Emerging Secondary Markets for Intellectual Property: US and Japan Comparisons

Research Report to

National Center for Industrial Property Information and Training (NCIPI)

March 31, 2006

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Chapter 1

Executive Summary of Research Report

Most patents are initially assigned to a corporation. Once assigned, the majority of these patents are neither used within the company that owns the patent, nor are they licensed out for other companies to use. Instead, they are kept on the shelf by the corporation throughout the patent's legal life. This is inefficient for companies, and socially wasteful as well, since patents confer a legal right to exclude others from practicing a technology. Effective utilization of intellectual property (IP hereafter) is an important requirement for nations to advance their standard of living.

However, there are signs of an emerging secondary market for IP. Patent reassignment data from the USPTO, for example, show a rising trend in reassignments of patents. Anecdotal evidence shows that a small number of intermediary firms have arisen in recent years to assist in the process of identification, negotiation, and transfer of patents from one firm to another. As secondary markets advance, they create stronger incentives for the greater utilization of patents.

This proposal is the first study of its kind to explore the emerging secondary markets for IP. It will examine the reasons for the rise of secondary markets where they do appear, and what measures governments have taken to encourage or discourage this. It will also examine the important role of banks and financial institutions in promoting greater utilization of IP. Finally, it will explain why growing secondary markets create stronger incentives for greater patent utilization. As a first study, its results will be important and new. As a first study, these results inevitably will be incomplete, because there is relatively little known about these markets. As a proxy for this novelty, I will examine briefly the emergence of secondary markets in other services, such as mortgage banking, to illustrate the potential implications of liquid secondary markets for IP on IP management.

While it is limited by the availability of reassignment data from JPO, the research will also consider the opportunity for future patent transfers in the Japanese market as well.

Chapter 2

Patent Utilization in Large Companies

In the US, some observers claim that over 95% of issued patents are unlicensed, and over 97% never generate any royalties.[2] This chapter will briefly examine the history of patents, and then probe some of the reasons for this low level of utilization of patents in large companies. Patent strategies of firms will be explored. A model will be proposed, whereby we will see that R&D organizations often are uncoupled from the downstream business needs of the company, leading to the creation of patents that the company cannot use.

However, there are a few firms within the US who actively utilize their patents. Understanding the strategies and practices of these firms might suggest ways to encourage greater utilization of patents by other firms. By studying these exemplars of best practices in patent utilization, we can learn more about the opportunities and barriers to greater patent utilization.

Patents in Historical Perspective[3]

On April 10, 1790, President George Washington signed into law the bill which provided the foundations of the US patent system. At the time in history, this patent system was unique; for the first time in history the intrinsic right of an inventor to profit from his invention is recognized by law. Previously, privileges granted to an inventor were dependent upon the prerogative of a

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[2] Samson Vermont, *The Economics of Patents and Litigation,* at. 332 (in Bruce M. Berman (ed.) *From Ideas in Assets, Investing Wisely in Intellectual Property*, Wiley & Sons, Inc., 327-372, 2002).

[3] This section borrows from material in Chapter 3 of my forthcoming book, Open Business Models,(Harvard Business School Publishing: Cambridge, MA, 2006). It also has benefited from an analysis by Ms. Aura Soinenen of the Helsinki Institute of Technology, in Finland.

monarch or upon a special act of a legislature, on a case-by-case basis. This was the manifestation of the intent of the framers of the US Constitution, which explicitly provided that:

"Congress shall have the power...to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."[4]

In 1790, one Samuel Hopkins received the first U.S. patent, for an improvement in the making of potash (which is a substance derived from the ash of burnt plants, and is useful for making soap). Of greater interest is the fact that the reviewer of this first patent was Thomas Jefferson, the Secretary of State, who was a rather accomplished inventor himself. Jefferson's review was not enough to cause Hopkins to receive a patent, however. Other signatures from the Secretary of War, the Attorney General and even President Washington were required before Hopkins got his patent. Hopkin's patent application cost about $4.

By 1793, Jefferson stopped reviewing patents himself, and assigned these tasks to a State Department clerk. The US Patent Office itself was formed in 1802 during Jefferson's presidency. Initially the patent system was simply a registration system, to enable inventors to have an official record of their patents. No attempt was made to see if the claims of one patent conflicted with another patent, or if the claims of the patent represented a material advance over the current state of the art. That changed in 1836, when the US moved to a formal examination system, to assess the novelty, usefulness and non-obviousness of patent claims prior to granting the patent.

Throughout the 19th century in the US, patents become more difficult to obtain, and more valuable when they were obtained. This was a conscious outcome of government policy, to provide strong incentives for invention, in the hope of stimulating greater social advancement.

[4] U.S. Constitution Article 1. Section 8

Abraham Lincoln famously remarked that the patent system was intended “to add the fuel of interest to the fire of genius”, and Lincoln himself received a patent.

While patent protection was considered to be very strong at the start of the 20th century, the next 80 years caused the strength of patent protection to become progressively weaker. As US corporations become larger and stronger, the US government became increasingly suspicious of patents. Instead of fueling the fire of genius, the government worried that patents were being used as a means for monopolies to escape antitrust protections. Companies like AT&T and Xerox were sued by the government, and forced to publish or license their patents to all comers.

Other patent holders found that patent protection often wasn’t very effective, as a means of excluding competitors from using their inventions. A common defense against a patent infringement suit was to claim that the patent was not in fact valid. From the period of 1953 to 1977, only 30% of patents that were challenged in this way were subsequently upheld in court.[5] Patents were not regarded as particularly effective ways to protect inventions, and small companies were particularly disadvantaged, since the litigation process was very expensive for them.

In the 1980s, a backlash against this weakened protection emerged, in part due to the perceived Japanese threat to US competitiveness in many industries. US firms were felt to need greater incentive to invest in innovation, which would be critical to restoring the US competitive advantage in the world economy. This led to the creation of a new dedicated federal circuit court of appeals for patents. This court proved to be a more favorable court for patent owners, in that

[5] See Adam Jaffe and Josh Lerner’s insightful book, Innovation and Its Discontents, (Princeton: 2004) for an extended discussion of these patent protection issues. On pages 98-101, they report evidence that patent protection was about 30% overall in the the period of 1953 through 1977, but varied widely from one Federal District to another. This high variance (from as low as 8% in the Great Plains to as high as 57% in the Rocky Mountains) has no obvious explanation, and strongly encouraged litigants to shop for the best district for their own interests. As Jaffe and Lerner show, Congress gradually became concerned about this state of affairs, and set up the Court of Appeals for the Federal Circuit in 1982 to centralize patent cases, promote greater specialization of legal knowledge about patents, and eliminate the gross disparities between circuits.

the court upheld the validity of patents in 68% of the cases during its first four years,[6] a rate more than double that of the 1953-1977 period.

This court even now continues to be much more "pro patent" than the earlier period. Indeed, the court has expanded the scope of what can be protected by patents, and increased the value of remedies that infringed patent-holders can claim from the infringing party. This led to some dramatic court cases, as will be discussed below. More typically, it influenced the negotiations between patent owners and those alleged to infringe those patents. Most of the time, these parties settle out of court. But the terms of these settlements are strongly affected by the small portion of cases that do go to trial. As patent-holders gained more protection and larger awards, the terms of negotiated settlements before trial undoubtedly shifted towards the patent-holders. These historic shifts have opened the door to much more active, even aggressive, management of IP.

Companies Rewriting the Rules of Managing IP

Texas Instruments was one of the first companies to benefit significantly from this new state of affairs. Jack Kilby was an early inventor of the original semiconductor who worked at TI and assigned all rights to his invention to TI. Robert Noyce of Intel also received important foundational patents for his work in semiconductors, but Noyce's patents issued quickly, while Kilby's patents did not. Kilby's original original patent application was filed with the USPTO back in 1972 [check], but owing to various technical reasons the issuance of this patent was delayed for many years.

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[6] See Jaffe and Lerner (2004), p. 106. As they discuss there, comparing the 68% rate with the earlier rate is more complicated than looking at the two numbers. It is quite likely that the higher rate of upholding patents by the new court caused people holding weaker patents (who might have avoided litigation entirely under the old regime, since they had a lower chance of winning) now taking their chances in court. This "mix shift" means that more and weaker patents are being litigated now than earlier. Thus the true difference between the old and new patent regimes likely is even greater than the percentages suggest.

Intel created a wonderful business in microprocessors, and during the course of its business, it cross-licensed many of its patents with other large companies. It chose to compete in manufacturing and product design, and received little direct monetary compensation for its IP. However, the access to other IP cleared the way for Intel's success, so indirectly it benefited a great deal from its IP.

By the time the Kilby patent issued in 1986, TI found that it had more direct ways to profit from its IP windfall. By now, the semiconductor business was a global industry. And this newly issued patent gave TI the right to exclude others from many aspects of semiconductor design, if they didn't pay royalties to TI. While TI had cross-licensed many companies' IP in exchange with its own (including Intel, among others), there were many other companies, particularly in Japan and Korea, who had not signed any cross licensing deal with TI. Armed with Kilby patent and another key patent for planarization technology, TI proceeded to file suit with many semiconductor companies. Over the next several years, TI generated hundreds of millions of dollars from these patents. In some years, TI received as much as 50% of its entire corporate net income from royalties, most of which were due to these patents. [7]

This was unheard of, for a semiconductor company to make as much money from its IP as from its designs and its production facilities. It meant that TI was not only a maker of semiconductors, it was also an owner of valuable IP that was making a separate contribution to the company's profits. It would prove to be a harbinger of many subsequent semiconductor companies (such as ARM, Qualcomm, and Rambus), who made most or all of their money from IP, not from products.

[7] (Grindley and Teece, 1997)

Although patents were typically used for electronics, semiconductors and computer hardware[8], patent protection was not available for software at all. Nowadays, however, the amount of patents in the Information and Communications Technology (ICT) sector compared with the total number of patents is relatively high, with a "patent share" of over 10%, and the share of ICT patents appears to be constantly rising[9]. Of course, this has not only to do with the changes in the patentability regime, and patents' more central role in business, but also with the increase in information and communications technology's importance in relation to other fields. ICT has grown into one of the largest and most influential industries in the world. It consists of manufacturing and service industries involved in information acquisition, processing and transfer as well as communications. It includes part of electronics and electrical industries, telecommunication services, information technology and, depending on definition, also content businesses.[10]

It is worth noting, when it comes to the information technology part of the ICT sector, that the absence of patent protection did not appear to hinder the software industry from developing, growing and blooming into a very large and profitable industry. One reason for this is other forms of intellectual property rights (IPRs) have been available for software rather early in its lifecycle. In addition to keeping computer software as a trade secret, it was officially given copyright protection in the early 1980s both in the U.S. and Europe. Even before, for instance, the U.S. copyright office had issued registration certificates to software source code, and also to object

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[8] Mark A. Lemley, Peter S. Menell, Robert P. Merges & Pamela Samuelson, *Software and Internet Law*, at 259 (Aspen Law & Business 2000). All authors were professors at Berkeley's Boalt School of Law. The last three remain as Berkeley professors as of this writing.

[9] By "patent share", I mean the number of software patents, divided by the total number of patents issued in that same year. *See e.g.* OECD, *OECD Science, Technology and Industry Scoreboard 2001, Towards a Knowledge-Based Economy* (2001) <http://www1.oecd.org/publications/e-book/92-2001-04-1-2987/index.htm> (last visited 3/22/2006.

[10] TEKES, *The Future is in Knowledge and Competence, Technology Strategy -a review of choices*, at 12 (June 2002) <http://www.tekes.fi/julkaisut/Tekes_Teknstrat_eng.pdf> (last visited 6/15/04). *See also* OECD, *Measuring the Information Economy 2002, Annex 1. The OECD Definition of the ICT Sector*, at 81 <http://www.oecd.org/dataoecd/34/37/2771153.pdf> (last visited 7/1/04).

code under its "rule of doubt"[11]. Nonetheless, the need for more efficient protection was recognized in the mid-80s when microcomputers became popular, mass-markets for software developed, and the interpretation of copyright protection's scope reached its limits[12]. Consequently, software-implemented inventions have gradually come into the sphere of patentable subject matter both in the U.S. and Europe. Lately, patents for business methods like novel and non-obvious methods for pricing, distributing and/or marketing on the Internet have been accepted in the U.S.

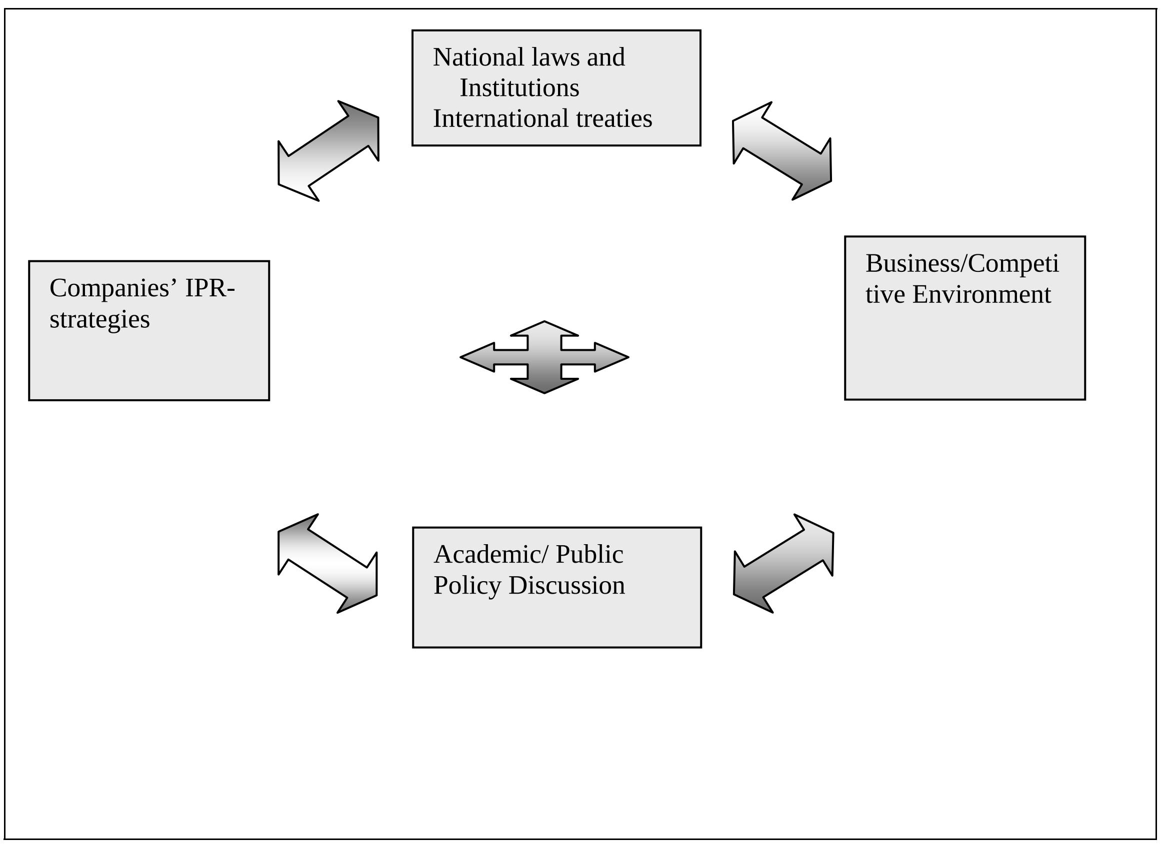
2.1 A Framework for the Evolution of Patent Protection

There are a number of forces from the history of patents that affect the evolution of patent protection. Changes in patentability of software and business methods were largely driven not only by technological and business developments, but also by the political atmosphere in the 1980s, where concerns about international competitiveness favored a wide patent scope. Concerns about industrial stagnation and lack of technological innovation had resulted in U.S. Congress and the courts strengthening patent rights during 1980s and 1990s. For instance, before the specialized patent court, the Court of Appeals for the Federal Circuit (CAFC) was established in 1982, around one in three patent holders won their cases. After that, around two in three won.[13] In addition, the antitrust policy analysis framework was updated at that time. This change was driven in part by academic rethinking, which was based on the Chicago school of economics, and related to antitrust law and its approach to patents.[14]

[11] Mark A. Lemley, Peter S. Menell, Robert P. Merges & Pamela Samuelson, *Software and Internet Law*, at 97 (Aspen Law & Business 2000). All are professors at Berkeley's Boalt School of law.
[12] Denis T. Rice, *Building a Strategic Internet IP Portfolio in a "Down" Economy* (Practising Law Institute 2003).
[13] Economist, *Patent Wars, Better Get Yourself Armed, Everyone Else Is* (April 8 - 14, 2000) <http://www.globalpolicy.org/globaliz/law/patents.htm> (last visited 4/17/2004).
[14] Federal Trade Commission, *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*, at. I.18 (2003), <http://www.ftc.gov/os/2003/10/innovationrpt.pdf> (last visited 5/18/04).

Academic, political and legal changes concerning patents and antitrust analysis have affected the way companies exploit patents today but these are certainly not the only factors. See Figure 1 below. The competitive environment has become more knowledge-based, and as technological complexity and convergence have increased, companies' innovation processes have become more decentralized and open.[15] In this context, large ICT companies in particular acquire and use patents in order to get access to technologies developed by others. At the same time, it has become necessary to secure one's freedom to operate and develop a defensive patent strategy, particularly in markets flooded with patents and in an environment in which infringement is common. We will consider each of these forces in turn.

Figure 1. Forces Driving the Evolution of Patent Protection



[15] OECD, *Patents and Innovation: Trends and Policy Challenges*, at 7 (2004), <http://www.oecd.org/dataoecd/48/12/24508541.pdf> (last visited 3/16/04). *See also* Henry Chesbrough, *The Logic of Open Innovation: Managing Intellectual Property* (California Management Review, Volume 45, number 3, 33-58, 2003).

2.1.1 Business and Competitive Forces

The ICT sector is one of the most significant and influential industries in the world today. Software, for example, can be found everywhere. It is embedded in products and manufacturing guiding and information systems in all fields of technology and business, and as a separate commodity, software forms a diverse business sector. In addition to hardware and software providers, there are service providers, content providers, and end-users (organizations and individuals), which are part of the complex software ecosystem.

The effects of information technology extend even further. In fact, in conjunction with the development of communications technology, information technology has affected all of society. It has changed the way information is acquired and transferred, improving productivity at home and in the workplace. It has also created new ways to reach a larger customer-base than previously possible. Particularly, the expansion and vast utilization of the Internet have facilitated the flow of information. Consequently, the development of the ICT sector has led the way towards a new, information economy.

Compared to the old, industrial economy that was to a large extent driven by the economies of scale[16], the information economy is more knowledge-based. Importance of intangible assets, such as knowledge, competence and intellectual property (IP) weighed against tangible assets, like plants and manufacturing capabilities, has risen.[17] As a consequence, strategies to prevent others from stealing and imitating these companies' key assets have become more important. Contracts and intellectual property rights, *e.g.* patents, copyrights, trademarks and

[16] Carl Shapiro & Hal R. Varian, *Information Rules. A Strategic Guide to the Network Economy*, at 173 (Harvard Business School Press 1999).
[17] David J. Teece, *Managing Intellectual Capital. Organizational, Strategic and Policy Dimensions,* at. 3 (Oxford University Press 2002).

trade secrets, combined with various technical means like access controls can be utilized to achieve this goal.

2.1.2. Firm Business and IPR Strategies

Although patents have become central for protection, trade, co-operation and leverage purposes, firms may need to further amend their patent strategies if they want to maintain their competitive advantage. Although many firms are keen on controlling the rights in a product, process or service, a proprietary model, in which the access to those rights is restricted, is not viable or practical in every occasion. In fact, the special characteristics and opportunities the Internet offers ought to be noticed. The Internet is a highly interactive environment with sequential innovation. Thus, allowing a large amount of subsequent inventors to make improvements to the original work instead of limiting the access to a certain technology may actually add to its value.[18] In addition, there are strategic reasons why companies should not always react if their products are used without authorization: when network effects are potentially strong, a larger number of users, whether they are authorized or not, increases the utility of a particular product or service[19]. In sum, even a more open approach to innovation and technology diffusion than most companies are currently used to may turn out to be the winning strategy.

2.1.3. National Laws and Institutions; International Treaties

In order to promote the progress of useful arts, exclusive rights to novel and non-obvious inventions are guaranteed by national patent laws. These laws date back to the era of industrialism

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[18] James Bessen, & Eric Maskin, *Intellectual Property on the Internet: What's wrong with Conventional Wisdom* (Working Paper 1997) <www.researchoninnovation.org/iippap2.pdf> (last visited 5/18/04); *See also* Oz Shy & Jacques-François Thisse, *A Strategic Approach to Software Protection*, (Journal of Economics and Management Strategy, Volume 8, Number 2, Summer 1999, 163-190).

[19] Oz Shy & Jacques-François Thisse, *A Strategic Approach to Software Protection*, at 186 (Journal of Economics and Management Strategy, Volume 8, Number 2, Summer 1999, 163-190). See also Davis Lee, *Profiting from Innovations in Digital Information Goods* (in Dundar F. Kocaoglu & Timothy R. Anderson, *The Role of Intellectual Property Rights. Technology Management in the New Technology Era*, 2001, 471-480).

but have been modified since. It is necessary to maintain a supportive policy framework and infrastructure that allows creative thinkers to innovate and entrepreneurs to create jobs, start new companies and ultimately generate perpetual wealth.

In general, most business developments are dictated by the markets and have only little to do with the legal framework. For instance the availability and strength of patent protection does not force companies to operate in a particular way. However, the legal framework does encourage firms to adopt a certain model. By adapting the patent and antitrust regimes, for instance, the government may be able to guide society's development to a desired direction.

Notwithstanding the trend toward more open innovation processes, preventing the findings of companies' research and development (R&D) activities from leaking to competitors remains an important function of patents[20]. In fact, also this use of patents has become more important in the knowledge-based economy. Another factor that has contributed to patents' attractiveness as a protection measure is the decreased usability of other intellectual property rights. In many cases the other forms of IPRs have turned out to be inefficient, or their use no longer complies with the market needs. Nowadays, in the software industry, for instance, the customers often require access to the source code. They want to be able to update and fix the program even if the software vendor goes bankrupt. Therefore, keeping the source code as trade secret and providing the customer only with the object code version, is not necessarily a viable strategy particularly if the software is tailor-made[21]. As an alternative to a strictly proprietary model a company may, however, choose to employ a more open approach and simply let others to access the source code, learn from it and

[20] Below, I will discuss how stronger intellectual patent rights can help enable greater use of secondary markets. For more on the limits of strong IPRs, see Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting Their Intellectual Assets: Appropriability Conditions And Why U.S. Manufacturing Firms Patent (Or Not)* (NBER Working Paper Series, Working Paper 7552, 2000).

[21] One option is to use escrow agreements that allow the licensee to obtain access to the software's source code under certain circumstances, such as bankruptcy or failure to make required modifications to the software.

modify it. Of course, non-disclosure agreements may be used to restrict the flow of information. The recent success of open source software has verified, however, that there are benefits even to a more open approach.

Harmonization of national patent laws has been seen as an important improvement, and regarded as inevitable due to the internationalizing business environment. Treaties like the Paris Convention (1883), Patent Cooperation Treaty (PCT, 1970), European Patent Convention (EPC, 1973) and WTO governed Trade-related Aspects of Intellectual Property Rights agreement (TRIPS, 1995) have had their role in this respect. Nevertheless, national legislations have maintained some diverging characteristics. Also, even if similar terms and phrases are used, interpretation of these terms may be different. Despite their deficiencies, new international agreements are constantly called for.

These policy changes do not occur in a vacuum. Changes to the rationale and language of current legislation are made through political decision-making. The urgency of issuing new legislation in certain areas and the form that legislation takes depend on topics highlighted in academic discussion and other forums, and the constraints set by previous legislation and international agreements. Interest groups' lobbying efforts are included and given emphasis among materials legislators and those who participate in preparation processes. Of course, these groups and their interests are likely to vary across countries.

2.1.4. Academic and Public Policy Perspectives

New innovations are essential for the positive development of society. Academic and public policy views have long sought to balance strong incentives to encourage innovation with effective processes to diffuse useful knowledge throughout the society. To maintain incentives to finance the development and commercialization of new products and services, efficient protection is one element that is needed[22]. In case of patent regimes, adapting what can be patented, what are the patentability requirements and what is the patent term and breadth, are the basic tools for balancing patents' strength so that the optimal protection level can be achieved. The amount of damages and exemptions to patent holders' rights also determine the strength of patents.[23]

As we have already noted, this strong protection can go too far. Antitrust laws may impose limitations to rights holders' possibilities to benefit from their patent rights. Patents can namely be used as entry barriers, and as such, their purpose is at odds with that of antitrust law. Antitrust regulation is based on an idea of ensuring that competition is free from cartels and acquisition or maintenance of monopoly power by unacceptable means[24].

2.1.4.1. More is Better: the "Pro Patent" Shift in US Policy

Recent academic and policy views have evolved themselves. Back in the 1970s and early 1980s, the "Chicago School" of strong property rights for IP grew in influence. This led to a change towards pro-patent era occurred in the U.S. in mid-80s, due to concerns about industrial stagnation and lack of technological innovation in the US relative to rising economies such as Japan. It was assumed that stronger patents in the US would encourage more innovation in the US. The basic concept was that, since a patent grants the inventor the right to exclude others from utilizing his invention for a certain period of time, stronger protection would allow the innovator to make the investments in innovation, and by excluding others, increase his changes to recoup his initial R&D investments. In this view, the stronger the patent, the more stimulus there would be to invest in R&D.

[22] *See e.g.* Richard C. Levin, Alvin K. Klevorick, Richard R. Nelson & Sidney G. Winter, *Appropriating the Returns from Industrial Research and Development* (Cowles Foundation Paper 714, 1987).
[23] OECD, *Patents and Innovation: Trends and Policy Challenges*, at 9-10 (2004) <http://www.oecd.org/dataoecd/48/12/24508541.pdf> (last visited 5/18/04).
[24] Robert Pitofsky, *Antitrust and Challenges of the New Economy: Issues at the Intersection of Antitrust and Intellectual Property*, (American Antitrust Institute Conference: An Agenda for Antitrust in the 21st Century, National Press Club, Washington, D.C. June 15, 2000).

These perspectives soon shaped policy in the US towards patents. The most tangible shift was the formation of the Court of Appeals for the Federal Circuit (CAFC) that was established in 1982. This unified and strengthened the treatment of patent rights.[25] The CAFC has resorted to a great extent to the doctrine of equivalents and expanded average patent scope. The court has also been quite willing to sustain large damage awards and to grant preliminary injunctive relief to patentees[26]. In addition, common law exceptions to patent holders' rights have been interpreted recently in an increasingly narrow way, such as the Madey vs. Duke University case I will discuss further below.

