L.J. (forthcoming 2010) (manuscript at 28, on file with authors).

[8] Ronald J. Mann & Thomas W. Sager, *Patents, Venture Capital, and Software Start-ups*, 36 Research Pol'y 193 (2007).

Numerous anecdotal accounts give texture to these large-scale empirical findings. For example, according to ExploraMed, a venture-backed medical technology incubation company based in Mountain View, California, the ability to secure timely patents has been critical in its quest to secure venture financing for the six medical device companies and more than 400 jobs it has created. These companies include Acclarent Inc., a company that develops new technologies in the field of ear, nose, and throat surgery. Acclarent, which employs 300 people and was acquired by Johnson and Johnson/Ethicon in January 2010, has a portfolio of over 100 patents.

Similarly, the Foundry (a medical device incubator in Menlo Park, California that has created 14 companies and employs over 300 people) reports that timely patent protection "was critical to enable our companies to receive the significant capital required to bring their technologies to market." These companies included Evalve, a manufacturer of ultra-thin catheter for repairing diseased heart valves, that employed over 140 employees and owned over 50 patents before it was acquired by Abbott last year.

B. High-Quality Patents Spur Innovation in the Pharmaceutical Industry

Along with timeliness of patent examination and grant, high patent quality – that is, the grant of patents that meet statutory requirements of patentability such as novelty, non-obviousness, and a clear identification of precisely what the patent claims – is closely correlated with the most valuable innovations. Generally speaking, high quality is a feature of patents held by successful, growing companies in industries like the pharmaceutical industry. Moreover, economists have argued that this high quality contributes significantly to making pharmaceutical patents valuable to the industry, even after the costs of defending against patent litigation are taken into account.[9] Similarly, surveys of CEOs and R&D managers have shown that patents are among the most important means for securing competitive advantage from pharmaceutical innovations.[10] The so-called "patent premium" (i.e., the incremental value realized on an invention by patenting it) also tends to be highest for biotechnology, pharmaceutical, and medical device companies.[11] For those companies, a 10% increase in the strength of patent protection available to meritorious patents is associated with a 9-10% increase in R&D expenditures, which in turn drives innovation and growth.

III. Delay, Uncertainty, Poor Quality, and Inefficient Legal Processes Hinder Innovation

While timely, high-quality patents can provide a strong spur to innovation, the current patent system fails to provide consistent timeliness and quality. To the contrary, the current U.S. system is highly prone to delay and uncertainty as well as inconsistent quality. Moreover, lawsuits at the back-end that challenge the validity or scope of a patent after it has been issued cannot address the quality deficit. Delay, uncertainty, and poor quality at the front end ultimately make private investments in innovation less likely and undermine the potential for economic growth and job creation.

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[9] James Bessen & Michael Meurer, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK (2008).
[10] Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not),* (Nat'l Bureau of Econ. Research, Working Paper No. 7552, 2000).
[11] Ashish Arora, Marco Ceccagnoli & Wesley M. Cohen, *R&D and the Patent Premium*, 26(5) International Journal of Industrial Organization 1153 (2008).

A. The Negative Effects of Delay and Uncertainty

As regards timeliness, the problem is quite acute. The USPTO currently has a backlog of more than 750,000 patent applications, an accumulation that has doubled over the last decade. Delays are particularly problematic for startups with high growth potential. While the startups discussed in Section II were able to secure patents – and venture funding – in a timely fashion, many other startups have encountered difficulties. For example, NeoTract, Inc., one of the firms created by medical incubator ExploraMed, was not able to secure its first patent on enlarged prostate treatment until four years after it filed a patent application. This delay created significant issues for Neotract in raising a new round of VC financing. In fact, VC financing did not ultimately materialize until after the patent issued. Similarly, Innate Immune, a California firm with a new concept for treating asthma and lupus was prevented from securing a second round of VC financing because it lacked issued patents.

More quantitative research also demonstrates the negative economic effects of a large backlog. For example, recent work conducted for the UK Intellectual Property Office by the consulting firm London Economics has focused in part on the costs that delays in securing patents impose on startups in the three major global patent offices -- the USPTO, the European Patent Office, and the Japan Patent Office. This report concludes that backlogs of the sort that the USPTO is currently facing could lead to "foregone innovation," costing the economy billions of dollars annually.[12]

The uncertainty associated with patent delay imposes significant costs not only on patent applicants but also on potential competitors. These competitors cannot know where to focus their research and development investments until they know precisely what a patent applicant has been able to claim as its inventive territory. Accordingly, companies in this situation may make fewer, or misdirected and wasteful, investments in innovation.