In connection with the general pro-patent shift, the scope of patentable subject matter has become wider and wider within the last 20 years. This has occurred both in the U.S. and Europe. Especially in the U.S., the possibility of granting software and business method patents has led to difficulties in assessing the patentability of these new types of inventions. The obviousness standard in particular has created practical problems resulting in a huge amount of patents, which are likely to be determined invalid if challenged. Widespread critique from both academia and business has resulted[27]. The general claim is that patent protection, especially in its current form, deters rather than accelerates innovation for instance in the software industry.[28]

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[25] Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The patent paradox revisited: an empirical study of patenting in the U.S. semiconductor industry, 1979-1995*, at. 101 (RAND Journal of Economics, Vol 32, No 1, Spring 2001, 101-128).
[26] Samuel Kortum & Josh Lerner, *What is behind the recent surge in patenting?,* at 6 (Research Policy 28, 1-22, 1999); Robert P. Merges & John F. Duffy, *Patent Law and Policy: Cases and Materials*, at 11. (LexisNexis, 3rd edition, 2002).
[27] *See e.g.* Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform* (Berkeley Technology Law Journal, Volume 14, 1999); Lawrence Lessig, *The Problem With Patents* (The Standard, April 23, 1999). A list of articles criticising software and business method patents can be found for example in www.bustpatents.com.
[28] *See e.g.* James Bessen & Robert M. Hunt, *An Empirical Look at Software Patents* (Federal Reserve Bank of Philadelphia Working Papers, Working paper No.03-17, August 2003) <http://www.researchoninnovation.org/swpat.pdf> (last visited 4/15/04); Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, (89 Calif. L. Rev. (CLR) 1, 2001); Bronwyn H. Hall, *Business Method Patents, Innovation, and Policy*, (May 2003). <http://emlab.berkeley.edu/users/bhhall/papers/BHH%20on%20BMP%20May03WP.pdf> (last visited 4/15/04);

2.1.4.2 Signs of a Growing Backlash Against Stronger IPRs

It may be true that strong protection is needed especially in those fields of technology/business where research and development costs and risks are high and end-results are easy to copy. However, this does not constitute the full story in innovation. In areas where early investments are low, the industry develops fast, and product cycles are short, preventing others from manufacturing the same or comparable product or using a process without investing the same amount of money in R&D is not that critical. For example, lead-time, secrecy, copyright protection, advance on the learning curve, technological complexity and/or control of complementary assets may very well be enough for making profit. In fact, according to Cohen, Nelson and Walsh's (2000) empirical research, patents have fairly minimal importance as protection measures especially in complex industries like semiconductors. In industries like drugs, chemicals, medical equipments and to some extent machinery, auto parts and computers, patents were, however, reported as being rather important. Distinction in this respect can be made between those industries where one patent covers one product and industries were one product involves multiple patented inventions.[29]

The primary function of patents is to enhance innovation, and it is true that if the patent protection model is applied to a single, isolated invention, stronger patents will most likely induce more R&D investments. However, particularly in those fields of technology where innovation is cumulative in nature, it occurs rapidly, and technology is complex, strong rights may, according to

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Sylvain Perchaud, *Software Patents and Innovation*, (JILT (1) 2003) <http://elj.warwick.ac.uk/jilt/03-1/perchaud.html> (last visited 5/20/04).

[29] Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not),* at 9 (NBER Working Paper Series, Working Paper 7552, 2000); *See also*, Richard C. Levin, Alvin K. Klevorick, Richard R. Nelson & Sidney G. Winter, *Appropriating the Returns from Industrial Research and Development*, (Cowles Foundation Paper 714, 1987); Edwin Mansfield, *Intellectual Property Rights, Technological Change, and Economic Growth* (in Charles Walker & Mark A. Bloomfield, *Intellectual Property Rights and Capital Formation in the Next Decade,* New York, University Press of America, 1988, 221-244).

the prevailing economic literature, do more harm than good.[30] Cumulativeness in innovation context means that new innovations build upon previous innovations. Software, for one, consists typically of previously designed and developed software elements, and it is common to reuse components.

There is also empirical evidence, which illustrates that patents may in fact reduce R&D investments. For example, Bessen and Hunt (2003) have found out that software patents have substituted firms' R&D rather than complemented it. They argue that large companies, in particular, have started to employ aggressive patent portfolio strategies, which has resulted in patent thickets. Since multiple patented inventions may be involved in one innovation, companies willing to manufacture a product are often forced to license or cross-license patents from other companies. In this environment, patents have also a way to get access to other companies' R&D pools. This in turn may diminish theirs and other companies willingness to invest in R&D.[31] Similarly, Hall and Ham Ziedonis (2001) have found that although strengthening of patent rights did partly result in enhanced patenting activity in semiconductors, it did not bring about more R&D investments. Rise in patenting was rather a consequence of managerial improvements. Companies were harvesting more patents out of their R&D activities and building large patent portfolios in order to reduce hold-up problems posed by external patent holders. Strategic patenting can thus redirect resources away from productive research.[32] Hold-up problem means

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[30] *See e.g*. Robert Hunt, *Patent Reform: A Mixed Blessing For the U.S. Economy?* (Federal Reserve Bank of Philadelphia, Business Review, November/December 1999, 15-22).

[31] *See e.g.* James Bessen & Robert M. Hunt, *An Empirical Look at Software Patents* (Federal Reserve Bank of Philadelphia Working Papers, Working paper No.03-17, August 2003), <http://www.researchoninnovation.org/swpat.pdf> (last visited 4/15/04).

[32] Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The patent paradox revisited: an empirical study of patenting in the U.S. semiconductor industry, 1979-1995*, at. 122, 125 (RAND Journal of Economics, Vol 32, No 1, Spring 2001, 101-128).

that a patent claiming, for example, a single routine in a computer program may hold-up the production of the entire program[33].

A separate but equally important issue is the tension between patent rights and the ability to employ inventions in the search for new innovations. In the recent Madey v. Duke University case (2002) the Federal Circuit came to the conclusion that research projects advance institutions' legitimate business objectives, including educating and enlightening students and faculty participating in these projects. Consequently, experimental use doctrine, which is limited to actions performed "for amusement, to satisfy idle curiosity, or for strict philosophical inquiry", could not be used as a defense to patent infringement, according to this court ruling.[34] This is a potentially far-reaching decision, that if not corrected could jeopardize the research activities of most leading universities around the world.

Adjusting patentability criteria, patent scope and the length of patent term may, for instance, be used to fine-tune the strength of patent protection so that innovation is best encouraged. And a clear research exemption is needed to continue the stream of research at universitieis that will ultimately lead to important advances in our lives. To reach the best results, all factors affecting patents' strength must be balanced correctly. However, patents are not only about protection. In many cases they are central for other purposes than protecting the profits that may accrue to the commercialization or sale of a patented innovation. The weight these other possibilities to utilize patents carry, varies between industries.[35]

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[33] Federal Trade Commission, *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy* (October 2003) <http://www.ftc.gov/opa/2003/10/cpreport.htm> (last visited 10/14/04);
[34] Madey v. Duke University 64 USPQ2d 1737 (Fed. Cir. 2002).
[35] Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not)*, at. 4, 30 (NBER Working Paper Series, Working Paper 7552, 2000).

How to find this balance? On an international level, the OECD's report, "Patents and Innovation: Trends and Policy Challenges" (2004), can be mentioned as an example of research that recognizes the complexity around patents' positive and negative effects. In that report it is pointed out that the traditional view of patents as a trade-off between positive impacts on innovation and negative on competition and technology diffusion in a sense that others are not free to utilize patented inventions is incorrect. Patents can either encourage or deter innovation, diffusion and competition depending on certain conditions and particular features of the patent regime.[36]

2.1.4.3. Patent Rights and Markets for Innovations

So far, we have discussed the primary effects of patents on innovation, on antitrust, and on firms' strategies. There is another important dimension that is critical for this report**: patents may be a crucial enabling factor for new market entry and new firm creation.** This is a more subtle, more indirect effect that requires a bit of explanation. Startup ventures and small firms are typically lacking in financial capital. In order to perform, and in order to expand their operations, they need to raise capital from the capital markets on affordable terms. Patents can be an important signal of the quality of the venture and its technology, as firms strive to raise capital.[37]

How might this work? The broadness of patents determines a pioneer inventor's bargaining power concerning his invention's further development[38]. Strong legal rights to exclude others may provide economic incentives to license these rights and thus facilitate technology transfer. This can occur in the form of technology or patent licensing, cross-licensing or patent

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[36] OECD, *Patents and Innovation: Trends and Policy Challenges*, at 9-10 (2004) <http://www.oecd.org/dataoecd/48/12/24508541.pdf> (last visited 5/20/04)
[37] *Ibid.*
[38] *See e.g.* James Bessen & Eric Maskin, *Sequential Innovation, Patents, and Imitation* (2002); OECD, *Patents and Innovation: Trends and Policy Challenges*, at 18 (2004) <http://www.oecd.org/dataoecd/48/12/24508541.pdf> (last visited 3/16/04).

pools.[39] Thus, strong patents may promote innovativeness by making technology transfer easier. This could reduce duplication of innovative efforts between firms, since one firm could license the innovation of the other. Further, firms often don't understand the best use of their invention. Licensing in different areas of use, for example, broadens the number of potential applications considered for the invention.

In sum, the economic effects of strong patent rights turns out to be extremely complex. In the end it is often impossible to determine whether patents in general or in some technological fields are for better or for worse, without a careful understanding of the situation and the institutional context. And academics and policymakers are only just beginning to grapple with the opportunities and issues posed by secondary markets for patents, which would depend critically upon the strength of patent rights conferred by issuance of patents. We will discuss the market for intellectual property rights (IPRs) and innovations below in this report in Chapters 3 and 4, when we turn to an analysis of patent reassignments.

2.2. Patent Perspectives in Large US Companies

Companies' perspective to patent protection differs from that of academics. Instead of thinking what is good for society and acting upon those thoughts, companies focus mainly on their own agenda: making money to their shareholders. In order to do this, companies' utilize the means that are available at a given time. These means include patents. In fact, a glimpse to the prevailing

[39] Nancy T. Gallini, *The Economics of Patents: Lessons from Recent U.S. Patent Reform*, at 141-142 (Journal of Economic Perspectives, Vol 16, number 2, Spring 2002, 131-154); Anthony Arundel & P. Patel, *Strategic Patenting* at 3-4 (Background Report for the Trend Chart Policy Benchmarking Workshop New Trends in IPR Policy European, Trend Chart on Innovation, Luxemburg, 3-4 June, 2003).

business literature gives an idea of the sudden interest in better managing and utilizing patents and other intellectual property rights to support the implementation of companies' business strategies[40].

What makes patents and other intellectual property rights important to companies today is, that companies' value is to a large extent derived from their intangibles.[41] For example 97.2% of Microsoft's and 86.7% of Yahoo's value emerging from their balance sheets was based on intangible assets in 2003. The problem with intangibles is that it is hard to value them and prevent these assets from leaking to competitors. Then again, intellectual property rights give some intangible assets a form. They provide a company with a limited right to exclude others from utilizing patented inventions, copyrighted works or registered/established trademarks for instance. At the same time they give a company something "concrete and explicit" to exchange. Although it is not easy at all to put a price tag on a right to manufacture patented inventions or to copy and distribute copyrighted works, for example, there is at least someone who has a defined right and who is entitled to give it away. Yet, the market value of intellectual property is always context dependent and thus different for everyone.

2.2.1. New Management Processes for IP

As the value of intangibles within companies (such as resource pools and intellectual property rights as means for protecting, acquiring and transferring these assets) has risen, firms have started to pay a lot of attention to how to improve the management of their intellectual property rights. Well-thought IPR and patent strategies have emerged. Intellectual property

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[40] *See e.g.* Julie L. Davis & Suzanne S. Harrison, *Edison in the Boardroom, How Leading Companies Realize Value from Their Intellectual Assets* (John Wiley & Sons, Inc 2001); Kevin Rivette & David Kline, *Unlocking the Hidden Value of Patents, Rembrandts in the Attic* (Harvard Business School Press 2000); H. Jackson Knight, *Patent Strategy for Researchers and Research Managers* (2nd edition, John Wiley & Sons, LTD 2001); Anthony L. Miele, *Patent Strategy, The Manager's Guide to Profiting from Patent Portfolios* (John Wiley & Sons, Inc. 2000); Stephen C. Glazier, *e-Patent Strategies for Software, e-Commerce, the Internet, Telecom Services, and Business Methods (with Case Studies and Forecasts)* (LBI Law & Business Institute, Inc, 3rd edition, 2000); Robert C. Megantz, *Technology Management, Developing and Implementing Effective Licensing Programs* (John Wiley & Sons, Inc 2002).

[41] For a pathbreaking treatment of the increasingly important role of intangibles in economic value creation, see David Teece, Managing Intellectual Capital, Oxford University Press, 2002.

management, which historically was regarded as one of a company's supporting functions, has now become a critical business management function that is deserving of the attention of top management.

Expectations companies have set for their intellectual property functions in conjunction with their business strategies have changed. Nevertheless variations are many; patents' importance to firms varies, and so do their optimal patent strategies. Observers of current practice in IP management are beginning to develop a taxonomy of these strategies. Davis and Harrison,[42] for example, have divided companies' IP strategies into five different levels. They call it the value hierarchy. At the bottom of the hierarchy is the defensive level, where IPRs are generally viewed as legal assets. In the next, cost center, level, companies focus on how to reduce filing and maintenance costs of their IPR portfolios, but IPRs are still mainly viewed as legal assets. In the profit center level companies begin to view IPRs as business assets that have the potential of bringing additional revenues to the company. In the fourth, integrated level, IPRs are no longer managed from one department, but they are integrated into company's day-to-day operations, procedures and strategies. On top is the visionary level, where IPRs are deeply integrated into company's functions and are taken into account also when company's future is being planned.[43]

The implementation of these more business-oriented approaches in IP management in large companies requires many organizational changes. U.S. companies have been keen on modifying their organization structures so that patent and other IPR activities are no longer managed merely by companies' legal departments and to some extent their R&D departments but they are

[42] Julie L. Davis & Suzanne S. Harrison, *Edison in the Boardroom, How Leading Companies Realize Value from Their Intellectual Assets*, at. 12-14 (John Wiley & Sons, Inc 2001). I am grateful to Suzanne Harrison for numerous discussions on these topics.
[43] ibid, at Pp. 12-14 .

integrated to all organizations' functions[44]. What has also become popular lately in the U.S. is separating company's intellectual property altogether from other corporate liabilities and forming an intellectual property holding company.[45] For instance, Hewlett-Packard has created a holding company for managing its IPR strategy and to increasing the visibility, coordination and control of its IP assets[46]. By contrast, many European and Japanese companies still view patents as legal assets and thus prefer traditional organization structures where patent issues are managed generally by a legal/IPR department. Such practices often consign IP management to a largely defensive mode, at the bottom of the value hierarchy as put forward by Davis and Harrison.

2.2.2. New Patent Strategies for Large Firms

The term "patent strategy" here refers to those long-term goals companies have set for their patent activities and the implementation of these goals. Hence, patent strategy includes rewarding employees for patent disclosures, and thus, encouraging their innovation. It includes filing patents, making use of them in business *e.g.* blocking others from using a technology, licensing and selling patents, and enhancing company's reputation. Enforcing patent rights is a part of patent strategy. Interestingly, giving up those patents that are no longer useful also is part of patent strategy.

The purpose of strategy is to unify company's patent activities so that they support a company's business appropriately. Naturally, patent strategy goes hand in hand especially with

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[44] Kevin Rivette & David Kline, *Unlocking the Hidden Value of Patents, Rembrandts in the Attic,* at 90-91 (Harvard Business School Press, 2000).

[45] The aim is usually to reduce federal and state taxes. Typically the parent company creates a corporate subsidiary in a state or in a foreign country where little or no taxes are imposed (e.g., Delaware, Nevada, Bahamas, Cayman Islands). Company's intellectual property is created by or transferred to the subsidiary and the subsidiary licenses these rights to the parent corporation and to other companies. (Kara K. Smith & Duane K. Schroeder, *Intellectual Property Holding Companies Can Create Significant Tax Savings and Protect Valuable Assets* (Fredrikson & Byron P.A., April 2003)) <http://www.fredlaw.com/articles/ip/inte_0304_kks.html> (last visited 8/16/04)).

[46] HP, *Intellectual Property Licensing* <http://www.hp.com/hpinfo/abouthp/iplicensing/> (last visited 8/16/04).

company's IPR and technology strategies, and it acts as a guideline when decisions are made in individual cases.[47]

We will explore four patent strategies in evidence among leading large US companies: defensive, offensive, transactional, and open strategies. In practice these patent strategies are not mutually exclusive, and overlap in strategies is common. Nevertheless, companies' patent strategies can be characterized as being more offensive, more defensive, more transactional and more open, when compares to other companies' patent strategies. The goal is to use patents so that company's competitive advantage is enhanced. The value of company's intellectual capital should be maximized and the overall value of the enterprise boosted. Patents may also be a part of company's risk management. In essence, patent strategy is about creating and sustaining value for the business.

2.2.2.1. Defensive Patent Strategies

Many U.S., European and Japanese firms do not consider patents to be one of their key resources. Rather, these companies file for patents to be used for defensive purposes. The goal is to ensure the freedom to operate now and in the future and to avoid patent infringement claims. Essentially, the goal is to minimize the risk of a negative outcome from patent litigation, either in the form of an injunction to cease operating in a particular business, or having to pay a very large settlement to an IP owner.

The defensive objective is typically accomplished by building large patent portfolios. Even though having patents does not necessarily provide absolute exclusivity over the technology in question, it gives some assurance that company's products are proprietary. Alternative

[47] For more on the intersection between the business model, the management of IP, and the innovation process of a company, see Chesbrough, Open Business Models, forthcoming, 2006.

technologies and minor improvements may also be patented so that others do not have the possibility to hinder a firm from developing their technologies in the future. In fact, according to Cohen, Nelson and Walsh's (2000) study 81.8 % of U.S. manufacturing companies file product patents for blocking purposes[48].

If a company is likely to infringe on patents of other firms, it customarily makes sure that it has patents that are or can be infringed by those firms.[49] These patents are treated as "bargaining chips" that can be cross-licenses to other firms, when those firms feel that their IP rights have been infringed. This way companies achieve more leverage in potential licensing negotiations and are capable of defending themselves better in a case of patent infringement claims.

Defensive licensing and cross licensing may occur also *ex ante*. In the ICT industry it is probably one of the most important reasons to license patents from other firms. Also, patent pools around a technology may be formed. This offers a company a "not to sue" coverage for a particular technology in advance. Contrary to usual antitrust suspicions, such patent pools can positively enable innovation by removing IP roadblocks that would otherwise impair the emergence of new standards and technologies.[50]

From a business perspective, the ability to defend one's business from patent litigation has become a critical success factor, especially in the U.S. Multiple US companies have started to use patents offensively. The USPTO has granted a larger number of arguable questionable patents, and the culture is far more litigation oriented than the business environment in Europe or Japan. It

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[48] Wesley M. Cohen, Richard R. Nelson & John P. Walsh, *Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not)* (NBER Working Paper Series, Working Paper 7552, 2000).

[49] Kevin Rivette & David Kline, *Unlocking the Hidden Value of Patents, Rembrandts in the Attic*, (Harvard Business School Press, 2000); Barton E. Showalter & Jeff E. Baxter, *Strategic use of Software Patents*, (Practising Law Institute, Patents, Copyrights, Trademarks, and Literary Property Course Handbook Series, PLI Order No. G0-004D, February-March, 1999).

[50] Carl Shapiro, "Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting", National Bureau of Economic Research, 2000.

is important to be able to avoid expensive and time-consuming litigation and potentially extremely high damages. Actually, numerous studies report that the direct and indirect costs associated with preparing, negotiating, filing, and litigating patent cases have risen over time[51]. In the U.S. the average legal fees for litigating a patent case through trial are at least $2 million per side[52]. Of course most patent suits are settled, but this does not usually occur until each side incurs more than $1 million in direct legal fees and indirect expenses.[53] Legal fees are not as excessive in Europe and Japan.

Litigation costs may become overwhelming, but how high is the risk of being sued, and who is susceptible to infringement claims? Most patents are namely never litigated. In fact, according to one estimate approximately 1.1% of all U.S. patents are litigated[54] and the amount of patent litigation per number of granted patents is actually going down. For instance in semiconductors the average litigation rate for manufacturers fell by 5 percent between 1973-1985 and 1986-2000. On the other hand, if the amount of case filings is compared with companies' R&D spending a different pattern emerges: The average rate of litigation for manufacturers rose noticeably between 1973-1985 and 1986-2000. There was a 45 percent increase in the number of patent cases filed and almost twice as many patents were being litigated per R&D dollar in the post-1985 period.[55] Given that the strength of patents has increased, which increases the dollar

[51] *See e.g*. Samson Vermont, *The Economics of Patents and Litigation* (in Bruce Berman (ed.) *From Ideas to Assets, Investing Wisely in Intellectual Property*, John Wiley & Sons, Inc., 327-372, 2002).
[52] Samson Vermont, *The Economics of Patents and Litigation*, at. 335 (in Bruce M. Berman (ed.), *From Ideas to Assets*, *Investing Wisely in Intellectual Property*, Wiley & Sons, Inc., 327-372, 2002).
[53] Samson Vermont, *The Economics of Patents and Litigation*, at. 328 (in Bruce M. Berman (ed.), *From Ideas to Assets, Investing Wisely in Intellectual Property*, Wiley & Sons, Inc., 327-372, 2002).
[54] Samson Vermont, *The Economics of Patents and Litigation*, at 334 (in Bruce Berman (ed.) *From Ideas to Assets, Investing Wisely in Intellectual Property*, John Wiley & Sons, Inc., 327-372, 2002).
[55] Rosemarie Ziedonis, *Patent Litigation in the U.S. Semiconductor Industry*, at. 202-203, 180-216 (in Wesley M. Cohen and Steven Merrill (eds.) *Patents in the Knowledge-Based Economy*, National Academy Press, Washington, D.C. 2003).

value of valid infringement claims, it is no surprise that the litigation market has responded in this way.

The risk of being sued depends also on the size of a company and its patent portfolio. According to Lanjouw and Schankerman (2003), the risk is lower if a company has a large patent portfolio than if it does not. For a small, unlisted U.S-based company with a small portfolio of 100 patents, the average probability of litigating a given patent is 2 percent. For a similar company but with a moderate portfolio of 500 patents, the figure drops to only 0.5 percent. In addition, patent owners who are large relative to the disputants may be able to avoid litigation more effectively or reach agreements more easily in licensing negotiations than smaller companies.[56]

Since small companies do not have resources to defend themselves against patent infringement claims, they have often been considered as targets of larger companies. However, intellectual property insurance may very well change the game. Although IPR insurance markets are still undeveloped in Europe[57], in the U.S. insurance companies have a wide insurance variety and many of them offer insurance that protects the patent holder against loss due to infringement of a patent. Also liability insurance is available. This insurance protects the insured against infringement claims by patent holders.[58] The latest development in this sector is that insurance is offered to Linux-using companies as "protection" against potential patent lawsuits. It has been claimed that there are 283 U.S. patents that are potentially infringed by the Linux operating

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[56] Jean O. Lanjouw and Mark Schankerman, *An Empirical Analysis of the Enforcement of Patent Rights in the United States*, at. 147-148 (in Wesley M. Cohen and Steven Merrill (eds.) *Patents in the Knowledge-Based Economy*, National Academy Press, Washington, D.C., 143-179, 2003).

[57] *See e.g.* Mette Gortz & Merete Konnerup, *Welfare Effects of Patent Insurance – Microeconomic Evaluation and Macroeconomic Consequences* (Policy Modelling for European and Global Issues –conference, Brussels, June 2001).

[58] *See e.g* William N. Hulsey, Patent insurance can guard intellectual capital, Policies can help cover costs of litigation on either side of the infringement issue (Austin Business Journal, June 12, 1998) <http://austin.bizjournals.com/austin/stories/1998/06/15/focus3.html> (last visited 3/22/2006).

system.[59] Although, it is unlikely that Linux-backing companies like, Hewlett-Packard, IBM, Novell and Oracle would assert claims Microsoft owns 27 of these patents.[60]

The problem with implementing a purely defensive strategy in an environment in which nobody uses patents actively and in which the risk of being sued is low is that a privately rational strategy is socially very sub-optimal. It is socially wasteful if most of a company's patents are not utilized. And a country full of companies who practice primarily defensive patenting strategies will find that most of its patents are never practiced, but instead are held as bargaining chips to maintain freedom to operate.

2.2.2.2. Offensive Patent Strategies

In many cases, an offensive patent strategy may not be feasible. Patents do not always provide an actual monopoly. First, there are always those who could not care less about others' patents; and second, it is often possible to achieve the same functionality in different ways and to design around a patent. In particular in the ICT sector, unlike in pharmaceuticals and biotechnology, one or two patents is seldom enough. This is what David Teece characterizes as the "appropriability regime" in which a firm operates.[61] ICT firms operate in a weak appropriability regime, while pharmaceutical firms enjoy a strong appropriability regime.

Offensive strategies are also costly. It is expensive to file patents and defend one's rights. Recently though, there has been a trend toward small companies winning patent infringement suits over large corporations in the U.S[62]. For example, in 1994 the court ordered Microsoft to pay Stac

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[59] Stephen Shankland, *Group: Linux potentially infringes 283 patents* (CNET, News.com, August 1st, 2004) <http://news.com.com/Group%3A+Linux+potentially+infringes+283+patents/2100-7344_3-5291403.html> (last visited 8/15/04).

[60] Charles Babcock & Larry Greenemeier, *Open Source Stress* (InformationWeek, August 9th, 2004) <http://www.informationweek.com/showArticle.jhtml?articleID=26806464> (last visited 10/7/04).

[61] David Teece, "Profiting from Technological Innovation", Research Policy, 1986, pp. 285-305.

[62] Arlen L. Olsen, *Patents Are Big Moneymaker These Days for Companies* (The Business Review, August 11, 2000).

Electronics $ 120 million in damages for Microsoft's unlicensed use of two Stac Electronics' patents for data compression. These cases have demonstrated that patents can also protect small firms.[63] Actually small high-tech companies have become more active in filing patents, building their own portfolios and also defending their patents[64]. In 1972 barely 5% of patents went to start-up firms and other first-time patentees. By 1995 the share had grown to 23 % of patent recipients. In addition, when it comes to Internet business method patents, small companies and individuals own a larger share of these patents (35.78%) than general patents (28.2%)[65]. The increase in small companies' patenting activity corresponds with the birth and development of venture capital industry[66]. Transactional patent strategies will be discussed later on.

Another event that reflected the new strength of patent protection was Polaroid's successful suit against Kodak in 1989.[67] Polariod, with the breakthrough inventions of its founder, Edward Land, had pioneered a number of important technologies in instant photography. Land was not only a prolific inventor, he was also an astute business man, and he filed for hundreds of patents for the inventions that he and his colleagues created in Polaroid's laboratories. Kodak was the leading company in film photography in the world, and was looking to grow. An obvious new market for them was instant photography. Kodak's scientists had created an alternative technology for instant photography, one that they thought would not infringe on Polaroid's patents. It is likely that senior management within Kodak calculated that, even if the Kodak technologies

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[63] Barton E. Showalter & Jeff D. Baxter, *Strategic use of Software Patents* (Practising Law Institute, Patents, Copyrights, Trademarks, and Literary Property Course Handbook Series, PLI Order No. G0-004D, February-March, 1999); Jerry A. Riedinger, *Patenting The New Business Model: Building Fences in Cyberspace* (2000).
[64] *Patent Strategies for Venture Firms: Experiences from the Uniter States* (March 2003) <http://www.iip.or.jp/summary/pdf/WCORE.PDF> (last visited 8/15/04).
[65] John R. Allison & Emerson H. Tiller, *Internet Business Method Patents* at. 275-276 (in Wesley M. Cohen and Steven Merrill (eds.) *Patents in the Knowledge-Based Economy*, National Academy Press, Washington, D.C. 2003, 259,282).
[66] *Patent Strategies for Venture Firms: Experiences from the Uniter States* (March 2003) <http://www.iip.or.jp/summary/pdf/WCORE.PDF> (last visited 8/15/04).
[67] This discussion of Kodak is taken from Chesbrough, Open Business Models, HBS Press, 2006.

did infringe to some extent, Kodak could negotiate a settlement with Polaroid that would enable them to share the instant photography market with them. After all, patents had not been particularly valuable, up until that point in time.

If indeed Kodak executives made this calculation, it proved to be an expensive error in judgment under the new, stronger patent regime. Polaroid filed suit for patent infringement. While the trial took place over many years, from the initial trial to the subsequent appeals, in the end, Polaroid won every important issue. Polaroid alleged that the infringement was willful, and that it deserved treble damages for the deliberate acts of infringement. To Kodak's disappointment, this was granted. Polaroid got the largest settlement ever awarded by a US court to that point in time (over $900 million) for Kodak's infringement of its many patents in instant photography.

This stupendous sum far exceeded even Kodak's worst nightmare, and reflected the new strength of patents. To make the matter worse yet, the court awarded Polaroid an injunction that forced Kodak to drop out of the instant photography market, restoring Polaroid's effective monopoly in instant photography. This raised the total cost to Kodak to more than double the damage award itself, because the company had to repurchase all of its unsold products from its distribution channels, and write off all of its manufacturing investments in instant photography as well.

New concepts around innovation processes suggest that companies increasingly need to acquire technologies from external organizations.[68] Increased R&D costs, rapid technological change, complexity of products, specialization among firms and technological convergence are

[68] Chesbrough, Open Innovation, HBS Press, 2003

also driving companies towards further dependency upon other firms.[69] Hence, companies do not merely block others from using their patented inventions, but now proactively sell and license their technologies to others to manufacture, distribute, use, develop further, and vice versa. Well-reasoned licensing strategies complement and enhance firm's product line and assist in positioning the company favorably in the markets[70].

In the technology-licensing context, patents in conjunction with other IPRs such as know-how often enhance technology's value[71]. For example, Japanese companies have been keen on practicing so called surrounding tactic: the desired key technology is surrounded by improvement patents and patents covering alternative applications so that it is not possible to develop that key technology further without licensing patents from that particular company.[72] The licenses concerning improvement patents are conditioned on licensing the key technology.

In addition to patent licensing combined with technology licensing, pure patent licensing has become popular in recent years. Pure patent licensing means that the licensee gets rights but no other deliverables. One reason for the popularity of pure patent licensing appears to be connected to the elevated amount of patents. The amount of applied and granted patents has increased fundamentally within the last 20 years. The recent figures are that in year 2001 the USPTO received 326,508 utility patent applications and granted 166,039 patents,[73] the European Patent Office received 158,200 applications and granted 34,700 patents.[74] As a result it has

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[69] OECD, *Patents and Innovation: Trends and Policy Challenges*, at 15-16, (2004), <http://www.oecd.org/dataoecd/48/12/24508541.pdf> (last visited 8/18/04).

[70] Robert C. Megantz, *Technology Management, Developing and Implementing Effective Licensing Programs*, at. 80 (John Wiley & Sons, Inc 2002), see also Rivette and Klein, Rembrandts in the Attic, HBS Press, 2000.

[71] *See e.g.* Denis T. Rice, *Building a Strategic Internet IP Portfolio in a "Down" Economy* (Practising Law Institute 2003).

[72] Ove Granstrand, *The Economics and Management of Intellectual Property, Towards Intellectual Capitalism*, at 219-222 (Edward Elgar Publishing, Inc., Great Britain, 1999).

[73] USPTO, *U.S. Patent statistics, Calendar year 1963-2001*, <http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.pdf> (last visited 9/23/04).

[74] DW-World.De, Deutsce Welle, *Record Number of Patents in Europe* (June 20, 2002).

become hard to avoid infringing other's patents particularly in areas like ICT where most processes and products consist of multiple components, many of these components involve various patentable inventions and many of these patentable inventions can be used in multiple products. Therefore, on the one hand a patent holder may have leverage concerning multiple innovations, not just one product. On the other hand, his product may involve inventions patented by others, and licenses from other companies are, at least in theory, required in order to manufacture, sell and distribute these products. In sum, a company may be in a position where it has developed the technology independently but finds out later that in order to actually sell the product or use the process it needs a license from someone.

As markets for pure patent licensing and particularly patent licensing combined *e.g.* with a know-how license have been formed, many companies are currently in the process of establishing new, more aggressive licensing programs and other companies are in the process of modifying their existing licensing operations to be more effective. As an example of this type of successful operational reform, IBM simplified its licensing negotiation processes essentially in 1992. IBM used to enter the negotiations with a huge stack of patents claiming that the opposite party infringes at least one of them and tried to get results by wearing down the opponent. After 1992, IBM focused on one patent claim at a time and demonstrated the infringement to the potential infringer in a simple way so that even non-technical individuals could understand it. Results were remarkable; IBM's licensing revenues went up from $150 million in 1992 to $800 million in 1995.[75] During 1999, 2000 and 2001 IBM's yearly royalty rates were over 580 million dollars[76].

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[75] Vince DePalma, *Process Packaging Technology* (IP Society: Semiconductor Licensing Seminar, Palo Alto, June 3, 2004).
[76] Deepak Somaya, *Theoretical Perspectives on Patent Strategy* (Robert H. Smith School of Business, Maryland, Draft, 2002).

Typically, it has been those patented inventions that are not used in any of the company's key products that have been voluntarily licensed to others. However, when the goal is to establish a successful licensing program, a company needs to actively acquire patents that cover technology that is employed or potentially employed by its prospective licensing partners, regardless of whether or not the technology originated within the firm's R&D lab. It is not enough, for instance, that a company relies only on its own R&D staff's invention disclosures and patents merely those inventions. The patenting process has to be more interactive, more business oriented, and patent claims should be drafted and amended with the external market potential in mind, in addition to internal needs and requirements.

Another difficulty with an offensive patent licensing strategy is to find potential and actual licensors/buyers. If they are not already utilizing the invention, an offensive strategy must encourage them to actually manufacture and market the product so that a royalty stream back to the licensor can be expected. This means that the protected technology must have value in the market place, and that the licensor must have a deep understanding of licensee's business so that he will hopefully be able to contribute in making the licensee's product line profitable. The risk is on the licensor's side and his revenues depend on the licensees' willingness to actually employ, develop and market the technology instead of designing around the patent and choosing another technology.[77]

One approach for finding a customer base for licensing purposes is to do it the "Qualcomm way".[78] There are multiple industry standards which incorporate Qualcomm's patented technology. Consequently, licenses from Qualcomm are required for using these standards. As Mock's history

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[77] Kent Richardson, *Patent Licensing in the Semiconductor Industry* (IP Society: Semiconductor Licensing Seminar, Palo Alto, June 3, 2004)
[78] See David Mock, The Qualcomm Equation, AMACOM, 2005, for a useful study of Qualcomm's history, and the evolution of its successful offensive IP licensing model.

of Qualcomm reveals, though, it took Qualcomm many years, and hundreds of millions of dollars in R&D investment, to demonstrate the value of its code division multiple access (CDMA) technology in a convincing fashion to its licensees.

2.2.2.3. Transactional IP Strategies

A third kind of strategy is to approach IP as a corporate asset, and transact IP in whatever ways create the most money for the company. In contrast to offensive strategies, transactional strategies tend to be purely financially oriented (vs. oriented toward to the overall strategy of the firm). The recent strengthening of patent rights, and the new ways in which IP is being managed have created the beginnings of a market for IP. However, transacting IP does not fit well with methods for transacting tangible property. For instance, unlike tangible property, intellectual property has not one but multiple potential value chains. If one learns about an invention, he is able to manufacture and use it and his use does not diminish others' ability to utilize the same invention.[79]

This function of intellectual property rights takes on greater importance due to the changes in the innovation environment. Many companies are no longer relying only on their own resources and capabilities to produce new innovations, but they have moved towards a more open approach to innovation. Nowadays, a firm has to be able to take advantage of useful ideas that are produced outside the company in order to be successful.[80] In-house R&D is not enough to bring competitive advantage in today's dynamic business environment. For example collaboration between various companies has become increasingly essential as a result of technological complexity of products

[79] Federal Trade Commission, *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy*, at. I.5 (October 2003) <http://www.ftc.gov/opa/2003/10/cpreport.htm> (last visited 3/22/2006).
[80] Henry W. Chesbrough, *Open Innovation, The New Imperative for Creating and Profiting from Technology*, at155 (Harvard Business School Press 2003).

and processes, rapid technological change, more intense competition, and higher costs and risks of innovation. In addition, companies have become more specialized and are thus often forced to acquire complementary technologies from other firms. These developments in innovation processes have enhanced technology and patent licensing,[81] and shifted the locus of innovation from the firm to the network in which the firm operates.

Patents are important for investment decisions in new and emerging companies. Investors have started to pay a lot of attention to whether a company has protected its key innovations before making the decision about granting financing to that particular company. It is essential from an investor's viewpoint that a company in which it invests has a secure and defendable position in the market and that it is able to form partnerships with other companies and thus has access to external resources. Also, when it comes to exit scenarios, patents may be of value. Start-up companies usually have two exit possibilities. Either a company can be sold on the public market through an initial public offering (IPO), or it can be bought by another company. In either case company's patent portfolio affects its value.[82]

As patents increase in importance, the sophistication of investors is also increasing. It is no longer only the existence of patents that makes a difference when companies are raising capital. According to Shelby (2003) companies should expect to have their intellectual property protection measures questioned and second-guessed by investors.[83] The change from a numbers game to a quality game is also relevant in a patent licensing/cross-licensing context. The method of valuating a company's patents based on the height of its patent stack is about to become extinct. The

[81] OECD, *Patents and Innovation: Trends and Policy Challenges*, at 15-16, (2004), <http://www.oecd.org/dataoecd/48/12/24508541.pdf> (last visited 5/18/04).
[82] Ron Corbett, *IP Strategies for Start-up eCommerce Companies in the Post-dot-bomb Era* (Texas Wesleyan Law Review, Issue 8, 643-663, 2002).
[83] Jeffrey Shelby, *Business Method Patents and Emerging Technology Companies* 116,118 (CASRIP Publication Series: Reconciling Int'l property, No. 7, 2001). <http://www.law.washington.edu/casrip/Symposium/Number7/3A-Shelby.pdf> (last visited 3/22/2006).

technology and what is actually protected matters, not the amount of patents involved. Quality of patents is appreciated more than their quantity.[84] Naturally, the amount of patents can be decisive for other reasons, like discouraging competitors from entering certain markets and reducing infringement allocations.

A Special Case of a Transactional Strategy: The Patent Troll

There is an emerging class of companies who have a different business, a model that creates asymmetric situations with other companies who practice the technologies that they patent. These are "pure play" patent licensing companies, whose business is solely to license out their patents to the highest bidder. Peter Detkin, formerly the head of Intel's patent licensing activities, coined the term "patent troll", to describe this kind of firm. Like a troll from children's fairy tales, a patent troll hides under a bridge, waits until some unsuspecting person crosses the bridge, and then attacks. Two recent examples of such companies are Acacia, a software patent licensing firm, and NTP, a firm that held patents that were infringed by Research in Motion's Blackberry product.

The asymmetry posed by the trolls is that the defensive "counterclaim strategy" that usually leads to an eventual cross-license is not viable against pure patent licensing companies. They do not have operations that could infringe someone's patents, which gives them a comparatively strong negotiation position. Moreover, their lack of an operational side makes it hard to settle a dispute on the basis of a "business solution". Put differently, most patent disputes are resolved through two currencies: an exchange of patents (and technology), and an exchange of money. In the patent troll case, money is the only currency of interest.

How do patent trolls obtain their patents? After all, they do not typically perform much if any R&D. Patent trolls have developed processes to obtain patents from the secondary market.

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[84] Ron Laurie, *IP Valuation – Magic or Myth* (Intellectual Property Issues in M&A Transactions Seminar organized by IP Society, Palo Alto, April 29, 2004).

One example of such a process is to purchase patents from bankrupt firms at auction. When a company fails and enters bankruptcy, all of its assets, from the furniture, the computer equipment, and the IP, are all sold. It is quite common for bankrupt firms to sell a patent for only a few hundred dollars. The price is so low that it often costs more for a buyer to evaluate the quality of the patent than it would to simply purchase it. Other processes used by trolls are to buy up a company's patents when that company is exiting that business, and needs cash. Individual inventors are a third source of patents for trolls.

Once the technology is obtained, trolls then target companies that utilize the technology. These patent trolls use the threat of litigation to generate significant revenue streams from royalties.[85] The trolls must analyze their situation carefully. If there is zero chance that a court will uphold their claim of infringement, the troll cannot invest much money in pursuing an infringement claim. If the potential infringer is a small company with very little money, there is very little value in winning a judgment, since damages are likely to be small, and hard to collect. Only when there is a plausible chance of winning, and only when the prospective infringer possesses enough resources to pay out a significant judgment, does the troll invest its resources in a patent infringement claim.

Perhaps the original troll was Jerome Lemelson. Lemelson was a prolific inventor (with more than 500 patents to his name, second only to Thomas Edison in the number of patents he has received from the USPTO). But Lemelson also invented a clever - and legal – way to play the patent game. He pioneered the ability to file a patent claim privately with the patent office, and then revise his claims periodically to keep the claim private, while updating the claims to make them more commercially relevant and valuable. In many cases, the eventual claims that issued with the patent bore little resemblance to the initial claims made. But Lemelson did receive

[85] Denis T. Rice, *Building a Strategic Internet IP Portfolio in a "Down" Economy* (Practising Law Institute 2003).

hundreds of patents that claimed inventions in commercially useful areas such as television, computers, and other leading edge industries. Hundreds of companies have had to pay the toll that Lemelson exacted.[86]

While most observers regard Lemelson's behavior as anti-innovative, the larger question of when an IP owner is advancing or inhibiting innovation is harder to determine. Inventors rely on initial secrecy to establish an advantage in the market. And society grants an inventor a legal right to exclude others (a patent) for a limited period of time to encourage inventors to take the risks necessary to achieve a new invention. Universities, for example, often invent new technologies, but seldom practice them. Does that make them "trolls" too? Of course not, since universities advance knowledge for society by their research.

But the other half of the patent bargain is that society also publishes patents when they are awarded, so that others "practiced in the art" can learn from and build upon this invention, perhaps to create further inventions. Publication is key to diffusing new inventions out to the rest of society. Practices such as Lemelson's, which kept the claimed invention secret for decades, deprive society of any publication benefit. In his case, the private returns did not yield more research and publication of new technologies sooner. In more general cases, though, how to balance secrecy with diffusion is a challenging social tradeoff.

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In many situations, though, businesses will have private incentives to publish or diffuse their inventions. These actions could help set a standard, or deny a competitor the ability to claim IP for a particular technology. These are explored in more depth in <u>Open Innovation: The New Imperative for Creating and Profiting from Technology</u> (Harvard Business School Press, 2003), particularly chapter 6.

In any case, Lemelson is not alone any longer. There appear to be more and more companies that base their entire businesses on licensing patents and/or technologies that have been patented or otherwise legally protected (IP). I already mentioned Acacia and NTP above. Other examples include Lemelson's legacy Lemelson Medical, Education and Research Foundation, which has generated $1.2 billion revenue since 1988 from the Lemelson patent portfolio, and Ronald A. Katz Technology Licensing, which has received $350 to $450 million in licensing fees since 1994.[87]

As noted above, typically these licensing companies acquire "interesting" IP from other companies and/or individuals and license it to those in need. IP licensing companies may also have their own R&D activity for these purposes. Usually, they do not manufacture any products themselves. The challenge these firms face is to keep up with technological development and file patents covering inventions that become pervasive in the future. It is always hard to predict what technology will be adopted in 5 to 10 years, and without direct feedback from the marketplace, it is even harder. A close cooperation with the licensee gives the company some reference concerning a specific market and its future developments. Thus a patent troll might offer an early licensee relatively favorable terms, to validate the technology, obtain more feedback, and improve its ability to target more companies later at higher fees.

2.2.2.4. Open IP strategy[88]

It is ironic, but true, that stronger patent protection has coincided with a increased prevalence of open source technologies. There have been numerous studies of the open source software

[87] Brenda Sandburg, *You may not have a choice. Trolling for dollars. Patent enforcers are scaring America and they are getting rich – very rich – doing it* (The Recorder, July 30, 2001), <http://www.phonetel.com/pdfs/LWTrolls.pdf> (last visited 3/23/2006).
[88] This section is taken from part of Chapter 2 in Chesbrough (2006) Open Business Models, (Harvard Business School Publishing: Cambridge, MA).

community, ranging from enthusiastic proclamations of its benefits (e.g., Eric Raymond[89], The Cathedral and the Bazaar), to condemnations of it as pernicious to innovation (such as the comments by Steve Ballmer, CEO of Microsoft, likening Linux to a "cancer"). More scholarly examinations of the open source software approach can be found in O'Maloney (2003), Lerner and Tirole[90], 2003, and Dedrick and West (2003). Listings of open source research resources online are abundant.[91]

And this wealth of study takes no account of the enormous online literature that discusses many elements of open source. This ranges from online weblogs (blogs) to communal places like Slashdot (www.slashdot.org) to online repositories of open source software code, such as SourceForge.com.

As a result, we now know a great deal about how open source software development works. It is a collaborative model of development, based on a process that does not allow any contributor to exert a claim to intellectual property on any portion of the code being developed collaboratively. (However, the technical legal status of open source software is actually complex, as different projects employ different licensing arrangements, which vary in the ability they convey to contributors to utilize their contributions in other, proprietary software.)

What You Don't Read About: Open Source Business Models

One doesn't read much about business models in open source software development. There are strong social norms and legal protections that have been crafted to discourage people from profiteering on the work of their peers. There are even frequent postings on highly visited websites

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[89] Raymond, E.S. *The Cathedral & the Bazaar*, (2 ed.) O'Reilly, Sebastapol, CA, 2001. For a critique of the book, see Nikolai Bezroukov, A Second Look at the Catherdral and the Bazaar, http://firstmonday.org/issues/issue4_12/bezroukov/; last accessed Feb. 15, 2005

[90] Lerner, J., and Tirole, J. "The Simple Economics of Open Source," Working Paper 7600, National Bureau of Economic Research, 2000, p. 40

[91] One useful listing by Joseph Feller can be found at http://opensource.ucc.ie/biblio.htm.

that identify cases where the norms of the group appear to be violated (though there have been few, if any, legal sanctions against violators).

However, there are occasional crises that arise that can reveal who some of the parties are that have developed business models to profit from the adoption of open source software. One recent crisis of this kind was the threat by the Santa Cruz Operation (SCO) to enforce its alleged IP rights (contained in a version of Unix it purchased from Novell) over the code being widely circulated in the Linux community. It subsequently sued IBM and certain users of Linux software for $1 billion for this alleged patent infringement.

While the open source community was very upset over this lawsuit, a very different response came from a group of companies that included Intel, IBM, Hewlett-Packard, Novell, and Red Hat. These companies banded together to pool resources into a fund to indemnify customers of open source software for legal expenses they might incur in defending themselves from a lawsuit, should they choose to use open source software. Separately, IBM appears to have taken the lead role in defending against the SCO suit. Without demeaning IBM's sincerity in any way, committing substantial resources in this way is a highly reliable indicator that IBM's business model, and the business model of the other companies above, benefits significantly from the adoption of open source. Indeed, IBM has publicly stated their strong support of Linux, and devotes more internal software personnel to supporting Linux development than any other single organization in the world. Other important IT companies like Sun[92] also have positioned themselves recently to profit from open source. Even longtime Microsoft allies Intel and Dell have active programs supporting open source.

How can a company create a business model to profit from open source software? One example of such a model is when companies voluntarily choose to donate portions of their intellectual

[92] See Sun President Jonathan Schwarz's own weblog on how Sun co-exists with open source, http://blogs.sun.com/roller/page/jonathan/20040721, last accessed February 15, 2005

property to a "commons", so that they and others can practice their technologies freely without fear of being sued for patent infringement. This would boost the amount of innovative activity in the area, and effectively lower the cost of producing useful output for customers of this activity. Intel has done this by creating "lablets" that work closely with universities to collaborate on research that will be published, and not owned by Intel. IBM recently created a powerful example of this in their decision to transfer 500 software patents to a nonprofit foundation in the open source community. IBM did something similar back in 2003 when it donated a bundle of development tools, called Eclipse, into the public domain. While IBM is being praised by the open source community for its generous donation of its intellectual property, IBM shareholders might also praise the company for helping to lower the cost of the software upon which IBM builds its own offerings. Lowering the cost of your input technologies, which is the practical effect of IBM's generosity, is a good way to boost your own business model.[93]

A related business model that makes good business sense is to be very open with technologies that are complementary to the core activities of the firm. Enabling many others to work with these technologies may expand the demand for the core activities of the firm (which are not as open), and increase the profits of the firm. This is another rationale for Intel's Lablets. Others may even find uses for the technologies that were not known to the firm, providing the best market research money

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[93] Joel Cawley, VP of Corporate Strategy for IBM, quantifies the savings thusly: "I have long observed that it takes $500M to create and sustain a commercially viable OS. Take our development lab for Linux in Beaverton, Oregon. We spend about $100M there each year. About $50M of that is spent on basic improvements to Linux, how to make it more reliable. The other $50M is spent on things that IBM needs, like special drivers for particular hardware or software to connect with it. We asked the Open Source Development Lab to estimate how much other commercial development spending was being done on Linux. This didn't count any university or individual work, just other companies like us. They told us the number was $800-900M a year, and that the mix of basic/specific needs was close to 50/50. So that $500M expense for a viable OS is there now for Linux as well. And we only pay $100M toward that. So you can see even from a very narrow accounting view that this is a good business investment for us." Interview with Joel Cawley, IBM Corporate Headquarters, Oct. 7, 2005.

can buy, while the firm paid no money and took no risk to acquire that research. And increased demand for those complements will increase demand for the core technologies of the firm.

A third, more subtle, and perhaps even more powerful strategy to leverage open source in one's business model is to develop system architectures that build upon it. In a world with lots of useful building blocks, the ability to create and capture value shifts from developing yet another building block that is slightly differentiated from the others, to crafting coherent combinations of building blocks into systems that solve real commercial problems.

This competition is well underway in Web services. Microsoft is trying to establish its .Net architecture as the platform for these services. That architecture will undoubtedly leverage Microsoft's tremendous franchise in its Windows operating system, and the extensive community of developers and other third parties who have based their livelihood upon it. IBM, by contrast, is countering with its WebSphere architecture, which will have to work with Windows, but has the opportunity to leverage open source technologies far more extensively, along with the extensive community that has arisen around those technologies. And the key determinant of who will win this competition will ultimately depend upon the decisions of the many independent software and services providers who must make their own investments in choosing which architecture to support. Each of these actors must decide where to focus their own business model, and where the opportunities for value creation and value capture seem to be the greatest.

Other business models include using open source software to provide the customer with a lower cost of initial acquisition, and then sell him more proprietary, enhanced products later. Other strategies offer the customer the ability to perform user modifications of the software without any penalty. With that ability, the customer achieves greater customization of the product to his needs, without making the software company have to develop the custom portion of the code.[94] Thus, while open source was created in ways that sought to deliberately eschew the creation of IP rights over its technology, alert companies have nonetheless developed business models that are propelling the technology forward into the market.

The existence of effective business models for open source augurs well for the further adoption of open source software. It is these companies' business models that comprise the real threat to companies like Microsoft, not the rhetoric of "software should be free". And companies like IBM are developing business models that simultaneously exploit the availability of high quality, low cost open source software, even as they profit from greater patent protection for their more proprietary technologies in other parts of their business.

While open source has been celebrated as a new and different approach to software development, its emergence has ironically coincided with the emergence of stronger intellectual property protection for patents and other IP. Alert companies will construct business models that incorporate both trends in their logic.

[94] For a very recent and thoughtful treatment of the user side of open source technologies, see Eric von Hippel's Democratizing Innovation, MIT Press, 2005. One issue that separates von Hippel's work from this chapter is the question of a business model. The term is not found in his book, and he believes that users are often better served by freely revealing their innovations to others in their communities. That can be a precursor to a business model, if the revealing party has complementary activities (where he or she has more protection) that benefit from more innovation. But even in open source, business models are developing, and are important to the further adoption of the technologies in society.

2.3 A Model of Patent Utilization in Large Companies[95]

One of the dirty little secrets of more traditional innovation processes is that many of the ideas and technologies developed within the company never get used, either within or outside the company. IN this section, I shall present a model that helps to explain why this situation arises. First, though, let me supply a little motivation for the model.

When Procter & Gamble (P&G) surveyed all of the patents it owned, it determined that about 10% of them were in active use in at least one P&G business, and that many of the remaining 90% of patents had no business value of any kind to P&G (Sakkab, 2002). Dow Chemical went through an extensive analysis of its patent portfolio starting in 1993, as reported in Davis and Harrison (2001:146). In that year, about 19% of Dow's patents were in use in one of Dow's businesses, while a further 33% had some potential defensive use, or future business use. The remaining patents were either being licensed to others (23%), or simply not being used in any discernable way (25%). In the typical pharmaceutical development process, a company must screen hundreds or even thousands of patented compounds, in order to find a single compound that makes it through the process and gets into the market.[96] From a naïve perspective, it seems very wasteful to create and develop a large number of technologies, and then only utilize a small fraction of the technologies in any way, shape, or form.

Reasons for Unused Ideas and Technology: The Connection to the Business Model

The reason this low utilization level arises is because many firms consciously keep their R&D process only loosely coupled to their business model. Most companies have a very decentralized process for determining what projects research staff work on, what invention discoveries get made,

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[95] This section borrows from material in Chapter 2 of Chesbrough (2006) Open Business Models

[96] For one study among many at the Tufts Center for Study of Drug Development, which conducts period studies on the attrition rate of compounds in the drug development process, see DiMasi JA. Risks in new drug development: approval success rates for investigational drugs. *Clinical Pharmacology & Therapeutics* 2001 May;69(5):297-307.

and a similarly decentralized process for deciding whether or not to patent these invention discoveries. Many R&D departments recruit R&D staff by promising the prospective employee extensive freedom in what research they do, and often compete against universities for hiring these people. So these organizations consciously limit the coupling of research output to any business model.