B. The Negative Effects of Poor Quality and Inefficient Legal Processes

Low-quality patents – that is, patents that are obvious, overly broad, or unclear in the inventive territory that they cover – also hinder innovation. This is because although patents may be low-quality, they can nonetheless be profitably asserted against genuine innovators in litigation. Indeed, some economists have argued that patent quality in technological areas such as software may have been so low during certain time periods that the litigation costs of defending against dubious patents exceeded the innovation benefits offered by high-quality patents.[13]

Equally important, many invalid patents are never challenged in our current litigation system. In part, this is simply because of the extremely high cost associated with patent litigation. For example, in cases in which more than $25 million is at stake, the average cost per side can rise to $5 million or more. Over and above the sheer cost of a court challenge, the rules of civil litigation procedure place a substantial burden on those competitors in the same technological arena that are likely to have the best knowledge of invalidity, and could otherwise effectively challenge an invalid patent. Because of these civil litigation rules, the potential infringer that expends money to challenge an invalid patent successfully shares its victory with all potential infringers – the patent is invalid as to all potential infringers, including the challenger's own

[12] London Economics, *Economic Study on Patent Backlogs and a System of Mutual Recognition – Final Report To the Intellectual Property Office* (2010), *available at* http://www.ipo.gov.uk/p-backlog-report.pdf.
[13] James Bessen & Michael Meurer, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK (2008).

competitors. Under these circumstances, as well as others, innovative firms often find it more economically rational to simply license invalid patents rather than challenge them.[14] Collectively, the litigation and these licensing costs represent a significant tax on innovation.

IV. Patent Reform Promotes Innovation by Addressing Delay, Uncertainty, Poor Quality, and Inefficient Court Challenges

Patent reform has a number of features that should effectively address delay and uncertainty as well as poor quality and inefficiencies inherent in legal challenges. The two most notable reforms are fee-setting authority and enhanced post-grant review procedures.

A. With Fee-Setting Authority, USPTO Can Significantly Reduce Delay and Uncertainty

As noted, the USPTO currently has an unexamined patent application backlog of over 750,000. Patent application pendency – the time between when an application is filed and when it receives a final disposition – currently stands at 34 months on average. In certain areas of information and communications technology, pendency is even longer -- a particularly acute problem since rapid technological turnover and short product life-cycles may render delayed patents in these areas obsolete and worthless.

In order to reduce the backlog, the USPTO will have to incur significant additional expenses, most notably expenditure on IT infrastructure upgrades and additional hiring of examiners. As a fully fee-funded organization, the USPTO must use fee revenues for all of these expenses. However, the fee schedule in the current patent statute fails to provide the USPTO with the flexibility it needs to assure that its future revenues are commensurate with the costs it will incur to modernize its operations. The current fee structure is inflexible and poorly aligned with actual costs, making it exceedingly difficult to fund long-needed modernizations.

Additionally, even though the USPTO is a fee-based organization, patent applicants do not pay the full cost of the services the USPTO provides them. Rather, the initial processing and review of a patent application are highly subsidized. Under the current system, a patent applicant whose application does not issue pays only about one-third of total search and examination costs.

The front-end costs are subsidized by back-end patent issuance and maintenance fees that are assessed on successful applicants. This dependence on back-end revenues is particularly perilous in the case of maintenance fees. Patentees may or may not choose to pay maintenance fees, and the magnitude of fees that will be realized in any given year can be quite difficult to predict. This model has proven extremely difficult to manage from an accounting and planning standpoint, especially during the economic tumult of recent years.

Patent reform would be a significant step forward. It would provide the USPTO authority to flexibly adjust fees in a manner commensurate with its needs (as opposed to awaiting congressional amendment of fee schedules, which is currently the case). Aggregate fees would simply have to be set so as to recover the costs to the USPTO of the services it provides. With fee-setting authority, the USPTO could deliver on its aggressive goal (enunciated in the FY 2011

[14] Joseph Farrell & Robert P. Merges, *Incentives To Challenge And Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors And Why Administrative Patent Review Might Help*, 19 Berkeley Tech. L.J. 943 (2004).