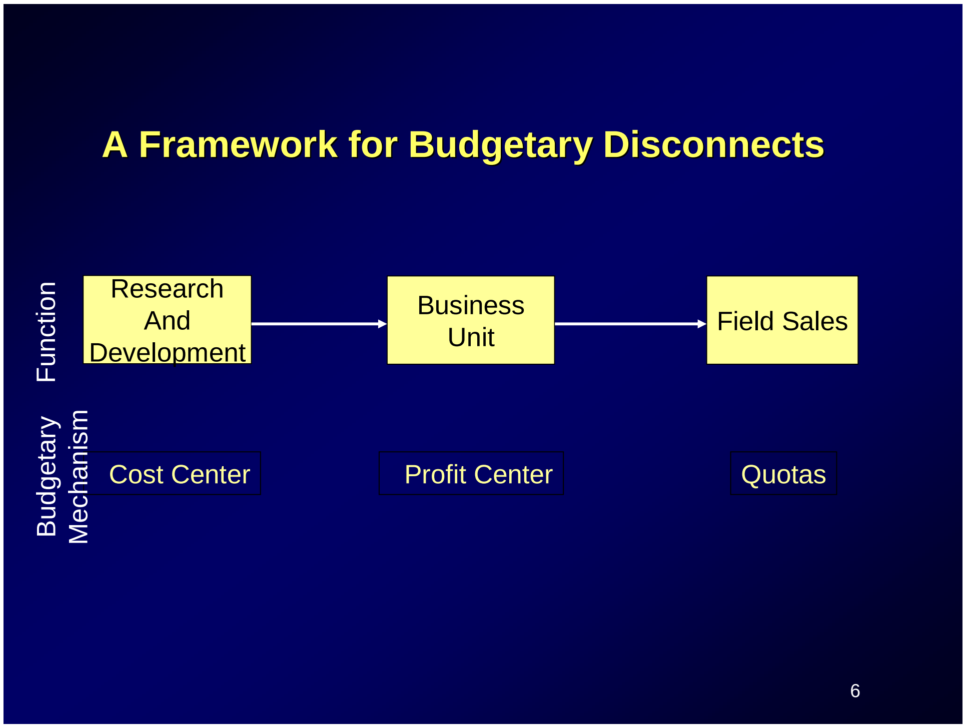
Further, R&D managers often use the number of patents generated by an R&D research or an R&D organization as a metric to judge the productivity of that person or organization. Similarly, some R&D organizations, such as Microsoft Research, count the number of publications generated by their R&D staff as another measure of productivity. Unsurprisingly, when organizations reward the quantity of patents or papers produced, the R&D organization responds by generating a large number of patents or papers, with little regard as to their eventual business relevance.

Budgetary Disconnects within the Business: A Model

To carry this point further, there may be a budgetary disconnect between a research and development group on the one hand, and a business unit on the other. To see this, examine **Figure 2.1.**

Figure 2.1

A Model of Budgetary Disconnection Between R&D and the Business Unit



In this figure, the R&D operation produces research results, and operates as a cost center. This is usually how such organizations are funded, since they do not sell their output, and since it is hard to estimate how much money a particular R&D project will need in order to be successful. Instead, companies determine an amount of funding that they can sustain over time, which can be dedicated to R&D tasks. The R&D unit manager must in turn decide how many projects to support with the funds she has that period. It is bad for her to exceed her budget, since the organization may not be able to sustain the additional expenses. It is also bad for her to come in much under the budget that year, because that may suggest that next year's budget can be reduced as well. So the manager tries to develop as many projects as she can, subject to the budget constraint.

The internal business unit customer, by contrast, is typically managed on a profit-and-loss (P&L) basis. The business unit typically does sell its output to customers, and giving each business unit its own P&L enables that business manager to make the best use of his information to maximize profits for the business. That manager wants to buy low, and sell high. So the business unit manager wants any R&D project coming from his internal "supplier" to be as fully developed as possible. This reduces any additional costs the manager must incur prior to using the technology in the business. It also reduces any risk to that business's profitability that period.

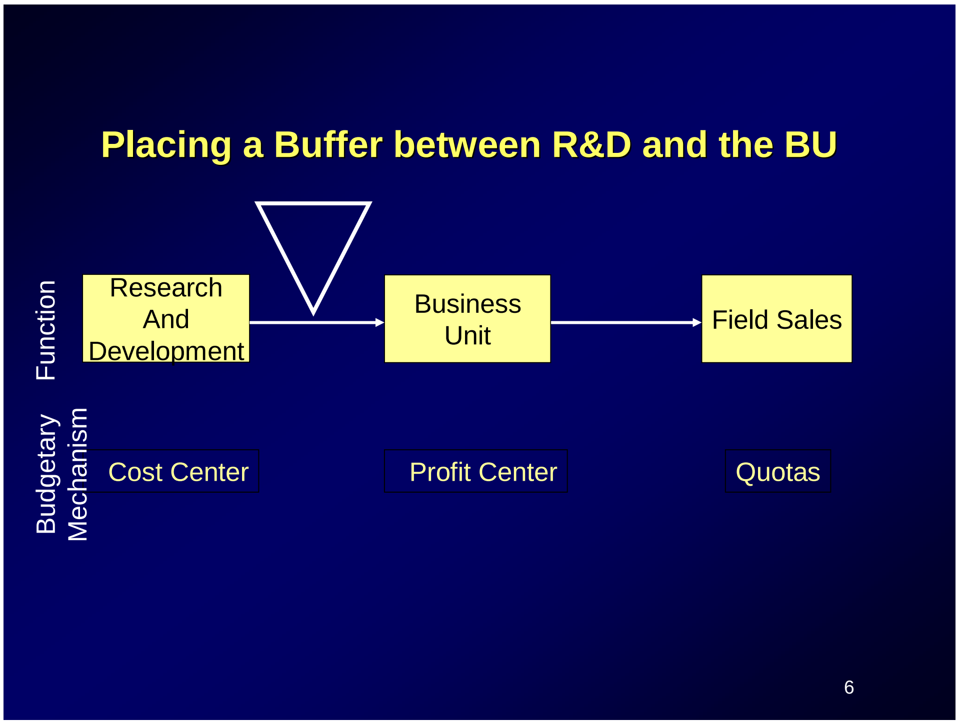
The stage is now set for the budgetary disconnect between the two functions. The R&D manager wants to push out the project as soon as the publications and patents have been generated. Further development within the R&D budget crowds out other, newer projects that have greater potential for generating new patents and publications. So the R&D manager's incentives are to transfer the project sooner rather than later to the business unit. Meanwhile, the business unit manager's incentives are to wait as long as possible before taking over the further funding of the R&D project onto his P&L. Waiting longer reduces the risks that the technology won't fit his business needs, or won't perform as advertised.

Resolving the Budgetary Disconnect: Putting Ideas on the Shelf

The resolution of this budgetary disconnect is to place a buffer between the R&D operation, and the business unit, as shown in **Figure 2.2**. This buffer provides temporary storage for the R&D project, until the time when the business unit is ready to invest in its further application within the business. This lets the R&D manager get onto work on her next project, without requiring the business unit manager to commit to further funding on his P&L until he judges it to be beneficial.

Figure 2.2

Decoupling R&D from the Business Unit



While this solves the local problem of each manager, from a system viewpoint, the “solution” causes many R&D projects to pile up in this buffer. These projects are often termed “on the shelf”, because they are no longer being actively pursued by the R&D organization, nor are they actually being used by the business unit.

How can this challenge be overcome? Some research organizations obtain a significant percentage of their funds from “research contracts” with their internal business units. These contracts tend to be fairly specific, near term in time frame, and are likely to be utilized by the business units, which pay directly for the output of the work. But other funds for those same research organizations come from a corporate allocation of funds (which is generated from a “tax” on all of the businesses within the firm). These corporate funds are not tied to any specific business unit objective, and are allocated to longer term projects whose output may benefit multiple businesses. Still other research funds come from government research contracts. These funds tend to be academically peer reviewed, and may therefore have little or no relevance to any business unit activity within the firm.

At IBM’s R&D organization, the company tries to establish research contracts between IBM business units, and IBM research teams, to establish a stronger connection between the goals of the business, and the output of the researchers. While this has helped increase business utilization of IBM research results, it is not a complete solution to the problem. For one, the business units have a clear sense of their needs in the next 1-2 years, but have much more limited visibility into their needs over a longer period. For another, many research outputs have uses in multiple areas, some of which may not be addressed by any single business unit – at least not yet.

Barriers to Greater External Use of Unused Internal Ideas

The foregoing analysis suggests that R&D processes are only loosely coupled to the business models of firms, resulting in a substantial number of technologies that are un- or under-utilized within those businesses. This prompts a second question: what prevents the business from enabling other firms to utilize those underperforming technologies in their own respective businesses?

One issue may be that companies think that if they cannot find a profitable use for their technology, no one else will either. If companies were truly objective in their assessments, that might be so. But the internal view of the technology's potential is likely biased by the business model of the company. An external view of the technology's value may be more unbiased (if less informed, at least initially) than the internal view. But by itself, this analysis would suggest a potentially substantial market for underutilized technologies. After all, when buyers have higher valuations of projects than sellers, those parties can find a mutually beneficial transaction that sells those projects to the party with the higher valuation.

A second concern may be adverse selection. Buyers may worry that the sellers of unutilized technologies will only offer the "bad" ones. Adverse selection presumes that both parties are rational and unbiased, so the seller (who has more information sooner) will inevitably have an information advantage over the buyer. But the dominant logic of a company's business model would actually suggest countervailing forces that might enable the profitable use of external technologies. While companies have significant prior information on a technology project, that information will be interpreted within the context of the company's business model. If the buyer possesses or can identify a very different business model, the buyer's evaluation of the project may differ greatly from that of the seller. Put differently, the buyer may see an opportunity that is not visible to the seller.

Different Business Models for the Same Technology – The Case of Xerox

To give an example here, consider the experience of Xerox PARC with its many technology spinoff projects.[97] In that work, I identified 35 projects that left Xerox after the further funding for the

[97] See H. Chesbrough, "Graceful Exits and Foregone Opportunities: A History of Xerox's Management of its Technology Spinoff Companies", Business History Review, 2002.

work had been ended within Xerox. Xerox judged that there was little or no additional value to be gained from continuing this work. In 30 of the 35 projects, Xerox even gave a license for the technology to the departing spin-off, so most of these separations were consciously managed departures, not inadvertent oversights. In 24 of the 35 projects, there was little business success after separation. But for 11 of the projects, each of which developed under a very different business model from that of Xerox, there turned out to be substantial value. The collective market value of the companies that emerged from these 11 projects turned out to exceed the total market value of Xerox by a factor of two. I interpret these data to mean that Xerox's estimates of the value of these projects was biased by its business model. In direct interviews with many of the participants in these events, they acknowledged that they never dreamed that some of these projects would become so valuable.

Not Sold Here – Another Barrier to Greater External Use of Internal Ideas

Other barriers to greater utilization of unused technology may lurk as well. There may be a behavioral analogue to NIH that sits within the business units, which I term the Not Sold Here (NSH) virus. NSH is a syndrome that argues that, if we don't sell it, no one should. It is rooted in the surface perception that, if our organization cannot find sufficient value in the technology, it is highly unlikely that anyone else can either. At a deeper level, however, the NSH virus seeks to forestall competition with outside entities for accessing internal technology. Most business units enjoy a monopsony position relative to their R&D unit suppliers. Because they have exclusive rights to the technology, they can defer costs and delay commitments to the technology without incurring any penalty to their unit for waiting longer before using it.

Enabling greater external use of unused technologies alters the business unit's calculation. Let's assume that a business unit chooses not to incorporate a technology, and that the company now has a process that allows others the chance to do so. The business unit now faces a previously latent cost to waiting: if it doesn't use the technology itself, it might "lose" that technology to an external organization. Typically, internal business units have some defined interval of time during which they can "claim" the technology. After that interval expires, the technology is then made available to other firms.[98] Depending on who that external firm is, the internal business unit may even have to compete against that technology in the market. Worse (from the business unit's perspective), the external use of the technology might reveal previously unrealized value from the technology, leaving the business unit in the awkward position of explaining why it failed to utilize this apparently valuable technology. Another asymmetry presents itself: if the technology is licensed externally, the corporation may "win" through additional licensing revenue, but the business unit may "lose" through additional competition in its market (where the business does not participate in the revenues generated from licensing, which are typically managed by corporate).

Aligning Incentives for Greater External Use of Ideas

Here, there may be mechanisms that firms can employ to align incentives within the business unit to more closely approximate those of the overall firm. GE and IBM, for example, both make many technologies available for external use. They manage the internal business resistance to this by sharing any licensing revenues from a technology with the business unit associated with the technology. So the business unit P&L not only bears the risk of competing with the technology in the market (thus negatively impacting the P&L of the unit), but also receives credit for licensing revenue from the technology on its P&L (thus boosting the revenue and profit of the P&L of the unit).

The Human Cost of Unused Ideas and Knowledge

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[98] In two cases I have studied, the interval was quite different. In Lucent's New Ventures Group in the late 1990s, the interval was initially nine months, and later condensed to three months, in which the business units had the right of first refusal. In Procter & Gamble, the interval is set at 3 years after a patent is issued to P&G. If the technology is not in use in at least one P&G business by then, the technology is made available to any outside organization (Sakkab, 2002).

There is a further, more human business rationale for enabling greater external use of un-or under-utilized technologies. Companies in which NSH is dominant likely frustrate many of the R&D staff, because many of the ideas these people work on are never deployed in the market. It is reportedly quite common for a pharmaceutical researcher to never see one of her projects ship into the market, even over a 30 year career, because the attrition rate of compounds is so high. This is an enormous waste of human talent, and must take a toll on any person's initiative. Companies that can overcome NSH begin to allow other pathways for internal ideas to get into the market. These other pathways allow the market to provide feedback on those ideas. This helps researchers see their ideas in action in the wider world, even if those ideas do not make it into the company's own products. That also provides new sources of feedback for the researcher on how to improve upon those ideas. Some of those improvements might one day make it into the company's own products. So it might be an act of enlightened self-interest for companies to let more unused ideas flow outside of the company.

Socially, this situation is even more costly. Unutilized technologies constitute a deadweight loss on the innovation potential of the society. Every unused patent confers the right to prevent anyone else from using the patented invention, whether or not the company that owns the patent is using it itself. Unused patent claims create "dead zones", where no one can operate for fear of infringement. Society conferred a temporary monopoly on the invention, no one else can use it until it is either licensed or until it expires.

Secondary markets can help to alleviate the pernicious influence of these dead zones. Thicker, more robust markets for IP will reduce the search costs and transaction costs for firms to find willing buyers of their unused IP. These same markets will reduce the cost to buyers for obtaining licenses to useful IP. A higher percentage of patent utilization would result.

2.3.2. Survey Evidence of Patent Utilization

There is, to my knowledge, no published empirical study of the level of patent utilization among companies. Accordingly, I undertook a small informal survey of firms, based on a group of companies at the Intellectual Capital Management Group (ICMG) Gathering. The Gathering is a group of intellectual property and intellectual asset managers that meet 2-3 times per year in the US (usually, but not always in California) to discuss and share best practices. Given their interest in better ways to manage IP, the group was a natural target for an informal survey.

I promised confidentiality to the respondents, in order to encourage them to answer the questions frankly and honestly. I also offered to share a copy of the results of the survey with them, as an inducement to participate in the survey. I received 12 usable answers. It is worth noting that such a small sample is useful only for illustration. No projections or statistical significance can be claimed from these results.

The survey itself was very short. Here are the questions I posed to the group:

1. Who is responsible for managing the licensing of patents at your firm?
2. What are the incentives in this person's compensation plan? How do they achieve a bonus?
3. To whom does this person report?
4. To the best of your knowledge, what percentage of patents in your company are actively employed in at least one of the company's businesses? What percentage are licensed to other companies?
5. In your opinion, is the utilization of patents in your company too high, too low, or about right?

We will consider the responses to each question in turn.

Question 1: Who is responsible for managing the licensing of patents at your firm?

There was a surprising degree of variety in answer to this question. 5 of the respondents mentioned the chief legal officer of the company. 3 respondents mentioned their chief IP council. 2 mentioned the chief financial officer, and 2 mentioned a committee comprised of senior executives. This variety indicates that companies have differences in how they organize and govern the management of their patent licensing. While the ICMG group meets frequently, and might therefore be expected to share similar approaches to organization and governance, even within this group that was not the case. I would conjecture that there would be even greater variation in a broader sample.

Question 2: What are the incentives in this person's compensation plan? How do they achieve a bonus?

Again there was surprising (to me anyway) variety in the answer to this question. 6 of the respondents said that the bonus plan for their IP management was based on no objective metrics, but rather upon a subjective evaluation of the performance of that function for the past year. Key elements of this subjective rating included the outcome of litigation, the ability to avoid litigation, and achieving lower payments for lost suits than was expected. 3 of the respondents indicated that there were quantitative metrics, and that these were geared to the number of invention disclosures received, the number of patents issued, and shortening the time required to take an invention disclosure through to a patent. 2 respondents said that the bonus plan went beyond these measures, and rewarded the manager for the amount of royalty income generated from IP licensing. 1 respondent noted that the manager was part of a management bonus pool, which was determined by the overall performance of the company's business, relative to the level forecast at the beginning of the year. In this case, there was no separate incentive for IP licensing per se.

Question 3: To whom does this person report?

There was a more clear pattern in the answer to this question. In medium sized firms, the IP manager reported to the chief financial officer of the firm. This was the case for 5 of the respondents. In larger firms, the IP manager reported to the chief legal officer of the firm. This was the case for another 5 respondents. The last two respondents had more varied reporting relationships. In one case, the IP management person reported into the head of R&D. In the other case, the IP management person reported into the head of strategy.

Question 4: To the best of your knowledge, what percentage of patents in your company are actively employed in at least one of the company's businesses? What percentage are licensed to other companies?

Most respondents did not know the precise answer to this question. It turns out that, in this sample at least, patent utilization is not a statistic that is commonly collected and reported by IP management to the company. However, most respondents felt that they had a general sense of the level of licensing activity. So I chose to provide a scale divided into 20% percentiles. So 0-20% would be a 1, 21-40% would be a 2, 41-60% would be a 3, 61-80% would be a 4, and 81-100% would be a 5.

Out of the 12 respondents, the responses ranged from 1 to 3. That is, no respondent firm reported utilizing more than 60% of their patents. The average of the 12 responses was 1.75. While this cannot be directly translated into an average utilization, it suggests that the average falls between 21 and 40%.

Question 5: In your opinion, is the utilization of patents in your company too high, too low, or about right?

None of the 12 respondents reported that the utilization of patents was too high. Seven of them reported that the utilization was about right, while 5 reported that the utilization of patents was too low.

2.3.3 Analysis of the Survey Results

As indicated above, these data cannot be used to make any projections to the overall population from which these firms were drawn. And indeed, since the firms' respondents all attend the ICMG group meetings, there are strong reasons to suspect greater homogeneity within the group than would be the case in the overall population.

Nothwithstanding the common membership in the ICMG, the respondents evidence a high degree of variability in the management and governance of IP, the incentives used to reward good performance in IP management, and the resulting utilization of patents. There appear to be a variety of processes used to manage IP. Some are coupled tightly with the legal function of the company. A few are coupled with the finance organization, as well as legal. One was managed out of the R&D function.

Incentives offered to IP managers differed as well. In no case, though, was there any explicit reward for higher IP utilization. In only 2 cases were there any direct bonuses offered for higher IP royalty receipts. In general, there were more incentives for keeping things from going wrong (such as a negative outcome in a lawsuit) than there were incentives for generating positive business results (such as increased royalty income).

Seven of the respondents felt that the utilization of patents in their company was "about right". This was due to the perception that patent utilization should not be at or near 100%, because many patents would be needed in a defensive strategy to discourage a patent infringement suit, and to negotiate better settlement terms if a lawsuit should arise. Five respondents, though, felt that their companies should be doing more to utilize more of their patents. Their perception was rooted in the additional revenue that more licensing would obtain. A couple of respondents also noted that greater utilization would be appreciated by their technical staffs, who are sometimes frustrated when their work sits “on the shelf”, and isn’t used either inside or outside the firm.

These data on patent utilization in large US firms are fragmentary, and one must be careful to make any strong claims based upon the data. One claim that can be made is that the frictions and inefficiencies of the patent and associated IP markets acts to inhibit the greater external utilization of these assets. If these markets were to develop to a greater extent, we would see higher patent utilization.

In the next chapter, we will examine some preliminary evidence about secondary markets for exchanging IP. The next chapter will examine evidence from US patent reassignment data, while the following chapter will look at Japanese patent reassignment data.

Chapter 3

Reassignment Analysis of US Patents

Patents typically are held by the owner of the patent from the time of initial issuance until the time when the patent legally expires. One common exception to note in passing is when an individual inventor receives a patent, and immediately assigns the patent to the firm that employed him when he made the invention discovery. Even in this instance, though, the assignee firm (the firm receiving the assignment from the individual inventor) typically then holds the patent until its expiration.

For this reason, then, patent reassignment has not been much studied. Yet recent data collected by the USPTO shows that reassignment activity in the US has grown substantially. In 1980, fewer than 2000 reassignments were reported in the US. In 2003, nearly 90,000 reassignments were reported. This chapter is to present some preliminary analysis for the reasons behind this increase. In the following chapter, we will present some more preliminary analysis about reassignment of patents issued in Japan.

Since there is a lot of material in this section, some organization is in order. First, we will discuss some of the challenges in defining, collecting, analyzing and interpreting these data. This will be useful in case readers would like to undertake any analyses of their own. We then present some preliminary analyses of these data to develop some provocative hypotheses of changes in how firms are sourcing the technologies (as inferred from the patents they hold). In particular, we present suggestive evidence of an emerging secondary market for intellectual property. While this secondary market is at a very early stage, the reassignment data do provide some indication that this market is growing. We consider some of the implications for the management of intellectual property rights that might result from a more fully developed secondary market for IP.

To be clear, a reassignment is not the same thing as a license to a patent. And licensing is a challenging area to do empirical research, because licenses are private contracts. There are very few cases when the two parties have obligations to report the terms of a licensing agreement (in the US the main exceptions are SEC filing for material licensing contracts and agreements that relate to public funded research). This introduces a strong bias to the analysis, that various databases that look at licensing contracts attempt to solve using different approaches. Also, this represents a non trivial problem when one wishes to compare findings across different studies.

Moreover, licensing revenues can be a complex figure, very much bundled with other sources of income of a company. For example, the very well known IBM "1 billion dollars a year in licensing", that is often looked up by IP managers as one of the most striking success cases, might overestimate the success of IBM in securing licensing revenues from its technologies. According to our interviews with IP experts, IBM consultants bundle IP licensing contracts with their professional service fees and technical consulting. It is difficult to parse how much of this is truly IP-related, vs. more general consulting and services.

This empirical limitation on licensing has also impacted managerial writing in this area. The inflated predictions of growth for a licensing-based economy (Rivette and Kline, 2000), led to a myopia that ignored the emergence of new IP-based business models.[99] In a context characterized by the rise of Open Innovation (Chesbrough, 2003), these new business models are becoming mainstream approaches for the exploitation of a firm's intellectual property assets. But enacting processes to exploit one's own IP more fully outside of the firm, or equally, processes to incorporate external IP into the firm, both require astute management of IP.

[99]Ironically, in Rivette's (2000) book about selling intellectual property, there is no logic anywhere articulating why firms should wish to buy IP from other firms. Obviously, IP markets must be two-sided, if they are to obtain liquidity and function effectively. Chesbrough (2003) supplies a coherent rationale for why firms should be active in both sides of the IP market.

3.1. Types of Patent Reassignments

When a patent is registered and assigned a publication number by the US Patent & Trademark Office (USPTO), the investment that a firm made on the "exploration" phase of an R&D process is technically over, and a new "exploitation" phase begins. For a limited period of time (20 years in the US) the patent law grants the patent assignee a monopoly for the commercial exploitation of the technology protected by the patent.

In the course of the lifetime of a patent, the original assignee has the rights to sell the ownership rights over a patent. Patent reassignments are a type of post-grant action that certify the transfer of ownership of a patent. The US Patent and Trademark Office (USPTO) clearly states that "When a patent is reassigned, ownership rights are transferred from the original or current assignee to another company or individual". A reassignment is the legal document that certifies and records the transfer of ownership from an "assignor" (the previous owner) to an "assignee" (the new owner). The new owner enjoys all the rights and privileges of the original owner.

As for many other registered assets, also for patents, it is a specific responsibility of the parties involved to provide the regulation authority the necessary information about the nature of the transaction and the change of ownership. In the case of patents, an assignee and an assignor have to complete a special form (PTO 1595), and to register the reassignment with the USPTO.

A patent can be reassigned more than once. Normally, the first reassignment happens at the same time of the patent's publication. A patent is a title that is originally assigned to the inventors, which in many cases are bounded by contractual obligation to transfer their IP to their employer company. Subsequent reassignments reflect the history of the patent or the company (or individual) that owns it. Patents can be reassigned together with other assets in a larger transfer between two organizations, or they might be bundled with the control rights of a business unit, division or subsidiary which is acquired by another company. The assignee might decide to reassign a patent portfolio to a controlled company or to a spin-off. In other situations, two independent companies agree to transfer some IP assets as part of a technology transfer deal.

The following represents a complete list of possible reasons recorded by the USPTO for patent reassignments. The party that files form PTO 1595 checks the reason for the assignment, so this variable is self-reported, usually by the assignee.

Correction and Book-keeping changes. Reassignments are used to correct mistakes on the original published title. Also they can be used to reflect changes in the name of a company's official name or the address of the IP headquarters of a firm.

Affiliated Company Transfers. Patents are reassigned internally from one branch of a company to another, or they might travel from business unit to business unit. These changes reflect reorganization or strategic changes within a company. An interesting case is when the mother company assigns to a controlled subsidiary or a spin-off company a portfolio of its patents, which are managed separately from the rest of the portfolio. Another situation can be the formation of a joint venture (JV). Two autonomous and unrelated companies might agree to enforce the formation of a joint venture by granting the control of a set of patents from both the companies to the JV. Usually the patents that are developed by the JV organization are assigned directly to this company, and when the JV ceases to exist are transferred back to the former partners (a recent example well captured by reassignment data is the formation of the Sony-Ericsson). Alternatively a company might decide to centralize the management of its patents, or even create a dedicated subsidiary, specialized in the management of its IP portfolio (a recent example is Hewlett Packard (HP), which reassigned most of its patents to the subsidiary "HP capital"). There can be tax reasons to hold patents in certain jurisdictions.

Merging & Acquisitions (M&A). Patents are reassigned when two company merge into a new one or when the assignee acquires the assignor company. In some cases these reassignments are not recorded, or are recorded much after the M&A operation.

Transfer of IP bundled with other assets. Two autonomous companies, enter in an agreement where the assignor transfer some IP and other tangible assets to the assignee. These assets might be complementary to the exploitation of the technology which is protected by the patent.

Standalone IP Transfer. In this situation, the assignee seeks to get full control of the patents related to a particular technology. The assignor and the assignee agree to exchange property rights over a portfolio of IP. No other assets are transferred, and the two companies continue to operate independently. An interesting special case of this category is when the assignor is in a default situation and the acquisition of the patents is the result of a bankruptcy auction. Specialized IP firms are currently very active in seeking to consolidate patent portfolios, using this strategy. Standalone IP transfers also happen before or during an infringement litigation. It is extremely difficult to predict the verdict of these type of trials. One of the key challenges for the IP attorneys is to show that their clients have a legal set of rights over a particular technology. Acquiring patents filed by other companies or individuals, whose claims might somehow threaten the validity of key patents involved in the trial is an obvious important practice.

Licensing contracts. In some situations, reassignments are used also to validate a licensing agreement. In this case the reassignment from the licensor to the licensee is temporary, and it is normally followed by a reassignment back, similarly to a leasing contract. In particular situations, the assignor of a patent might ask the assignee to reassign back the patent for a limited time, in order to have access to the use of a technology whose patents have been transferred.

Transactions with research organizations or individuals. Sometimes reassignments do not happen between two companies, but they take place between a company and an individual, a government agency, or a university laboratory. In the situation of inventors, sometimes companies acquire patents from independent inventors that are not working for the assignee. We observe also the opposite situation, as individuals emancipate some IP from the control of a university or a company. Companies transfer patents to and from universities and independent research laboratories as well. A common practice is for commercial firm to donate some of their unutilized IP to universities mainly for tax purposes, but also to secure favorite access to the research developed by a university. On the other hand, universities might transfer a portfolio of their patents to companies for the commercial exploitation of the protected technologies. At Berkeley, a common practice is for the Central Campus Administration to shop an invention disclosure from one of the UC faculty to potential licensees. If a licensee is interested, it helps defray the costs of filing the patent application for UC, and then receives a license (usually in this case an exclusive license) to the technology. Similarly this happens with transactions from and to government agencies. A very particular (and rare) situation is when a government agency for national security reason, requires a company to surrender the rights over a patent. These are so-called “march-in rights”.

Security Agreement. As with many other registered assets, patents can be used to secure a loan. In some cases, patents represent one of the most valuable assets of a firm. During interviews with IP experts, we found evidence of at least two common practices used by financial institutions. According to some IP lawyers, in situations of a patent infringement suit, we were told that it is not unusual that banks ask their clients to secure a loan to cover the legal costs of the trial with the group of patents that are at the core of the litigation. A second practice is to secure a line of credit through patent reassignments. In the event of a company's bankruptcy, a bank that results to be the assignee of a portfolio of patents enjoys a better contractual position in the assembly of the creditors.

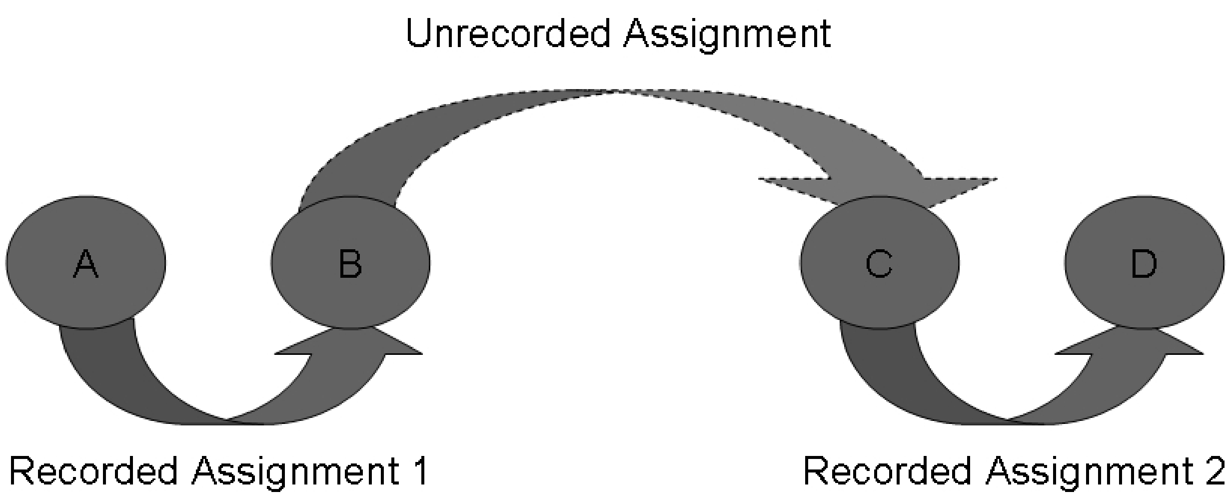
As we will see below, financial institutions show up to be assignee of a large number of patents. Obviously this is not because they performed the research activity that led to the innovation, but rather because they asked some of their clients to use patents as a form of guarantee on a line of credit. This is a perfect example of a type of activity captured by reassignment data that capitalizes an investment in R&D, in ways that were not originally thought by the inventors.

3.2. How Reassignments are Used and How are They Studied

The first important element to consider when looking at patent reassignments is that not all reassignments may be recorded. As any other transactions, reassigning a patent has a cost. Each reassignment costs 40$ plus legal fees. The rule of thumb is 100/200$ per patent reassigned for the legal fees. So it is quite possible that a patent reassignment may have occurred privately, but has not been reported (at least not yet) to the USPTO. Note that the USPTO performs no examination or review upon receipt of a patent reassignment form. They simply record the change in the current ownership of a patent.

Indirectly however, there are strong incentives for firms to keep reassignment information updated. The biggest incentive is to maintain the patent. Reassignment data has been recorded since 1980, more or less at the same time when renewal fees started to be enforced. Failure to pay renewal fees can result in the loss of patent coverage. For example, the first patent renewal fee is due 3.5 years after the initial issuance of the patent. While a grace period of up to 6 months can be obtained, patents that are not renewed by then are deemed abandoned. Moreover, the official dispositions of the USPTO state that "a transaction is void [against a subsequent purchaser] if not recorded within three months (...), unless it is recorded prior of the subsequent purchase." Thus, the acquirer of a reassigned patent has strong incentives to complete the reassignment process for a patent it purchases.

FIGURE 3

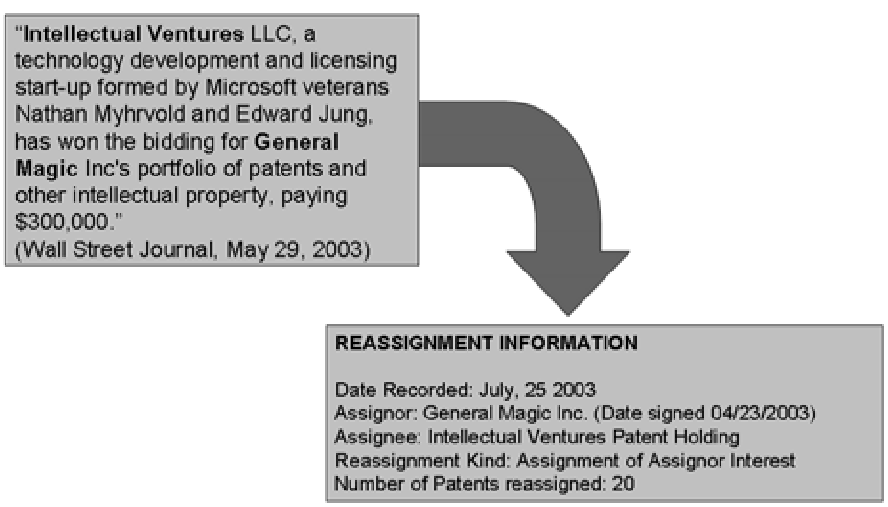


What this actually does mean is that if we are looking at reassignments to have complete information about a patent's life, some chapters of the history are probably missing. Figure 3 portrays this gap in the ownership chain of a patent. We might capture the assignment from A to B, and a separate assignment from C to D, but lack any observation of the reassignment from B to C. This is a very important limitation to keep in mind. When looking (or counting) reassignments, it is highly likely that some information may have been omitted. At the same time, however, when we take a close look at reassignment data, for a random group of USPTO patents, we find that the most significant market transactions of IP are regularly registered. That is, most patent reassignments that we examined did not possess the gaps shown in Figure 3.

In spite of the limitations of reassignment data, we believe that the vast majority of patent asset transfers are reported, and that can be therefore examined. This is a more observable set of IP transactions for an academic researcher than, say, licensing, where most transactions remain private and are not publicly available. These characteristics make reassignments worthy of study.

This also points out the role that the government's policy toward renewal fees has played in the emergence of reassignments. The desire to make the patent office more self-funding led to the decision to impose renewal fees at regular intervals. The first renewal payment comes in 3.5 years, then 7 years, and then 11.5 years. (Note that these intervals are quite different in Japan, where renewal fees are back-loaded, and become increasingly expensive as the patent nears its expiration date.)   This creates three windows in time where a firm might rationally decide not to pay the extra money to continue to maintain a patent. Once that decision is made, the firm might choose to see if there are other parties who might pay them something for a patent that they would otherwise abandon. This facilitates the emergence of a secondary market.

FIGURE 4



The most common use of patent reassignment data is to have a clear understanding of the ownership of a set of technologies. Figure 4 shows that a failed company, General Magic, reassigned 20 of its patents to Intellectual Ventures. The only other study that we came across, that attempted to look as patent reassignments to understand patent exploitation dynamics has been conducted by Carlos Serrano (University of Minnesota and Federal Reserve Bank of Minneapolis). Serrano (2004 and 2005) present very interesting stylized facts about patent reassignments, that our own research seems to confirm.

Serrano considers single patents as the unit of observation for his study, and correlates the occurrence of patent reassignment with the lifecycle of a patent. Serrano finds that the probability of patents to be reassigned monotonically decreases in time, with the exception of the months before a patent renewal fees due dates (3.5 years, 7.5 years, 11.5 years after the date of publication). This is consistent with the idea that renewal fees are an incentive to maintain an updated register of reassignments. The second interesting finding in Serrano (2005) is a significant and positive correlation between patent citations and patent reassignments. Serrano finds that more cited patents are more likely to be reassigned. The empirical literature that looks at patents finds significant evidence to consider patent citations as a proxy of "relevance" if not "quality" of a patent. Serrano's findings imply therefore that "better" or at least more "relevant" patents are more likely to be reassigned.

We also offer a corollary hypothesis that is not directly considered by Serrano: companies often rationally choose to abandon patents at these renewal intervals. When secondary markets are highly imperfect and incomplete, companies may choose to simply abandon a patent that is no longer useful to them, than to invest significant time and resources to look for a buyer in a highly imperfect market.

Serrano concludes his empirical investigation suggesting that “better patents are more likely to be traded”. Based on the concept of rational abandonment noted above, we would predict that abandoned patents are less often cited, suggesting that a survivorship bias may be driving (at least some of) his results.

3.3. Firm-level analysis of Patent Reassignments

It is important to draw clear distinctions between the type of reassignments that occur, and to look at the firms who reassign or receive them. Patent reassignments - when analyzed by the firms that transfer or receive them - can tell us something about a firm’s technology sourcing strategies. In order to test this hypothesis we need to aggregate reassignments into companies’ portfolios. Our preliminary empirical analysis will show how this approach can signal the presence of striking differences in terms of a firm’s strategy.

The reassignment data that we were using for this study was provided by Thomson - Dialog. We carefully checked these data against USPTO data for accuracy. While USPTO data are the root source of all reassignment data, their database lacks many additional features that we required for our analysis. Among these features, for example, was a way to exclude the initial assignment of a patent from an individual to his or her employer from our study of reassignment events. Patent data was integrated with post publication data prepared by IFI-Legal, a private company that contracted with Dialog to provide these data. This database has the advantage to be constantly updated with new reassignment, and the Dialog and IFI technical staff constantly checks for mistakes and typos.

3.3.1. Examples of Firm-Level Patent Reassignments

It might be helpful at this point to present some examples of patent reassignments, to give an idea of what can be said about the “exploitation” of a patent by looking at reassignment data.

FIGURE 5

Date	Assignor	Assignee	Reassignment Kind	Interpretation
1995.05.26	AMOCO CORP	E-Systems Inc.	Assignment of assignor's interest	Standalone IP transfer
1998.04.27	E-Systems Inc.	Raytheon E-Systems	Change of name	"book-keeping"
1998.04.27	Raytheon E-Systems	Molex Fiber Optics	Assignment of assignors interest.	Bundled or Standalone IP transfer

Figure 5 shows how we were able to code the reason for reassignment of a patent across multiple reassignments. With some reassignments it is extremely straightforward to understand what was the reason behind it. For others it is not that easy to reconstruct the transaction behind them. Figure 5 above, the first four columns show information available on the USPTO Reassignment website, when querying for the reassignments for patent number "US 4865923". The fourth column offers an interpretation for this reassignment, according to the taxonomy that we have previously defined.

This patent was originally assigned to Amoco Corporation, and it was issued on September the 12th 1989. In May 1995, Amoco sold part of its IP to E-Systems. Consulting Hoover's and Who Owns Whom?, we learned that E-Systems was a company owned and controlled by the defense contractor Raytheon. Using a Lexis-Nexis search, we could find corroborating evidence of the transaction, and no evidence that other assets were transferred. Then, a few years later Raytheon went through a reorganization, which affected also its IP portfolio. The Raytheon E-Systems business unit was created. In turn some of the patents from E-Systems were transferred to Molex Fiber Optics. It is not clear whether this was part of a larger operation, or this was another standalone IP transfer.

This suggests an important requirement of reassignment research. We have found that we need to supplement the USPTO data (as scrubbed by IFI-Legal for the Dialog data base) with non-patent data from online sources like Hoovers. If JPO wishes to perform similar analyses on JPO data, it will need to incorporate non-patent data as well. Fortunately, online search is fast these days, and a variety of information is available. However, even working fast, it took us a minute on average to understand the reason for each reassignment. This will limit our analysis to a more focused subset of reassignment data later in our analysis.

Reassignments allow a researcher to reconstruct the events of a portfolio of patents that surround a particular technology or business, with a high level of detail. From the work we have done so far, it appears that in order to protect a technology, most of the times a bundle of patents is necessary, when these patents are sold usually they are reassigned together, as in these situations an isolated patent would have little or no commercial value. Figure 6 shows the sequence of six reassignments for a portfolio of patents. The last column shows the number of patents that were reassigned at the same time.

FIGURE 6

Reas. Number	Date	Assignor	Assignee	Reassignment Kind	Number of Patents Reassigned
1	1995.03.14	AT&T	Hyundai Electronics	Assignment of assignors interest	60
2	1995.08.28	Hyundai Electr.	Symbios Logic	Assignment of assignors interest	63
3	1998.03.10	Symbios Logic	Symbios Inc.	Change of name	77
4	1998.11.27	Hyundai Electr.	Lehman Comm.	Security agreement	72
5	1998.12.04	Symbios Inc	Hyundai Electronics	Termination and license agreement	64
6	2004.10.12	Hyundai Electr.	Hynix Semic.	Change of name	280

1. In 1995, AT&T sells to Hyundai the assets and control of NCR Microelectronics, for $300 million (*Reassignment 1*).

2. Later on that year, Hyundai assigns the patents acquired plus a few others developed in the meanwhile to the controlled company Symbios Logic (*Reassignment 2*).

3. In 1997 Hyundai will sell Symbios to Adaptec for $775 million. Apparently, the Symbios patents are not reassigned to Adaptec, and remain with Symbios, which will change its name to Symbios Inc, all the non expired patents of the original transaction plus some others developed in the meanwhile are reassigned (*Reassignment 3*).

4. In 1998, Hyundai signs a security agreement with Lehman (*Reassignment 4*).

5. *Reassignment 5* suggests that when Symbios was sold to Adaptec, some kind of limited licensing agreement was signed between the two companies. In fact, one year after the announcement of the deal, a "termination of the license agreement" is recorded, and all the non-

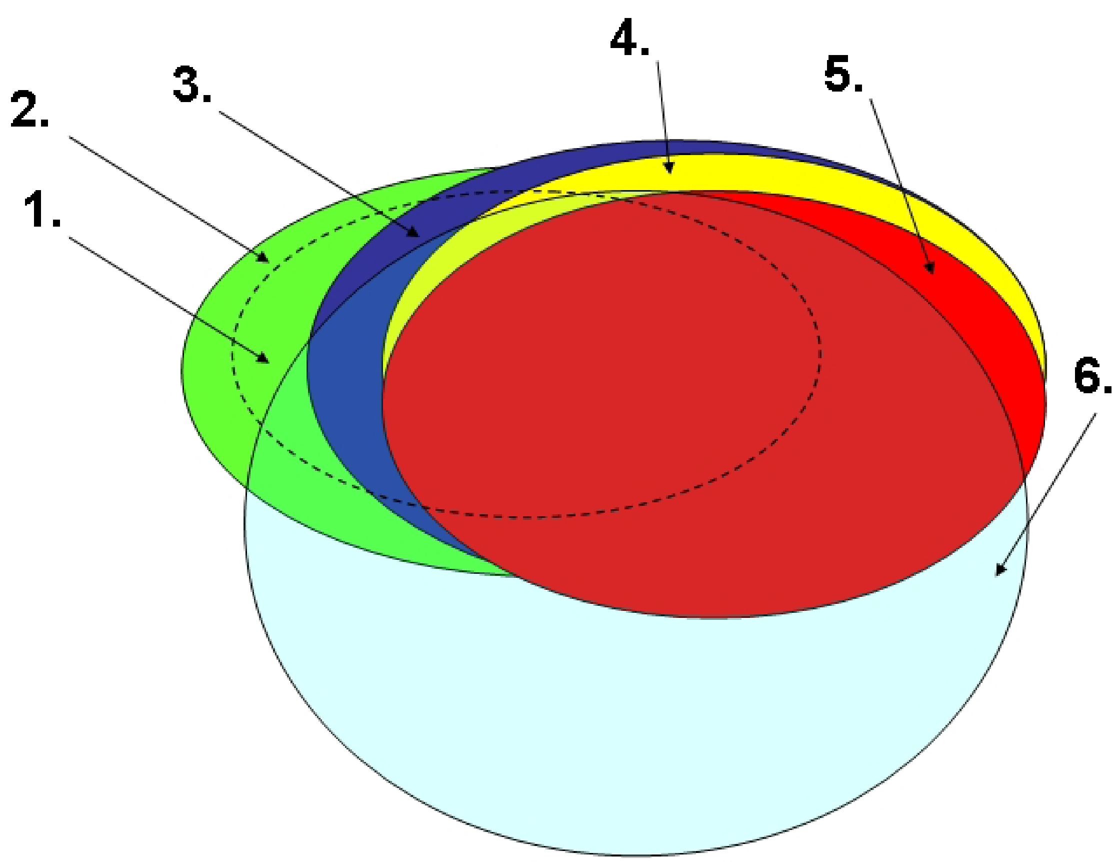
expired patents of the original transaction between AT&T and Hyundai together to the ones that were developed in the meanwhile are reassigned back to Hyundai.

6. Finally, in 2004 most of the semiconductor activities of Hyundai are spun-off to the controlled company Hynix Semiconductors (*Reassignment 6*).

A more visual way to illustrate these transactions is shown in Figure 7. As the reader can see, the pattern of transactions is complex, and the bundles of reassigned IP vary at each step in the process. It is not a matter of the same IP being sold and sold again. Instead, the IP is sold, recombined with other IP, then a different portion is sold, recombined, and so forth.

FIGURE 7

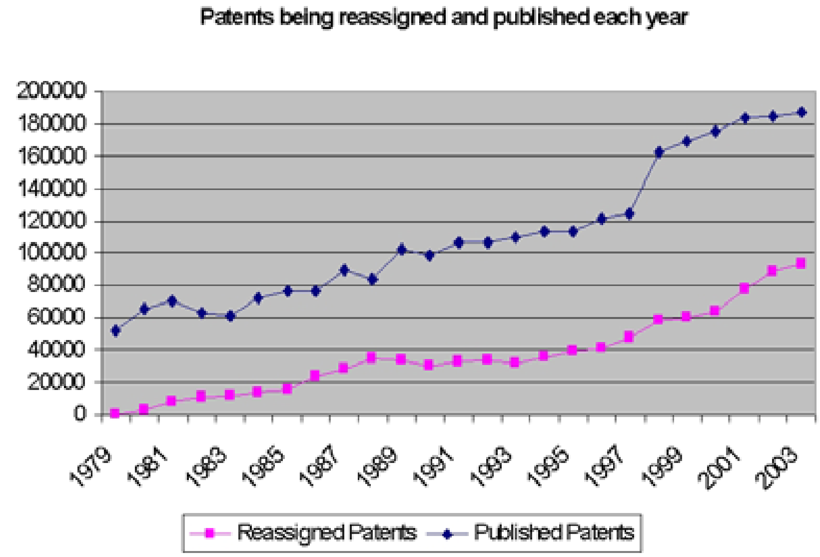
The numbers show the sequence of the various reassignments.



3.5. General Trends related to Patent Reassignments

The USPTO started to record patent reassignments in 1980. The chart in Figure 8 shows the complete time-series of patents being reassigned each year, compared with the time-series of published patent from 1980 to 2003. This graph, as well as all the analysis that follows, does not take into account the first reassignment between an inventor and the employer company. Since that is an automatic event, in our judgment it does not qualify for separate analysis.

FIGURE 8



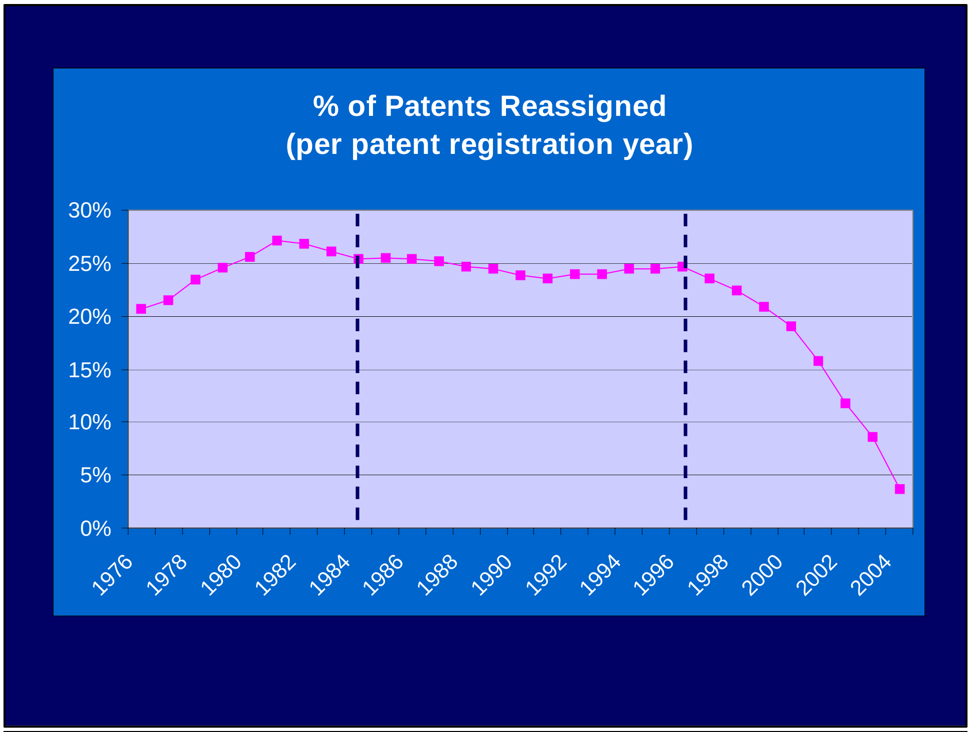
At least three different factors contribute to explain the growth of reassigned patents, during the 23 years from 1980 to 2003. The first and most obvious is an eligibility effect. Since the number of patents being published during these years increases, so does the number of patents that are eligible for reassignment. Moreover, according to Serrano (2005) new patents are more likely to be reassigned than older ones, and this fact multiplies the power of this eligibility effect. A second explanation has to do with the establishment of a new practice. Since the USPTO has started to record reassignments only since 1980, and since renewal fees seem to act as a strong incentive to maintain reassignment data updated, we can suggest that some time was necessary before patent assignors and assignees become familiar with this new practice.

A third explanation is the most relevant for this study, since it has to do with the emergence of a secondary market of technology. This emergence runs contrary to many known facts about patents, so it is necessary to discuss them first, before developing this explanation. As noted above, it appears that companies may rationally abandon some of their patents at renewal time. Further, as various empirical studies have shown, not all patents are equally valuable. The concentration of value of patents (however measured: number of forward citations, licensing revenue) is extremely skewed.[100] While most patents are worth very little, a few patents are extremely valuable.

The following graph in figure 9, for each registration year between 1976 and 2004, shows the percentage of patents being reassigned at least once, anytime after registration. Note that, since patent reassignments started to be registered only since 1980, these data are left-censored. Once the data began to be collected, it is likely that assignees went through an “adjustment period”, before getting familiar with the reassignment practice. Also, patents that are less than 11.5 years old (remember that the last renewal fee is due 11.5 years after issuance) did not go through their complete “reassignment life cycle”. So these patents are right-censored, in that some of them may be reassigned after the observation period. It is interesting to notice, that for older patents, an average 25% of patents were reassigned at least once. This percentage is roughly constant for patents registered between 20 and 8 years ago. So there is already a significant percentage of patents that are not simply held by the original owner throughout their useful life.

[100] D. Harhoff and F.M. Scherer, “Technology Policy for a World of Skew-Distributed Outcomes”, Research Policy, vol. 29 2000: 559-566

FIGURE 9

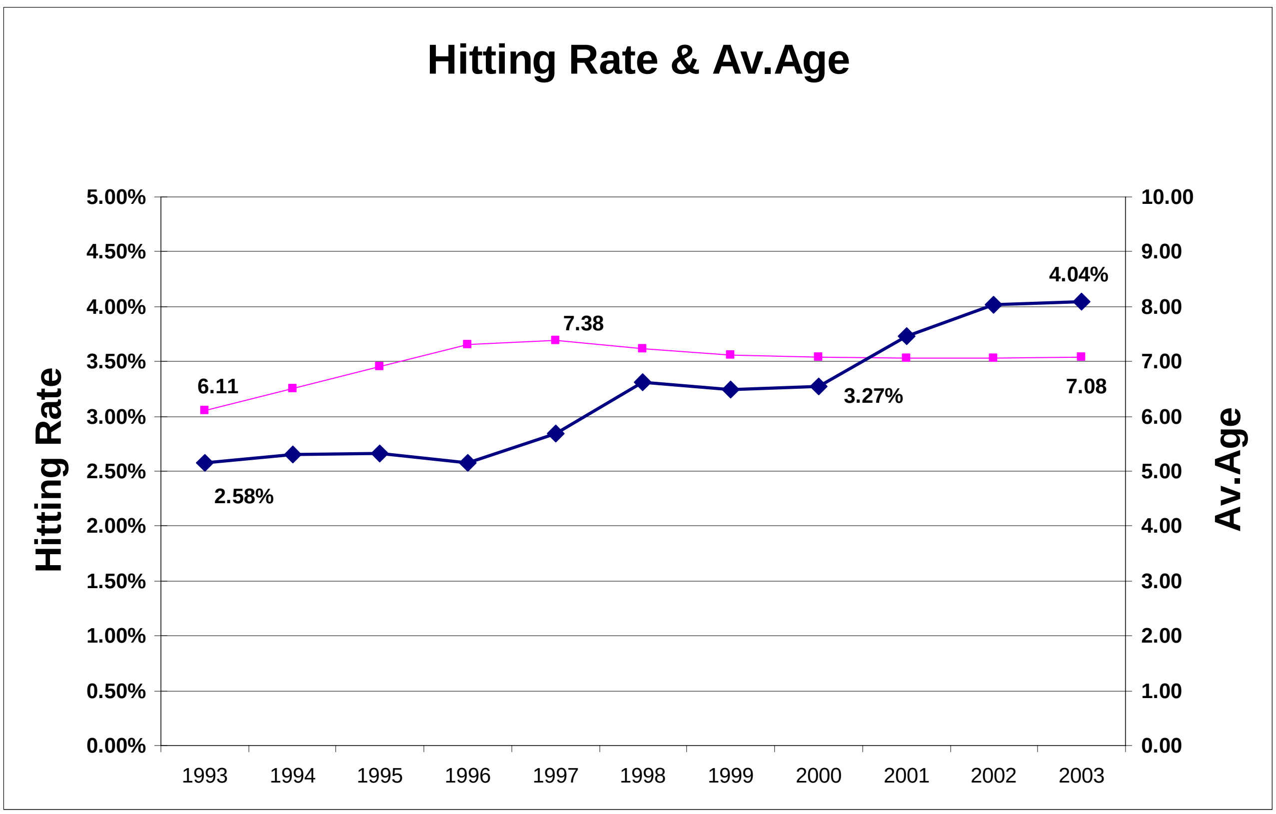


Another possible way to look at aggregate data about reassignments is to define a "reassignment rate" which is calculated as the ratio between the number of patents being reassigned each year over the number of patents being published in the previous 17 years. The denominator represents the pool of non-expired or non-expiring patents that might be reassigned. This reflects the likelihood that a patent might be reassigned after its initial issuance and initial assignment. The reassignment rate increases significantly in the last ten years (from 2.6% in 1993 to slightly over 4% in 2003). This is probably due to the fact that during this period, firms became more prone to maintain updated reassignment data, but it might be also due to a different use of patents in the secondary market of technology. In order to investigate this hypothesis further, it is necessary to decompose this general trend, and consider a different unit of observation.