President's Budget) of reducing to 20 months total average pendency. This anticipated 40% reduction in average pendency would offer greater certainty to innovators of all stripes, allowing for more timely and accurate R&D investments, and thus, substantially improve prospects for improvement in the Nation's innovative performance and overall economic growth.

B. Enhanced Post-Grant Review Would Improve Quality and Obviate the Need for Inefficient Legal Challenges

Patent reform can also help reduce the cost of patent disputes. Challenging invalid patents is particularly daunting for small firms with limited resources. As a consequence, some analysts believe that large firms have been able to use even weak patents to threaten litigation, thereby forcing small competitors with breakthrough technologies out of business.[15] Because enhanced post-grant review would offer a timely and much less expensive mechanism for challenging weak patents, it offers a solution to such problems. Enhanced post-grant review also offers an additional mechanism for improving patent quality.

Recent research provides dramatic quantitative evidence about the efficiency improvements offered by enhanced post-grant review.[16] This research relies on some basic mathematics on the cost of administrative review relative to litigation. Given that the cost of post-grant review is expected to be 50-100 times lower than the cost of patent litigation, it is reasonable to expect that more patents will be challenged under such a system. Moreover, if we take U.S. litigation experience as a guide, between one third and one half of these challenges can be expected to result in an invalidity decision. These patents will then be taken out of the system, saving both potential litigation costs and costs to consumers from the exercise of unwarranted market power. When patents are found to be valid, the post-grant review process will also generate significant benefits. These will include savings from a reduced likelihood of future litigation as well as more timely certainty for investors and innovators.[17] For these reasons, researchers believe the cost-benefit ratio of adopting an efficient system of enhanced post-grant review procedures, such as that created by patent reform, could be as high as 1 over 15 – in other words, so long as PGR costs do not exceed $100,000, benefits are expected to range, conservatively, from a high of $15 to a low of $8 for each $1 invested. [18]

Indeed, almost every academic economist who has ever examined whether an enhanced system of post-grant review should be adopted has favored such adoption.[19] Enhanced post-grant review has also been strongly recommended in reports authored by the National Academy of Sciences, the National Research Council, and the Federal Trade Commission.[20]

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[15] Stuart M. Benjamin & Arti K. Rai, *Fixing Innovation Policy: A Structural Perspective*, 77 Geo. Wash. L. Rev. 1 (2008).
[16] Stuart J.H. Graham and Dietmar Harhoff. *Separating Patent Wheat from Chaff: Would the U.S. Benefit from Adopting a patent Post-Grant Review?* (2009) (on file with authors).
[17] Stuart M. Benjamin & Arti K. Rai, *Who's Afraid of the APA: What the Patent System Can Learn From Administrative Law*, 95 Georgetown Law Journal 269 (2007).
[18] *Id*. Given the cost of current reexamination proceedings at the USPTO, $100,000 is a conservative (meaning high) estimate of the maximum cost for an enhanced post-grant review proceeding.
[19] Academic economists who have written in favor of enhanced post-grant review include Joseph Farrell, Bronwyn Hall, Dietmar Harhoff, Richard Levin, and David Mowery.
[20] One short study commissioned by opponents of patent reform finds otherwise. Scott Shane, Problems To Be Expected from Expanded Administrative Challenges to U.S. Patents, Prepared for the Manufacturing Alliance for Patent Policy (2009). But in arguing that enhanced post-grant review would increase pendency and be associated with delay, the study misses basic structural features of such review. For example, it erroneously assumes that examiner resources would be used in PGR and that PGR fees could not be set at a

By providing a timely resolution to patent validity, enhanced post-grant review also offers advantages to those seeking to assert valid patents. Litigation-related delay in the resolution of validity contributes to uncertainty for technology investors, increasing the likelihood of underinvestment and mistaken investment, and adding transaction costs to technology commercialization.[21] For granted patents reaching final judgment in a district court action, eight years elapses on average between the grant of the patent and the resolution of validity. For a quarter of these cases, more than 11 years elapses (see Figure 1, appendix).[22] In contrast, the post-grant review provided by patent reform legislation would resolve validity within one year and significantly reduce the likelihood of litigation.