The following table in Figure 10 considers a different hypothesis. According to Serrano (2005), patent reassignments are not evenly distributed across the lifecycle of patents, and new patents are more likely to be reassigned than older ones. We should therefore expect that a portfolio of newer patents, is more likely to have a higher reassignment rate than a portfolio of older patents. The comparison side by side of aging and reassignment rate of the outstanding patent portfolio, however, is not consistent with this. The reassignment rate during the second part of the 90s increases in spite of the fact that also the average aging of the patents increases slightly.

FIGURE 10

The blue line shows the reassignment rate (scale on the left) while the purple line is average age (right scale).

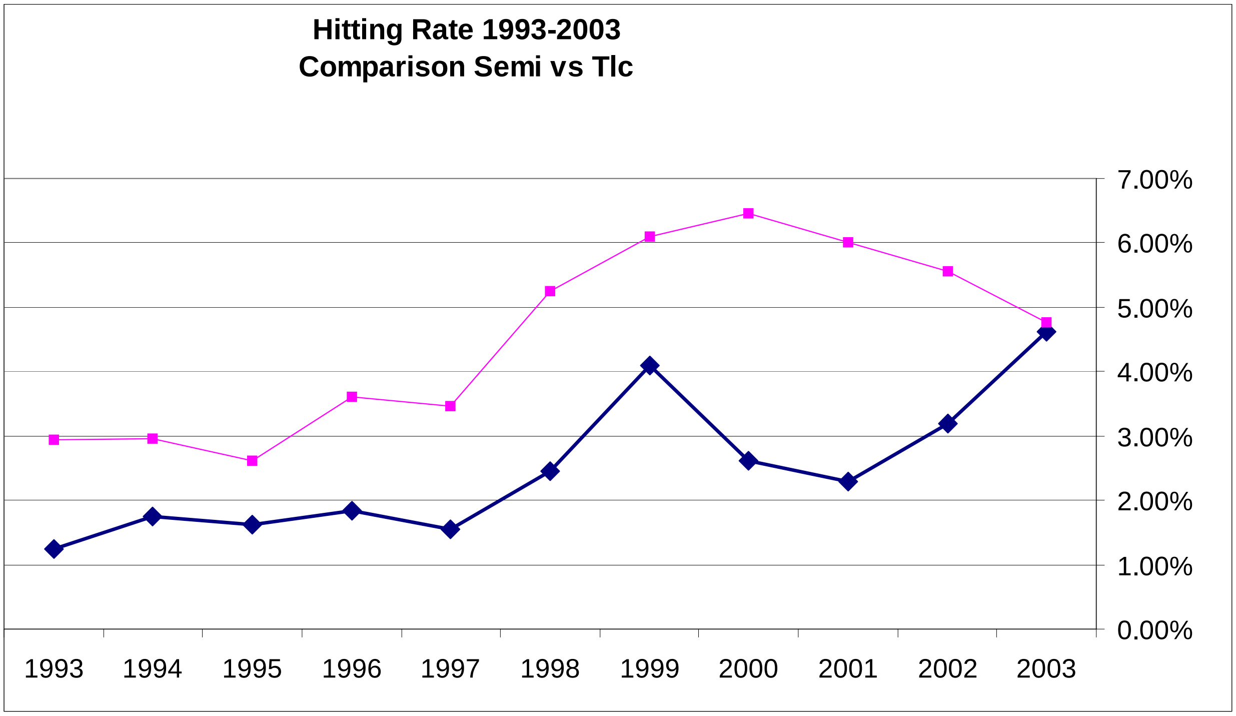


The interpretation of this finding requires further investigation, but it is clearly the case that this there is more than simple aging that is causing rising reassignment rates. Other influences may include technology or industry effects. To investigate this, we constructed the following tables to compare the dynamics of the reassignment rate of an industry like semiconductors (where dynamic technological change has been very active) with other application technology classes (telecommunication, information technology and biotechnologies, according to a grouping technique developed by the Fraunhofer ISI.

Figures 11, 12, and 11 show the comparison of reassignment rate for these industry groups. In spite of the fact that semiconductor, information technology (IT) and biotech outstanding patents' classes show a very similar aging dynamic with an average maturation that overlaps for many years, still the reassignment rates of these sectors appear to be quite different from one another. Likewise, if we consider telecommunications, the reassignment rate of this application technology is always significantly higher than semiconductors before 2003, with a very different trend. During the same period, when comparing the average age of semiconductor and telecommunication patents, this last group is approximately 0.5 years older than the previous, for all the 10 years in the sample. So if we accept Serrano (2005)'s finding that newer patents are more likely to be assigned than older ones, we also have to conclude that how frequently and how many times are patents going to be reassigned, will depend on other factors independently from the patent's age. Figures 11-12 show that these factors are both technology and industry specific. Below, we will also consider whether there are firm-specific factors at work as well.

<u>FIGURE 11</u>

<u>The blue lines show reassignment rate (first graph) and average age (second graph) in semiconductors patents, the purple lines refer to telecommunication patents.</u>



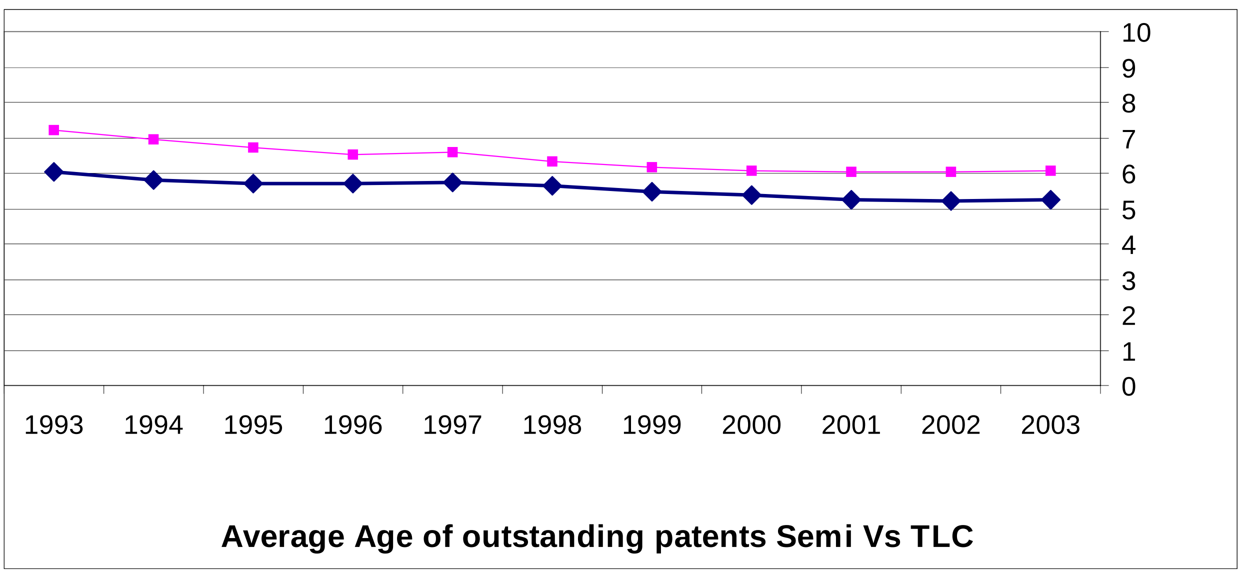
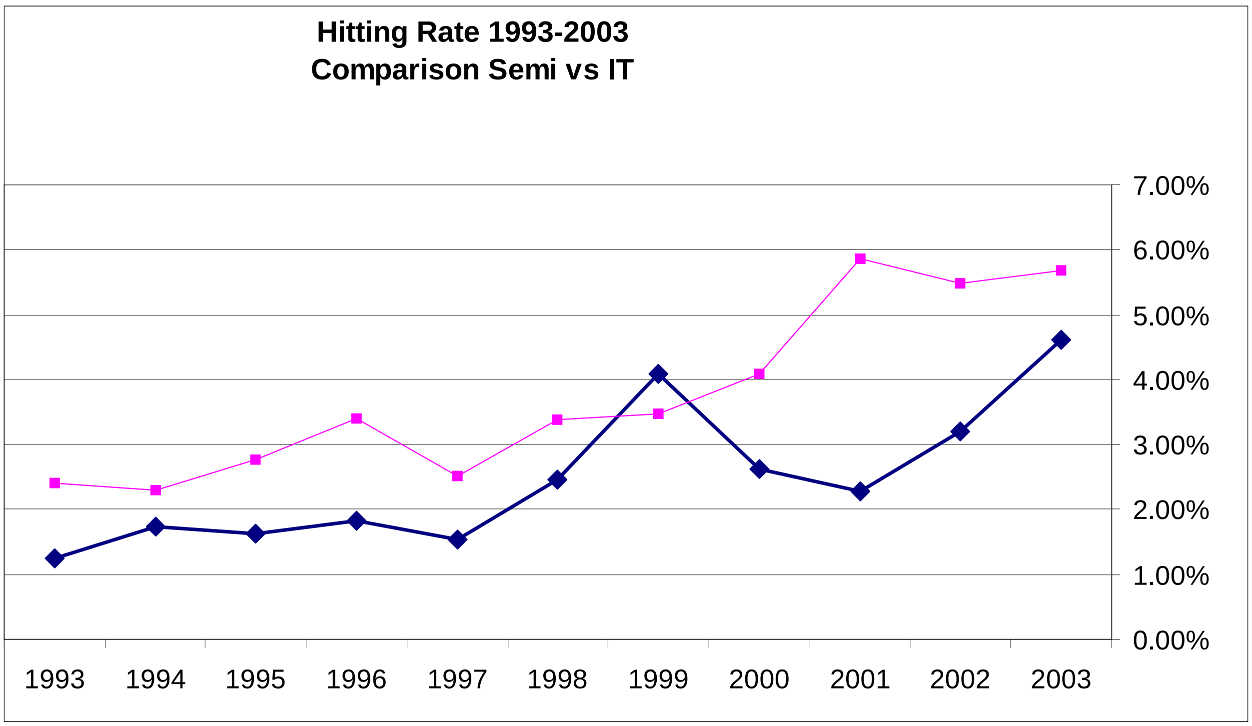


FIGURE 12

The blue lines show reassignment rate (first graph) and average age (second graph) in semiconductors patents, the purple lines refer to Information Technologies patents.



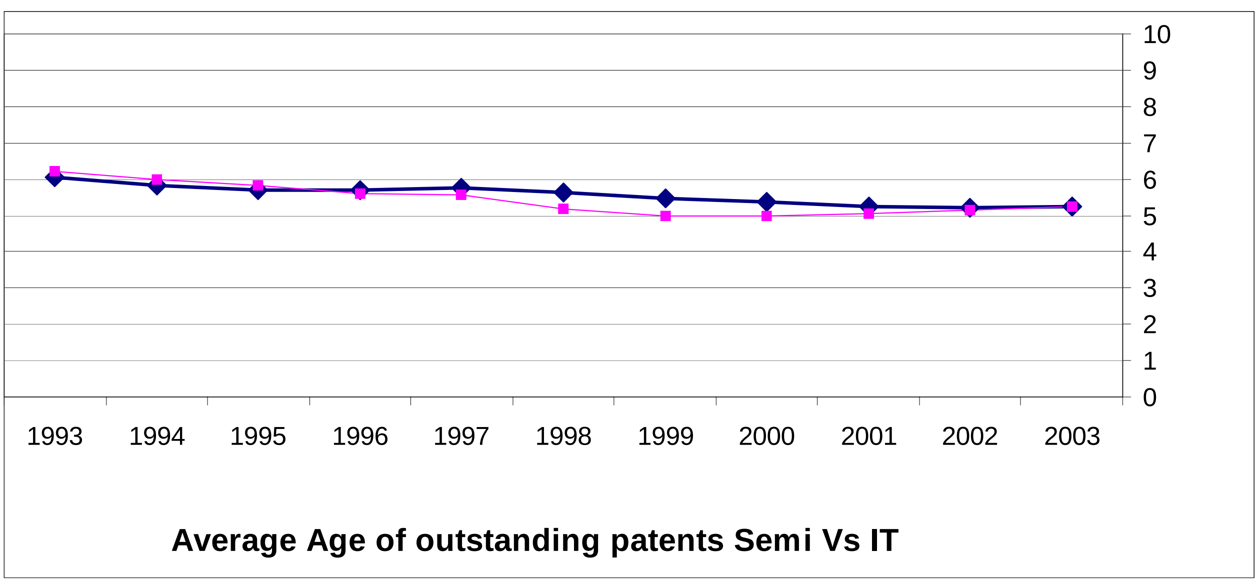
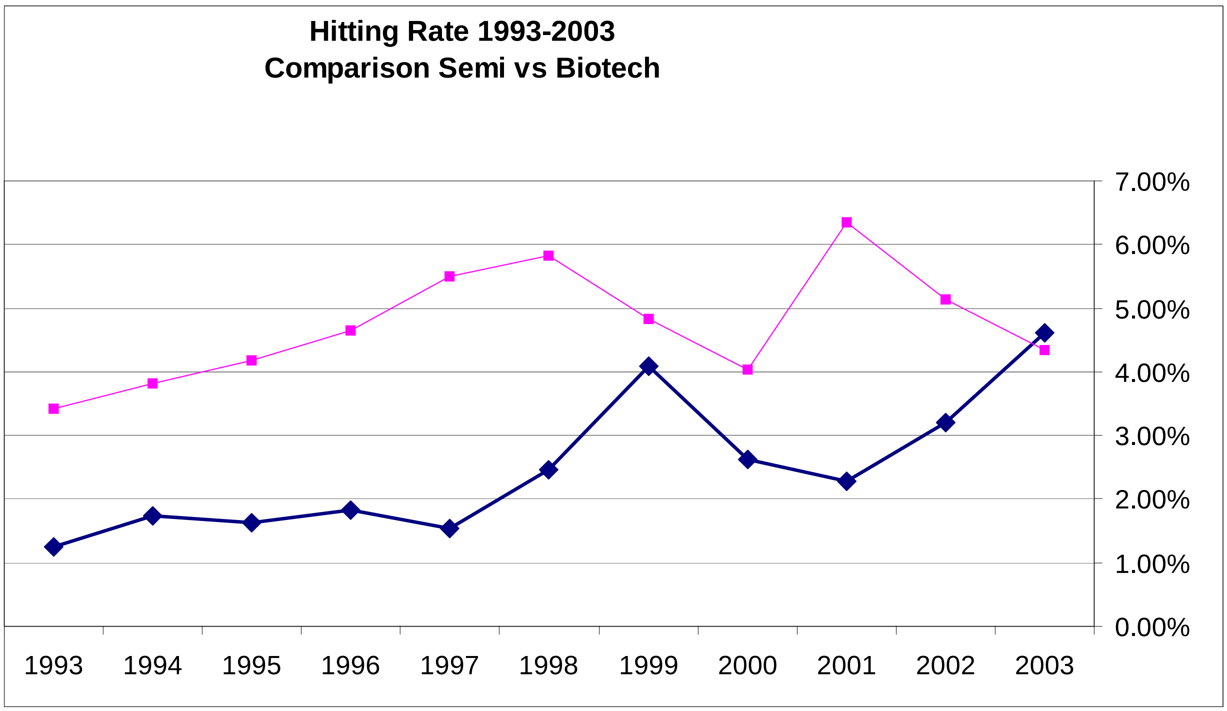
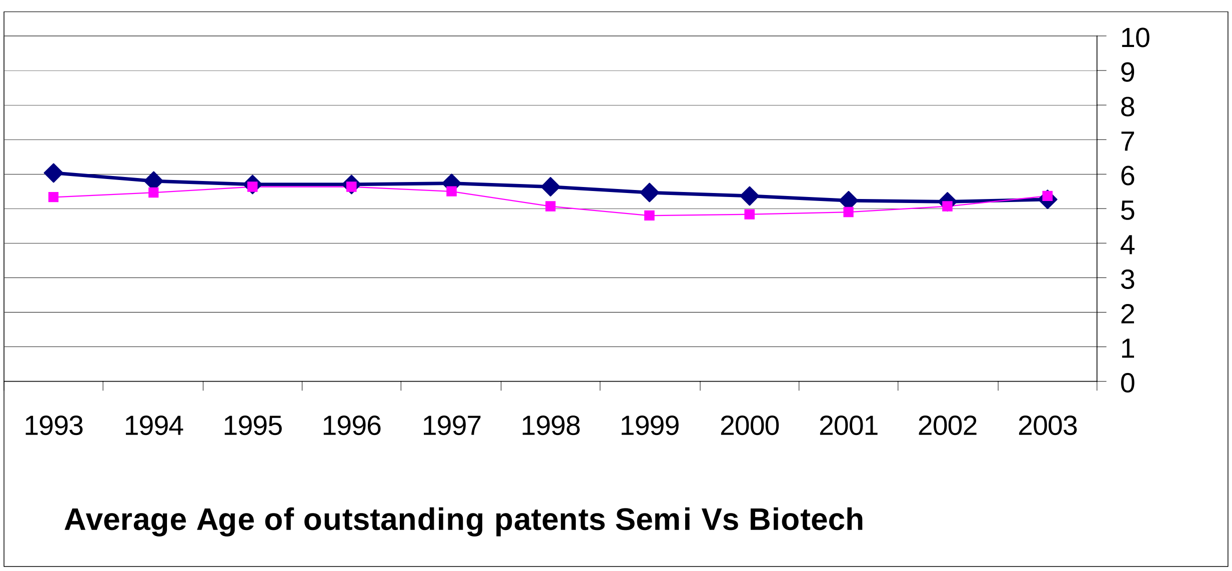


FIGURE 13

The blue lines show reassignment rate (first graph) and average age (second graph) in semiconductors patents, the purple lines refer to biotechnology patents.





3.6. Firm Level Technology Sourcing Strategies in the IT Hardware Industry

A different and relatively unexplored approach to look at patent data is to consider the reassignment behavior of companies within an industry. What this approach attempts to do, is to help make some inferences about the characteristics of a company's technology portfolio, and the strategies of technology sourcing, in and out of a company.

To exemplify this approach we consider the reassignment data for the top patent assignees in the IT hardware industry (as ranked in the "R&D Scoreboard 2003" developed by the UK Department of Trade and Industry, DTI 2003). The following table in Figure 14 lists the top patent assignees in the IT hardware industry. The first column displays the total number of patents assigned to each firm in the period 1976-2003. The second column displays the total number of patents assigned from other companies to each company as a percentage of the total patent portfolio. The last column displays the number of patents assigned from each company to other companies. We exclude from this computation both the first reassignment from inventor to employer company, and the intra-group transactions (eg: transactions of patents from a controlled of IBM to another company of the IBM group, or from HP to HP Capital).

FIGURE 14 : Reassignments in the IT Hardware industry

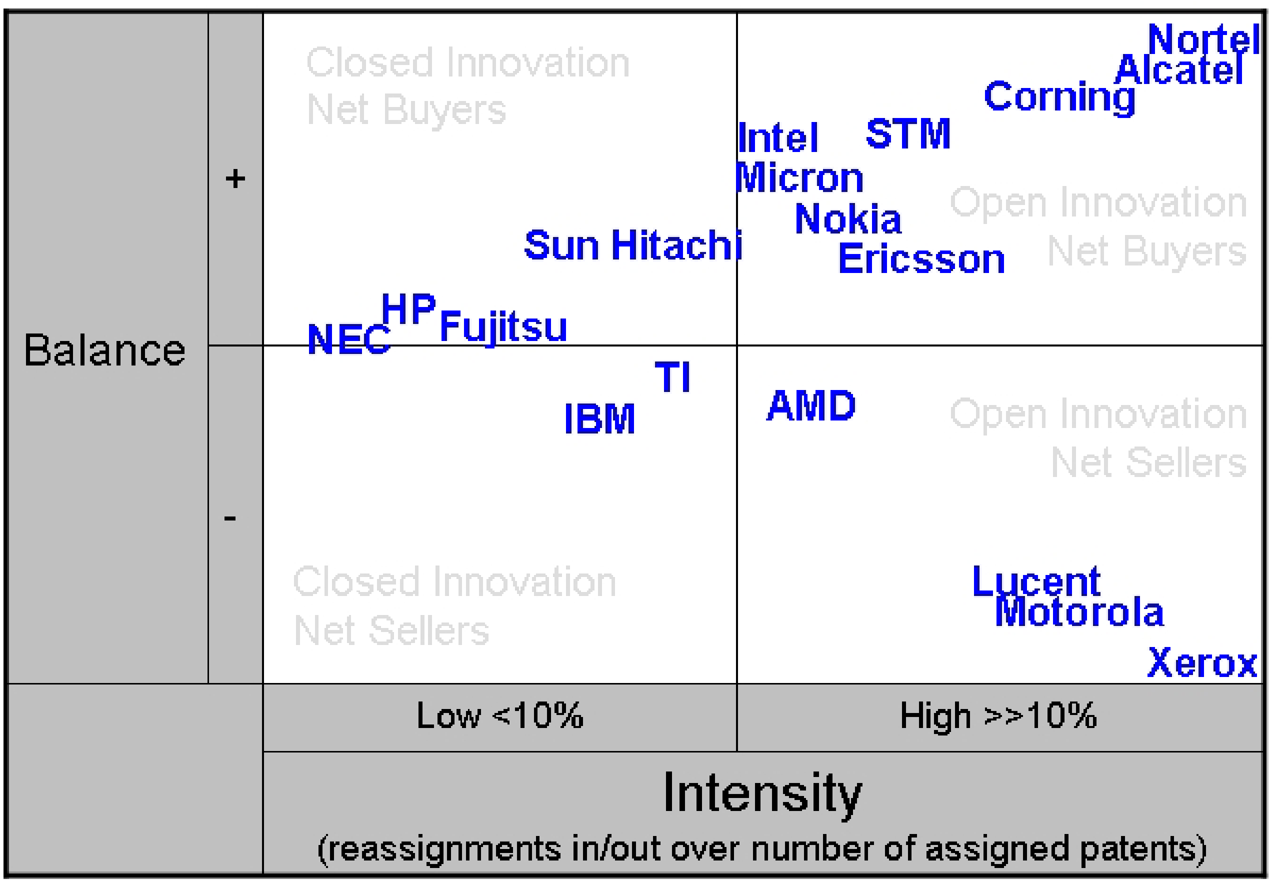
Company Name	Tot. Patents Reassigned to	Tot Patents Reassigned **TO** C as % of total Patents	Tot Patents Reassigned **FROM** C as % of total Patents
IBM	40443	2%	5%
Hitachi	33372	7%	1%
NEC Corporation	21756	2%	2%
Fujitsu	19964	3%	3%
Hewlett-Packard	18802	3%	2%
Motorola	18654	3%	28%
Xerox Corporation	16265	4%	53%
Lucent	13938	3%	27%
Texas Instruments	12599	3%	4%
Micron Technology	12580	9%	1%
Intel	10448	10%	1%
Corning	8813	24%	5%
AMD	8111	5%	7%
Alcatel	6475	28%	6%
Ericsson	6473	9%	4%
STMicroelectronics	5952	13%	0%
Nortel Networks	5481	49%	6%
Sun Microststems	4679	6%	0%
Nokia	4147	9%	2%

It is interesting to notice how even this very simple descriptive statistics reveals already quite significant differences among companies within the same industrial group. To better account for these differences we map the position of these companies across two variables in Figure 15. We define the first variable as "*Intensity of Reassignment Activity*". This variable is the ratio between the sum of reassignments in and out over the total number of patents originally granted to the company. The second dimension is the "*Reassignment Balance*". It is calculated simply considering the ratio between the difference of reassignments to a company and the reassignments from a company, over the total number of patents granted to a company.

The following table shows the relative position of the firms in this two dimensional space, by approximating the logarithmic distribution of "intensity" and the distribution of "balance" (the graph is not in scale). Four different profiles emerge.

FIGURE 15

Balance and intensity of patent trade in the IT Hardware industry. Patents reassigned between 1976 and 2003.



From the data in Figure 15, one can discern different firm profiles. The first profile is that of “Closed Innovation Technology Net-Buyers”. In the North-West quadrant we find firms with a positive balance of patent trade, as they reassign in more than out, but with a relatively small incidence of reassignment activity, with respect to the entire patenting activities. These companies are not very active players on the secondary market for technology, and their innovation system is probably relatively closed as a result. When they operate on the market of technology they are more likely to acquire, rather than selling patents. On average, also the balance of patents reassigned in and out is quite low, when compared to the intense internal patenting activity. Examples of these companies are NEC, HP, Fujitsu, Sun and Hitachi.

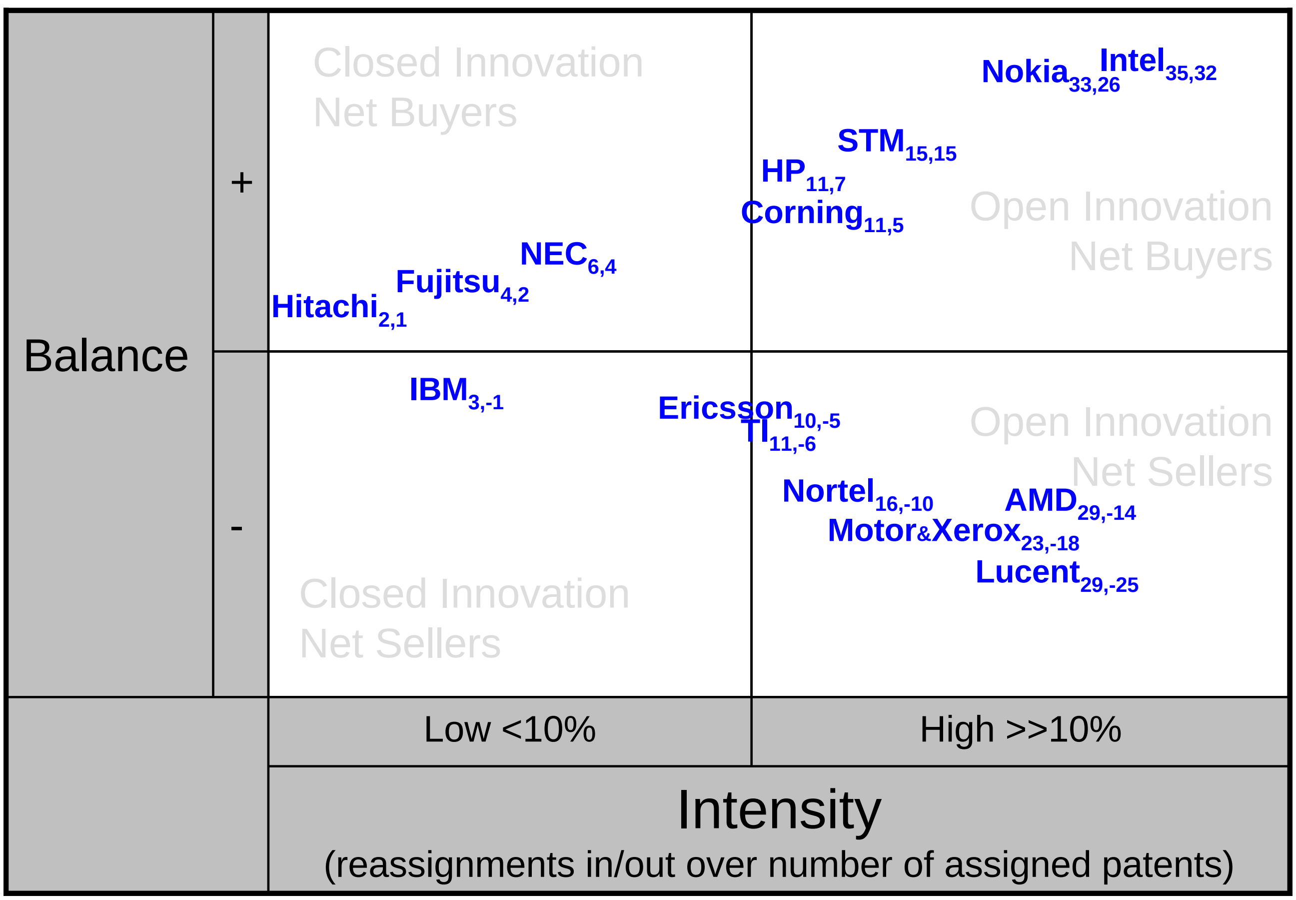
A second profile is “Closed Innovation Technology Net-Sellers”. The two firms in the South-West quadrant are characterized by extremely intense internal patenting activity and a very low level of reassignments. Companies such as IBM and to a lesser degree Texas Instruments (TI) are net providers of technologies. If IBM and TI are representative of this profile, their low level of reassignment activity may be a result of a high degree of licensing activity, which is an alternative way to monetize patent value.

A third firm profile is that of an “Open Innovation Technology Net-Seller”. The firms in this quadrant are characterized by an intense internal patenting activity, followed by frequent transfers of technologies to other firms at a later date. The case of Xerox is an exemplar of this quadrant. While they are very active sellers, these companies rarely seem to access the secondary market for technologies as buyers. They prefer to create internally, and sell externally.

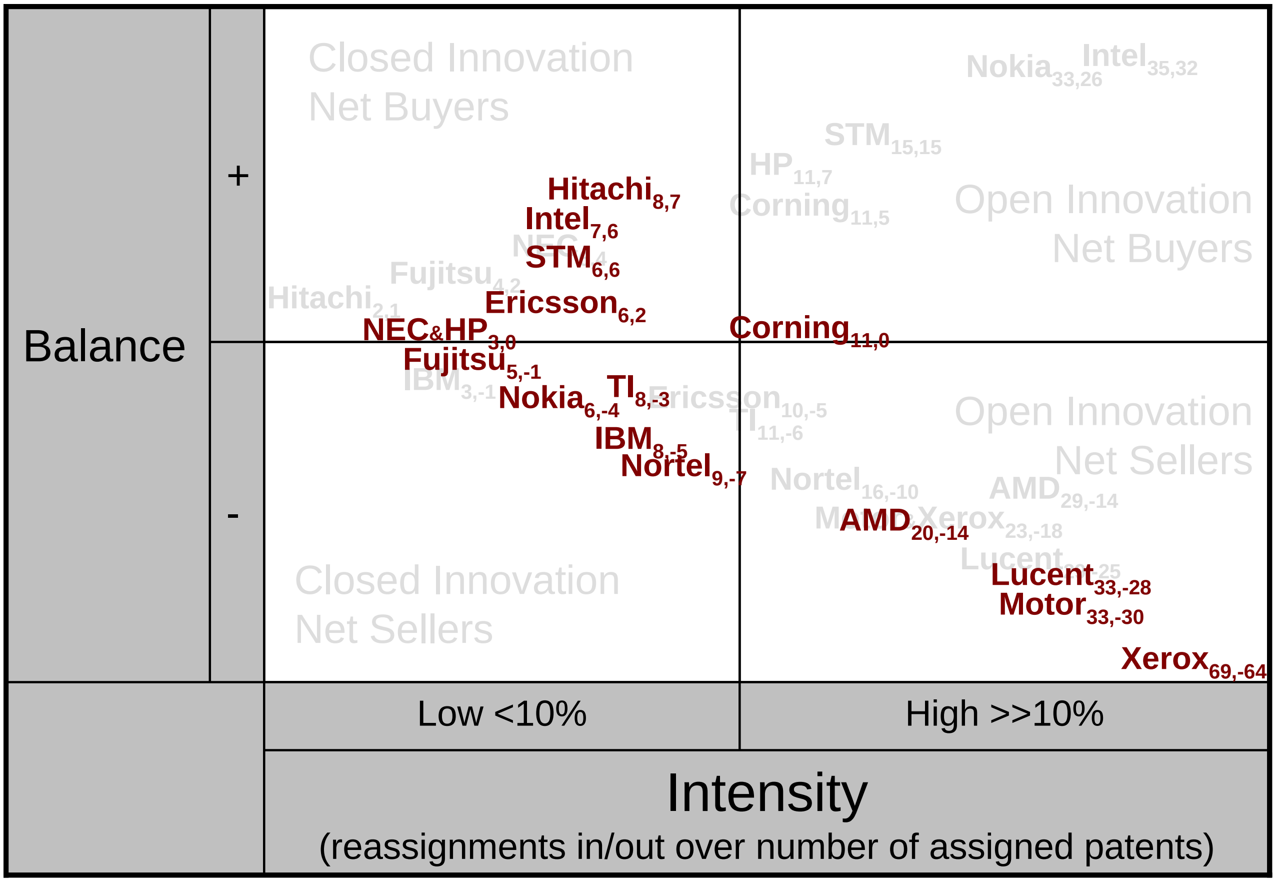
A fourth firm profile is that of an “Open Innovation Technology Net-Buyer”. The companies in this quadrant are characterized by a level of internal patenting which is relatively small, at least when compared to other companies in their industry. While these companies "make" many of their technologies, they also "buy" many of them as well, especially in relation to others in their industry. These companies are extremely active buyers on the secondary market for technology, and they maintain a very high positive trade balance in terms of the number of patents acquired. Exemplars of this profile are STMicroelectronics (STM) and Alcatel.

Figures 16 and 17 examine how firms map into these profiles over time. Figure 16 compares the balance and intensity for a selected group of companies for reassignments in the decade of the 1980's, while Figure 17 updates the comparison for the 1990's.

<u>FIGURE 16 Balance and intensity of patent trade in the IT Hardware industry. Patents reassigned between 1980 and 1989.</u>



<u>FIGURE 17 Balance and intensity of patent trade in the IT Hardware industry. Patents reassigned between 1990 and 1999.</u>



While some of the firms maintain their positions unaltered (such as Fujitsu and IBM), others change significantly. In particular the 90's the quadrant of "Open Innovation Buyers" is almost empty. Among the firms whose position remains unaltered or is reinforced we find a group of Open Innovation Sellers. During the 90's, AMD Lucent, Motorola and Xerox are characterized by an even more negative (and in some of the cases more intense) balance. We interpret these data to imply that these firms are reducing their patent portfolio positions in this area of technology.

The Open Innovation New Buyers of the 80's kept a substantially positive balance during the 90's, but they decreased the intensity of their reassignment activities relative to internal patenting (this is the case of Intel, STM and HP). This may be related to a growing maturity of the industry. It is possible to imagine that these companies were exploring new technological sectors in the course of the 80's, when they were acquiring technologies they did not fully control. In the course of the 90's, these companies were probably investing more into "local searches", developing internally a larger number of patents. This is consistent with a life cycle theory of R&D investment, that the literature on absorptive capacity seems to suggest (Cohen and Levinthal, 1990). Hitachi is the only company in the course of the 90's that moves "North-East" (increasing both intensity and positive balance). Only Ericsson goes from a negative to a positive balance in the course of the 90's (with however decreased intensity).

3.7. Reassignments for the Semiconductor Patent Class

The preceding sections show only a limited amount of insight into the reassignment behavior of firms. This is because of the limits of the data, which do not reveal much information about why patents are being reassigned. The assignor has to indicate the reason why a reassignment takes place, but this information, as reported in the official document, does not disclose much of the characteristics and reasons behind the single transaction. In fact, most of the reassignments are labeled "Assignment of Assignor's interest". If we want to know more about these transactions, a detailed case by case analysis of each reassignment transaction is necessary. As noted above, this requires non-patent data to be considered alongside the self-reported reasons given by the reassignee for the reassignment of the patent.

To conduct such an analysis, we require the development of a taxonomy of reassignments, and we need to supplement reassignment data with other archival data regarding the firms involved in the transaction. In what follows, we will look at the reassignments that took place in the years 1994 and 2003, for patents in the semiconductor application industry class, known as H01L. Through archival research, such as Lexis-Nexis or Hoover's, we were able to find enough evidence to classify most of the reassignment according to the type of transaction already discussed:

- Standalone IP Transfer
- Transfer of IP bundled with other assets
- Transaction with independent inventors
- Licensing contracts
- Merging & Acquisitions
- Affiliated Company Transfers
- Security Agreement
- Transactions with research organizations or individuals
- Others
    - Correction and Book-keeping changes
    - Transaction with Employees
    - No significant information retrieved

We would note that this taxonomy remains far from satisfactory, in that the motivation for the reassignment is not directly stated. Our taxonomy is still limited by the self-reported categories of Form USPTO 1595. A survey of reassigned patents might help to elucidate these motivations. For now, we confine ourselves to utilizing the information noted in the USPTO reassignment form.

We can observe from figure 18 that in 1995 patents in the semiconductor patent class were reassigned for a variety of reasons. One of the leading reasons for reassignment does not seem to us to be particularly relevant to the hypothesis of a secondary market, namely the 20% of reassignments that happened between affiliated companies. These affiliated transactions likely reflect changes in internal organizational structures (such as the formation or dissolution of new subsidiary companies) or perhaps tax considerations for the domicile in which patent royalties are received. We will have little to say about these transactions, since they take us far from the areas we wish to explore.

FIGURE 18 Total reassignments 516

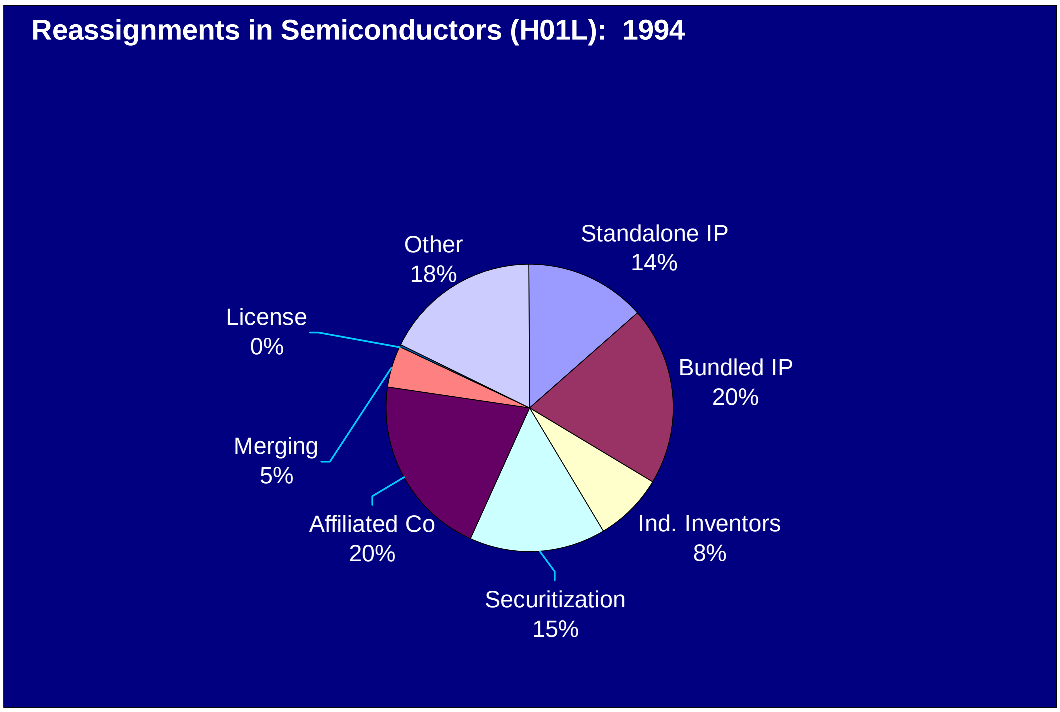
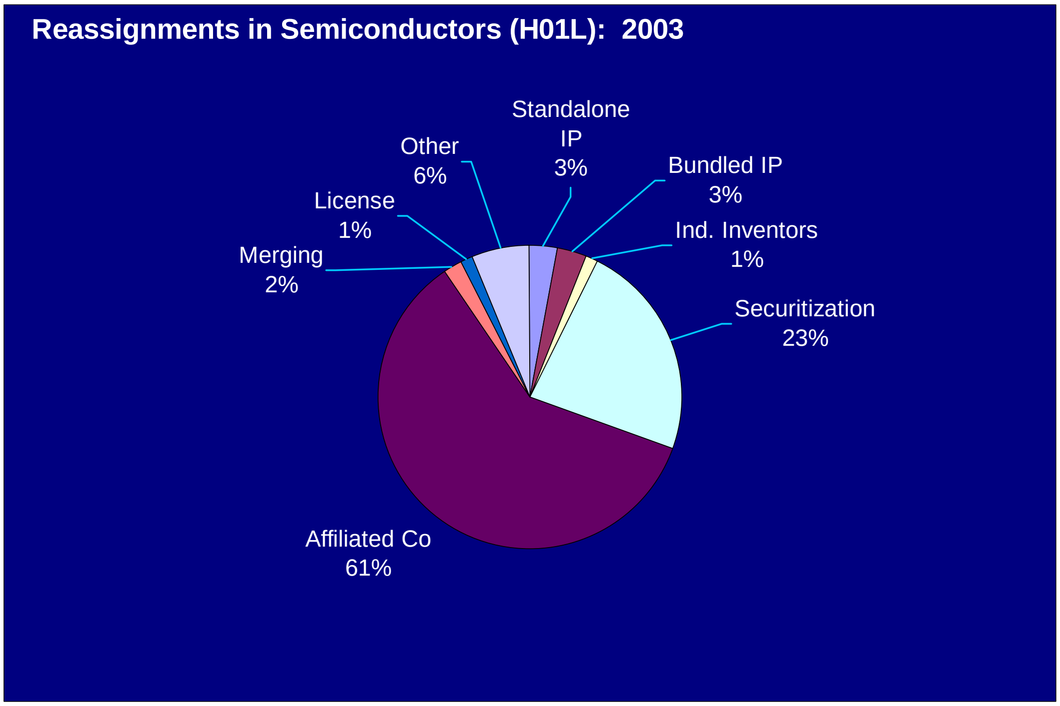


FIGURE 19 Total Reassignments 3891

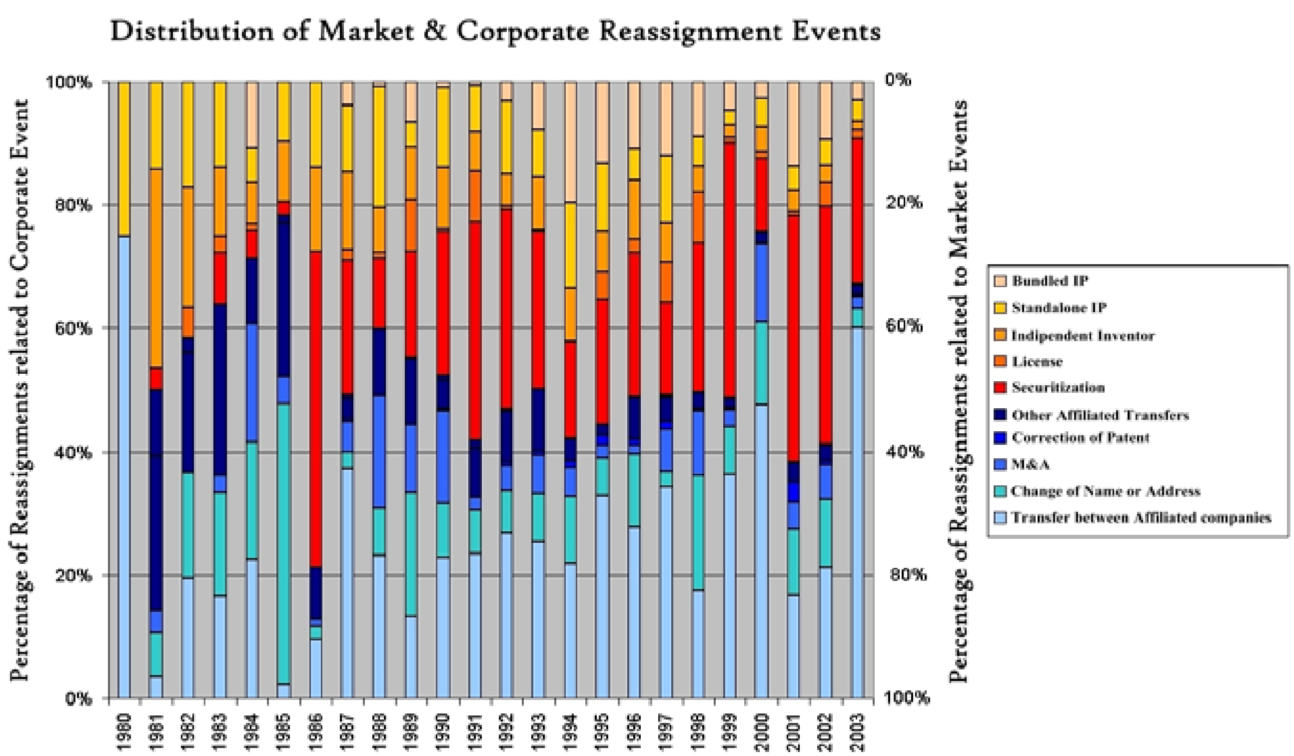


However, in 1995, about 34% of reassignments occurred for reasons that seem quite relevant to a potential secondary market, such as autonomous transfers of IP. Another very interesting category of transactions were “security agreements”. With the help of interviews with patent attorneys, we have learned that this refers to the practice of certain financial institutions receiving a security interest in one or more patents as collateral, usually to secure a loan of some kind. This securitization activity amounted to 15% of reassignments in 1995.

The picture in 2003 looks very different, as shown in Figure 19. By then the majority of reassignments happened between affiliated companies, rising to 61% of transactions. Securitization grew to be the second largest category, with 23% of all reassignments in that year. Standalone and bundled IP transactions decreased to 6%. From 1995 to 2003 there is also a significant drop in the number of reassignments from what were supposed to be independent inventors (from 8% to 1%). However this might be an overstatement, given the fact that we have included transactions to this category when the assignor was an inventor and we were not able to find evidence that the assignee was also her employer. Obviously it is much easier to find evidence for reassignments filed in 2003 than in 1995, given that we rely upon electronic sources for corroborating information of affiliations, etc.

The following graph in Figure 20 shows the distribution across times of the types of reassignments. The categories discussed so far are ranked according to their relevance to a market transaction and a corporate event. At the top of the graph (labeled with different tones of red) we have the reassignment types which are associated with a market transaction between independent organizations (Standalone, bundled IP, transactions with independent inventors, securitization). At the bottom of the graph (labeled with different tones of blue) we have reassignments related to a corporate event (change of name, affiliated patent transfer, corrections, M&A).

FIGURE 20

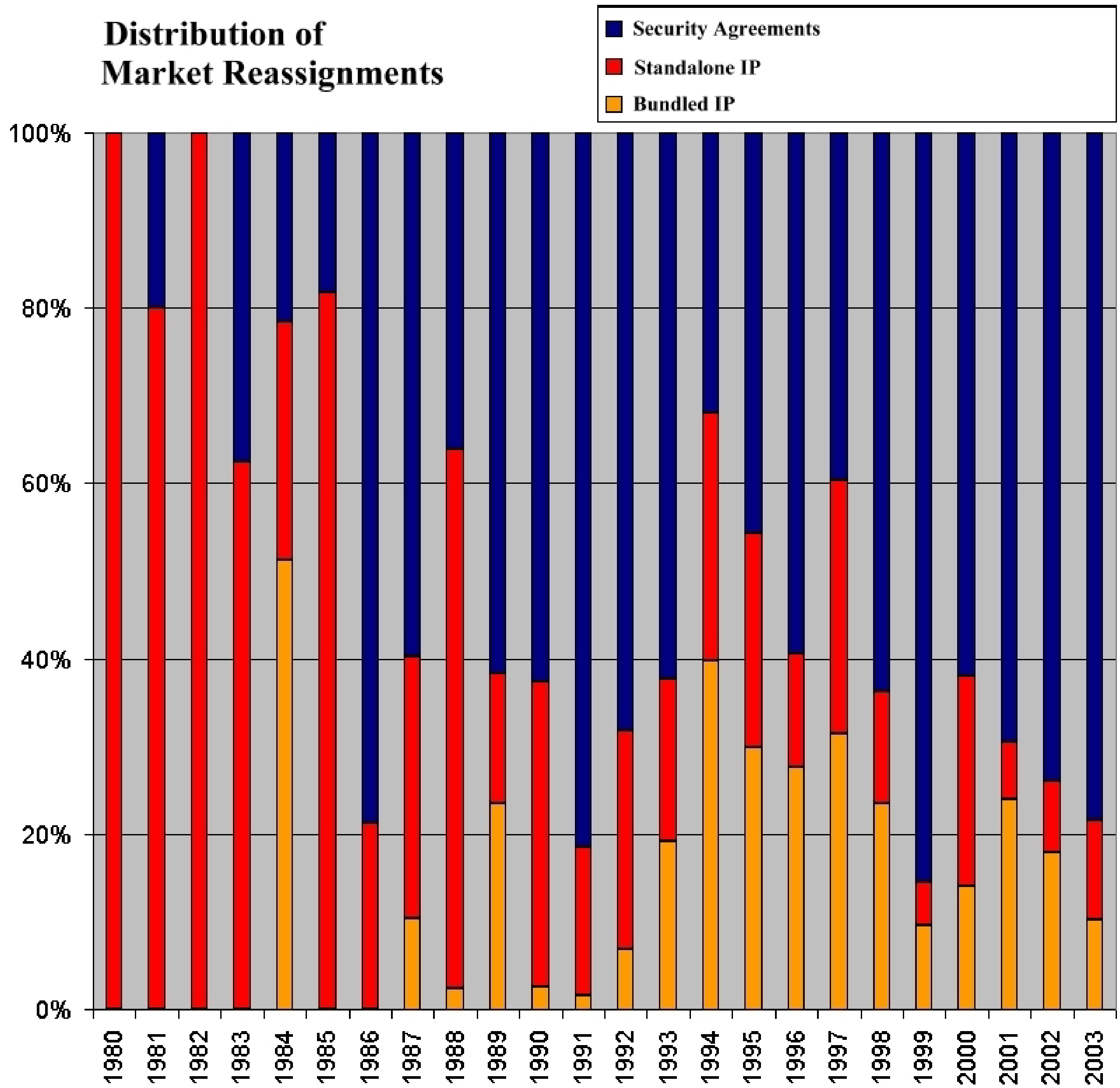


Some initial interpretations of firm level reassignment behavior

While the data are not conclusive by themselves, we can offer some initial interpretations by combining them with other observations of the semiconductor industry. The industry grew tremendously from 1995 to 2003, and new areas of specialization emerged during this time, even as many of the largest volume product categories consolidated. As Macher and Mowery (1998) have noted among others, this period also witnessed the rise of the so-called "fabless" model of semiconductor manufacturing, where newly entering design firms were able to contract with external semiconductor foundries to manufacture their designs. Our data show the rise in affiliated reassignments, which are consistent with a consolidating industry. We also find some evidence of specialization, as reassignments by inventors and by autonomous firms show. We may even have some indications of financial distress, as the increased level of securitization might be interpreted as one of the symptoms of the downturn in the industry after the burst of the bubble and the prolonged recession in the semiconductor industry that followed from 2000 through 2003. For example, Lucent and Xerox both encountered severe financial difficulty during this period. Both exhibited elevated levels of reassignment activity out of the company during this time, and we believe that much of this activity was related to collateralizing loans from financial sources with contingent reassignment of IP in the event of non-payment by those companies.

If we consider the market reassignments only, it is possible to notice the growing relevance of the securitization practice. Figure 21 considers the change of distribution between the various types of market reassignments. It is interesting to notice that in the years of major expansion of the semiconductor industry, bundled and standalone IP transactions represented the majority of market type reassignments. On the contrary, during years of crisis or turnaround, securitization of patents becomes a much common practice. The years 1986, 1991 and 1999, characterized by an approximate 80% of market type reassignments for securitization, were also the slowest years for the industry. By contrast, 1994 was one of the worst years for the semiconductor industry, with a large percentage of bundled and standalone IP transactions. So market reassignment activity in this industry appears to be inversely correlated with industry health and growth.

FIGURE 21



Along with Serrano's work (cited above), this study is one of the only studies of patent reassignment activity of which we are aware. Since this is such a new area of research, there is much more work needed to be done, before we can develop a clear understanding of what is going on. For the benefit of NCIPI, however, I have tried to offer my best interpretations of the data available so far. Assuming that NCIPI or others would like to extend this analysis, I have also included material on the limitations of the data, in hopes that they can go further than I have been able to do here.

Chapter 4

Reassignment Analysis of Japanese Patents

In this section, we attempt the first analysis of Japanese patent reassignments that has been conducted, to the best of our knowledge. The author was fortunate to receive excellent support and assistance from native Japanese speakers in this work. Their help was essential to carrying out this analysis.

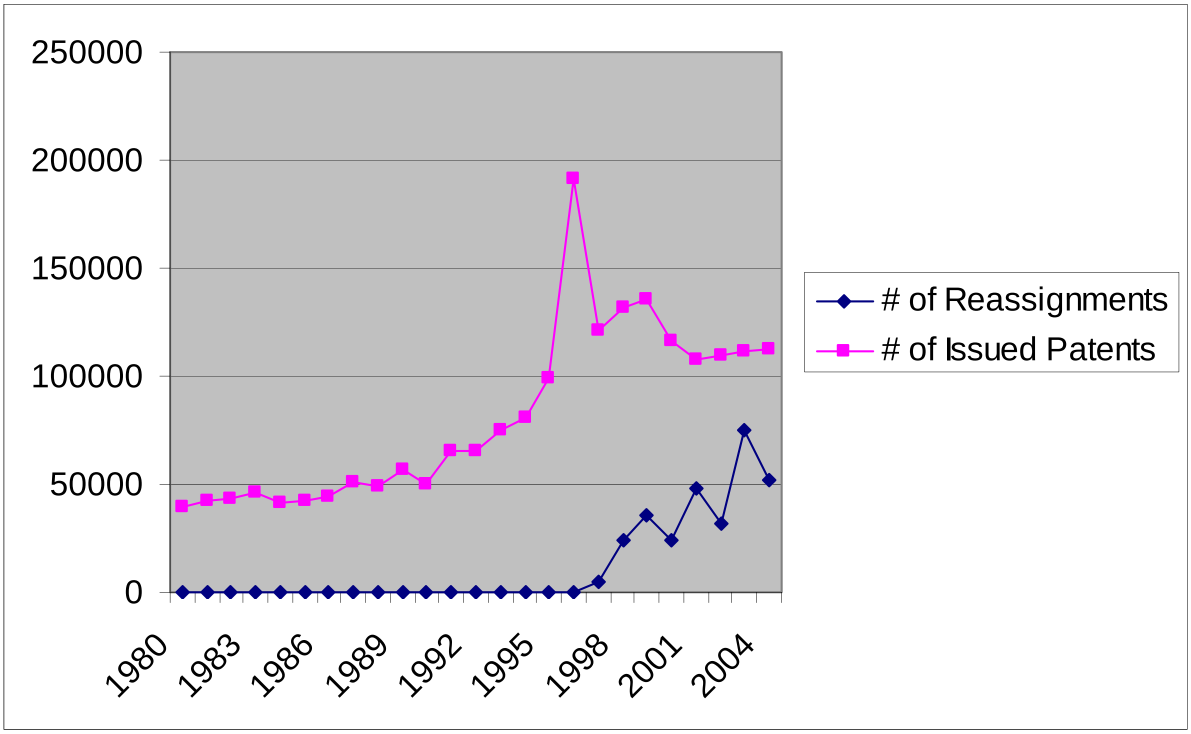
Like the USPTO, JPO also maintains a file on patent reassignments. But, a challenge to the data is that JPO does not have any of the reassignment information available in electronic form prior to 1997. As the US data also show, reassignment activity picked up substantially in the past decade, and the electronic data from 1997 forward will allow us to capture the majority of reassignment activity.