V. Conclusion: Patent Reform as a Deficit-Neutral Innovation Boost

Over the past several decades, the empirical evidence showing technological innovation as the leading driver of economic growth has become irrefutable. Congress has been presented with many policy proposals for promoting such innovation. Given the current economic and employment situation, all reasonable proposals should be considered. We believe the patent reform agenda deserves special attention because it has a unique trait. It is likely to expand the Nation's innovative output while adding $0 to the Federal deficit. This deficit-neutral form of stimulus presents an economic opportunity that should be seized.

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cost-recovery level. The study also ignores the strict time limits on PGR set up by the patent reform legislation.

[21] Bronwyn Hall, Stuart Graham, Dietmar Harhoff & David Mowery, Prospects for Improving U.S. Patent Quality via Post-grant Opposition, 4 INNOVATION POLICY AND THE ECONOMY 115 (2004).

[22] Stuart Graham, *Slow courts and the cost of uncertainty: How patent post-grant reviews may offer a partial solution* (2010) (on file with author).

Appendix

Table 1. Real Compensation Per Employee, 1990 and 2007 (All Dollar Amounts are in $2007)			
Industry	**Compensation per Employee**		
	1990	2007	Percent Change
Private Industry	$43,795	$52,620	20%
Selected Innovation -Intensive Industries			
Computer and Electronic Products	$65,053	$109,280	68%
Electrical Equipment	60,098	71,709	19%
Chemical Products	76,681	104,794	37%
Publishing Industries (including Software)	52,097	88,449	70%
Information and Data Processing	61,498	91,175	48%
Computer Systems Design and Related Services	82,133	103,323	26%
Total selected innovation-intensive industries	$65,793	$98,891	50%
Source: Bureau of Economic Analysis			

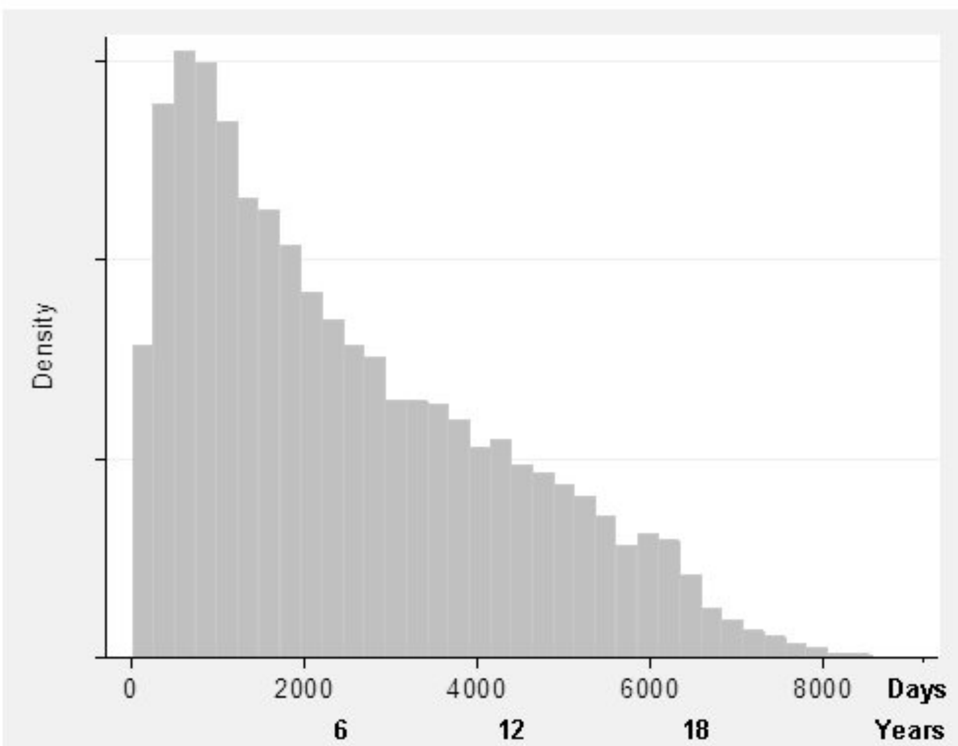

Figure 1: Distribution, time delay from patent grant to suit resolution at trial, litigated patents granted 1975-2000.

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