First Analysis: The Rising Reassignment Activity in Japanese Patents

Our first analysis was to inquire about the trend in reassignment activity among Japanese patents. The overall trend in reassignment activity is shown in Figure 22. Like the US data, there has been a rise in the number of issued Japanese patents, rising from fewer than 40,000 issued patents in 1980 to more than 110,000 in 2005. The reassignment of these patents only begins to be tracked in our data in 1997, owing to the lack of earlier reassignment data in electronic form. From the data that are available from 1997, reassignments also have risen sharply, from fewer than 5,000 in 1997 (which may or may not be a complete year's observations of reassignments) to more than 35,000 in 2005.

FIGURE 22

Issued and Reassigned Japanese Patents: 1980-2005



While the number of patents are increasing, and the number of reassignments is also increasing, what is the trend for the overall rate of patent reassignments? Figure 23 shows the answer to this question. As with the US patents, we construct the number of Japanese patents that are a) still valid and in force, and b) therefore able to be reassigned. We sum all patents that have been issued for the previous 17 years for our denominator. We then divide the number of reassignments by this denominator to calculate the reassignment rate.

FIGURE 23

Reassignment Rate of Japanese Patents: 1997-2005

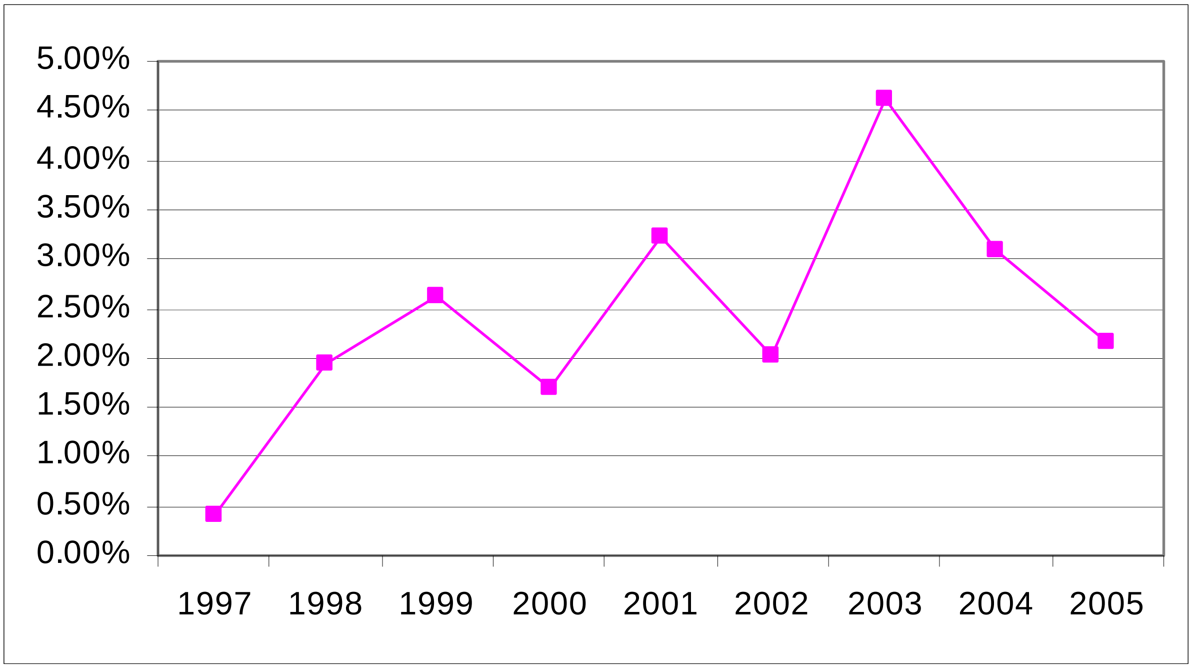


Figure 23 shows that the reassignment rate for Japanese patents has increased since 1997, from a rate of less than 0.5% in 1997 to more than 2% in 2005. It also shows a "sawtooth pattern", rising up and down every other year. While the overall trend is clearly up, there is more volatility in these data than in the US data shown in Figure 10. There appears to be a spike of reassignment activity in 2003, and we don't understand the reasons for the spike. However, 2004 and 2005 are more in line with the longer term trend.

Top Japanese Patent Reassignment Firms

Our next analysis considers the top firms in Japan who assign patents out, and those who receive them in. Another data limitation arises here, similar to the one we reported in the US data and illustrated in Figure 3. The JPO data enable us to identify the original patent holder, and the current recipient of the reassigned patent. However, there are reassignment gaps, as in Figure 3, where another patent reassignment may have occurred that was not captured in our data.

Figure 24 shows the top 10 firms that are most active in Japanese patent reassignment activity, either as recipients of patents assigned from others, or as the initial holders of patents that were assigned out of the company.

FIGURE 24

Top 10 Firms in Receiving or Assigning Out Japanese Patents

Rank	Present patent holder (Patent assignee)	# of Reassignment from 1997 to 2005	Present patent holder (Patent assignee)
1	ＪＦＥスチール株式会社	5598	JFE Steel Corporation
2	ＮＥＣエレクトロニクス株式会社	4032	NEC Electronics Corporation
3	独立行政法人新エネルギー・産業技術総合開発機構	2923	New Energy and Industrial Technology Development Organization (NEDO)
4	住友化学株式会社	2567	Sumitomo Chemical Co.,Ltd
5	コニカミノルタホールディングス株式会社	2189	Konica Minolta Holdings, Inc.
6	株式会社日立製作所	1995	Hitachi, Ltd.
7	独立行政法人産業技術総合研究所	1990	onal Institute of Advanced Industrial Science and Technology (AIST)
8	日本電気株式会社	1771	NEC Corporation
9	株式会社ルネサステクノロジ	1685	Renesas Technology Corporation
10	株式会社東芝	1585	Toshiba Corporation

Rank	Initial patent holder (NOT ASSIGNER)	# of Reassignment from 1997 to 2005	Initial patent holder (NOT ASSIGNER)
1	日本電気株式会社	9119	NEC Corporation
2	株式会社日立製作所	5080	Hitachi, Ltd.
3	ＪＦＥスチール株式会社	4637	JFE Steel Corporation
4	工業技術院長	4124	Industrial and Technology institute?
5	株式会社東芝	2914	Toshiba Corporation
6	住友化学株式会社	2621	Sumitomo Chemical Co.,Ltd
7	ＪＦＥエンジニアリング株式会社	2528	JFE Engineering Corporation
8	コニカミノルタホールディングス株式会社	2262	Konica Minolta Holdings, Inc.
9	三菱自動車工業株式会社	2171	Mitsubishi Motors Corporation
10	旭化成株式会社	1714	Asahi Kasei Corporation

As Figure 24 shows, many of the leading recipients of transferred patents are Japanese IT companies, such as NEC, Hitachi, Renesas, Toshiba, and Fujitsu. Other leading firms come from the chemicals industry (Sumitomo) or the steel industry (JFE). Two of the top 10 recipients, though, are quasi-governmental organizations, NEDO and AIST. There is no equivalent kind of firm among the top recipients of US patents. This is a distinctive characteristic of the Japanese innovation system.

The figure also shows the top 10 organizations that assign out patents. Note that these are based on the original patent owner, not necessarily the most recent owner. What is fascinating about this list is that most of the organizations are the same ones that were in the top 10 receiving patent reassignments. This is consistent with a pattern seen in the US reassignment data as well: much of the reassignment activity occurs between affiliated entities within large organizations. Such activity is not really part of a secondary market. Rather, this activity suggests a dynamism inside large organizations, as they restructure and reconfigure their businesses (and associated patents) for new challenges.

These data invite a further question: why do reassignments occur? Like the USPTO data, the JPO data record self-reported information on the reasons for reassignment. Figure 25 shows the total number of reassignments, and the self-reported reason given for the reassignment. It further shows our approach to aggregating these reasons into a smaller set of categories for the analysis that follows Figure 25.

FIGURE 25

Self-Reported Reasons for Reassignment of JPO Patents (2 pages)

Reassignment Type	Sum	Reason	Detail
R311801	175	Abandonment	Application for cancellation of ownership (Abandonment)
R311802	373	Abandonment	Application for partial cancellation of ownership (partial abandonment)
R313111	63412	Merging	Application for change of ownership (Inheritance and merging)
R313113	42849	Transfer	Application for change of ownership (Cession)
R313114	5173	Transfer	Application for change of ownership (Joint ownership)
R313115	16003	Merging	Application for change of ownership (Equity inheritance and merging)
R313117	15324	Transfer	Application for change of ownership (Equity transfer, abandonment)
R313118	237	Transfer	Application for change of ownership (Joint equity ownership)
R313121	18	Transfer	Application for change of ownership (Joint equity ownership)
R313131	750	Transfer	Application for trust registration for change of ownership (Agreement)
R313132	1	Transfer	Application for trust registration for change of ownership (Cancellation)
R313531	84640	Change Name/ address	Application for change of registered information(Address)
R313532	6676	Change Name/ address	Application for change of registered information(Address)
R313533	87288	Change Name/ address	Application for change of registered information(Name)
R313534	2	Change Name/ address	Application for change of registered information(Nationality)
R313631	2636	Correction of Patent	Application for reorganization of registered information(Address)
R313632	112	Correction of Patent	Application for reorganization of registered information(Address)
R313633	1844	Correction of Patent	Application for reorganization of registered information(Name)
R313634	15	Correction of Patent	Application for reorganization of registered information(Nationality)
R314201	1674	License	Application for licensee registration (Contract, agreement)
R315201	1783	License	Application for non-exclusive license registration (Contract, agreement)
R315211	10	License	Application for non-exclusive license registration (Accession, Merger)

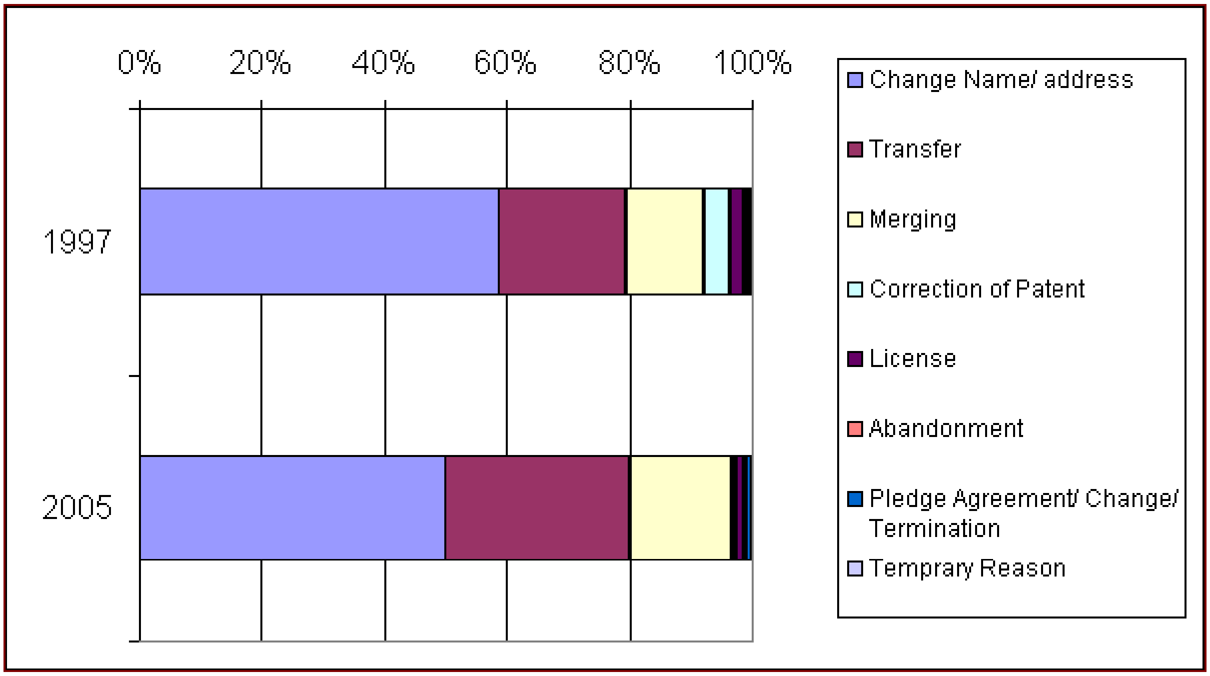
R315213	9	License	Application for change of non-exclusive license (Cession)
R315221	14	License	Application for non-exclusive license registration (Change Contract)
R316303	828	Pledge Agreement/ Change/ Termination	Application for pledgee registration (Contract)
R316304	206	Pledge Agreement/ Change/ Termination	Application for root pledgee registration (Contract)
R316311	49	Pledge Agreement/ Change/ Termination	Application for pledgee reassignment (Accession, merger)
R316313	4	Pledge Agreement/ Change/ Termination	Application for pledgee reassignment (Accession, merger)
R316314	6	Pledge Agreement/ Change/ Termination	Application for pledgee reassignment (Partial cession)
R316321	145	Pledge Agreement/ Change/ Termination	Application for change of pledgee (Change contract)
R316350	6	Pledge Agreement/ Change/ Termination	Application for change of root pledgee (Change contract)
R316531	3	Change Name/ address	Application for change of registered information(Address)
R316533	3	Change Name/ address	Application for change of registered information(Name)
R316631	10	Change Name/ address	Application for reorganization of registered information(Address)
R316633	30	Change Name/ address	Application for reorganization of registered information(Name)
R316803	195	Pledge Agreement/ Change/ Termination	Application for pledgee release (Cancellation, reimbursement)
R316805	60	Pledge Agreement/ Change/ Termination	Application for pledgee release (Abandonment)
R316F99	0	Temprary Reason	Temporary application
R316H99	1	Temprary Reason	Temporary application (advance registration)

Figure 25 shows the JPO listed reassignment categories, and how often each of these categories was checked by an organization reassigning a patent. The largest categories given in these data are: Change of Name (or Address); Merging; and Transfer. Only the last of these three categories is directly relevant to a secondary market. More work with non-patent information (such as Lexis-Nexis or an equivalent Japanese online source of company activity) is needed to establish whether these transfers are between affiliated firms or are instead between arms-length parties. This work is time-consuming, and must be done with care by someone who reads Japanese and is knowledgeable about Japanese business relations.

Casual inspection reveals that many of the JPO reassignment categories are redundant, or nearly so. In Figure 26, we propose a way to group these highly similar categories together, to identify the main patterns in the reasons for reassignment. Thus all the Change Name and Change Address fields are collected together into one grouping. Similarly, the different Merging and Transfer fields are brought together as well. Note that these three groupings comprise more than 95% of all reassignment activity.

FIGURE 26 – A Proposed Grouping of Reassignment Reasons: 1997-2006

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Change Name/ address	2844	13534	25824	13832	21571	16835	37093	28192	18927	3973
Transfer	1011	4217	6352	7051	7221	9136	9705	8231	11428	615
Merging	613	4658	1826	1759	18014	4639	27333	14305	6268	117
Correction of Patent	219	1329	527	547	351	310	252	760	312	11
License	103	312	555	429	480	360	401	384	466	76
Abandonment	35	48	95	79	85	80	47	32	47	5
Pledge Agreement/ Change/ Termination	29	160	84	143	139	173	160	188	423	13
Temprary Reason	0	1	0	0	0	0	0	0	0	1



As the bar chart at the bottom of Figure 26 shows, the bulk of the reassignment activity relates to Changing Names/Addresses. This is not evidence of a secondary market for patents, but evidence of the housekeeping associated with restructuring the IP portfolios of dynamic large organizations. Likewise, Merging reflects the need to update the assignment of patents, once a merger has taken place. In a true secondary market for patents, patents would be able to trade without having to bundle them with underlying businesses.

The Transfer category is more promising though. Here there is a transfer of a patent, not simply cleaning up the names or addresses, and not just reflecting the aftermath of a merger. If one had non-patent data from online search sources, one could assess the extent to which these Transfers were associated with reasons that are consistent with a growing secondary market for Japanese patents. All that can be said about this for now, given the absence of non-patent data, is that the Transfer category is growing from 1997 to 2004, from just over 20% to over 30% of all patent reassignments. It might be worth further investigation with non-patent data, to evaluate the reasons for the growth in Transfer-related reassignments.

Evidence of Japanese Patent Reassignment Activity within the Semiconductor Patent Class

The analysis above discusses all reassignment activity for all issued Japanese patents. In this section, we evaluate the reassignment activity for a single international patent class, class H01L, for semiconductors. It is likely that patent reassignment activity will vary by industry, and the semiconductor industry is one industry where there is likely to be a large amount of activity.

Figure 27 below shows the trend of Japanese patent reassignments for the H01L class. The reassignment rate in this class is growing, in a pattern very similar to the pattern for overall Japanese reassignments, from about 0.5% in 1997, to more than 2.0% by 2005. There is a spike in the data for the year 2003. We have reviewed the calculation and the inputs to be sure that this is correct, and we can find no error in the calculation. We have no good explanation for the spike (which also occurred in the overall Japanese data for 2003), and note that the trend reverts to the longer term trend line in 2004 and 2005.

Figure 28 shows the data for the Top 10 firms receiving Japanese patent assignments and assigning out patents that they originally owned. As would be expected, the top 10 firms consist primarily of leading Japanese IT companies. NEC affiliated companies alone occupy 4 of the top 10 spots both in receiving assignments, and in assigning out patents. NEDO again appears as a leading recipient of Japanese patents, though no quasi-governmental body makes the top 10 in assigning out patents.

FIGURE 27 – Total Number of Japanese Patent Reassignments, IPC H01L, 1997-2005

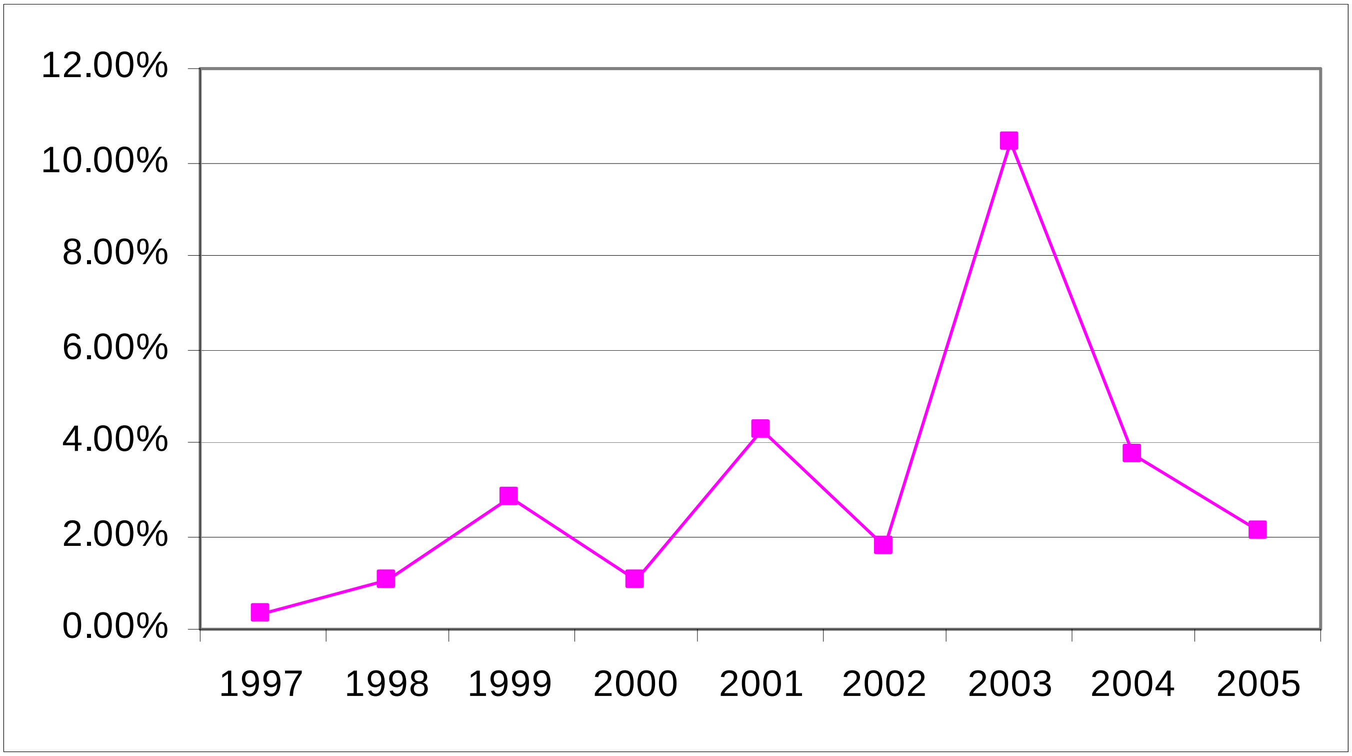


FIGURE 28 – Top Ten Firms Reassigning Japanese Patents: 1997-2005, H01L Patent Class Only

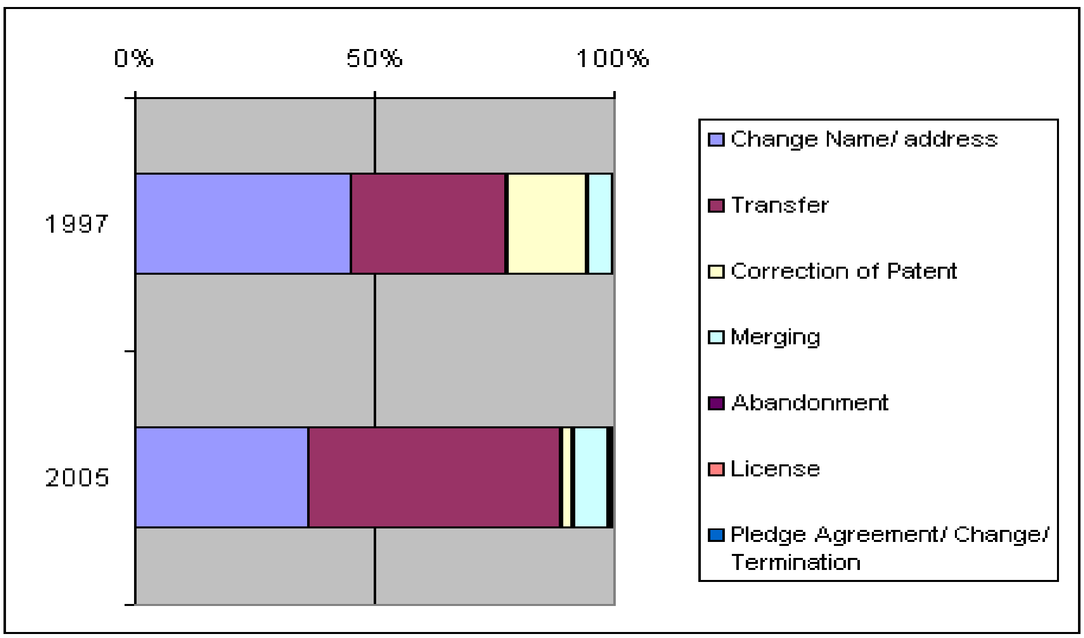
Rank	Present patent holder (Patent assignee)	# of Reassignment from 1997 to 2005	Present patent holder (Patent assignee)
1	ＮＥＣエレクトロニクス株式会社	2122	NEC Electronics Corporation
2	株式会社ルネサステクノロジ	795	Renesas Technology Corporation
3	独立行政法人新エネルギー・産業技術総合開発機構	651	New Energy and Industrial Technology Development Organization (NEDO)
4	ＮＥＣ化合物デバイス株式会社	461	NEC Compound Semiconductor Devices, Ltd.
5	松下電器産業株式会社	307	Matsushita Electric Industrial Co., Ltd.
6	ＮＥＣマイクロシステム株式会社	206	NEC Micro Systems,Ltd.
7	日本電気株式会社	184	NEC Corporation
8	株式会社東芝	165	Toshiba Corporation
9	三洋電機株式会社	159	Sanyo Electric Co.,Ltd.
10	三菱住友シリコン株式会社	151	Sumitomo Mitsubishi Silicon Corporation

Rank	Initial patent holder (NOT ASSIGNER)	# of Reassignment from 1997 to 2005	Initial patent holder (NOT ASSIGNER)
1	日本電気株式会社	2820	NEC Corporation
2	株式会社日立製作所	772	Hitachi, Ltd.
3	三洋電機株式会社	355	Sanyo Electric Co.,Ltd.
4	株式会社東芝	339	Toshiba Corporation
5	三菱電機株式会社	322	Mitsubishi Electric Corporation
6	ＮＥＣマイクロシステム株式会社	270	NEC Micro Systems,Ltd.
7	松下電子工業株式会社	260	Matsushita Electronics Corporation
8	九州日本電気株式会社	142	NEC Kyushu
9	山形日本電気株式会社	122	NEC Yamagata
10	セイコーインスツル株式会社	112	Seiko Instruments Inc.

In Figure 29, we performed the same groupings that we did for the overall Japanese patent reassignment activity, this time just for the H01L patent class. As Figure 29 shows, Name/Address Changes again comprise the bulk of reassignment activities. Mergers are again an important factor. Transfers, however, are not only important, but have grown to become a far more substantial portion of reassignments in this patent class than they have overall. In 1997, Transfers amounted to about one-third of reassignments in the H01L class. In 2005, Transfers rose to become more than half of all reassignments in that class. Thus the trend of increasing prevalence of Transfers in the overall reassignment data is amplified in the H01L class.

FIGURE 29- Reasons for Reassignment of Japanese Patents, H01L Patent Class Only

Reassignment Type	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Change Name/ address	67	250	1245	359	626	284	1348	723	581	140
Transfer	48	145	125	233	304	270	914	356	853	9
Correction of Patent	25	4	7	12	28	5	11	230	37	0
Merging	8	103	136	19	1748	615	5237	1464	123	0
Abandonment	0	0	7	1	1	2	0	0	0	0
License	0	1	17	2	5	27	7	15	15	2
Pledge Agreement/ Change/ Termination	0	1	1	1	0	11	18	7	0	0



Conclusion

Reassignments of Japanese patents are increasing, just as reassignments of US patents are growing. Most of this activity does not appear to be associated with a growing secondary markets for patents (i.e., Changing Names/Addresses, or Merging). However, the Transfer category is a large and growing reason for reassignments of Japanese patents. This increase appears in the overall Japanese patent data, and comprises the majority of reassignments in 2005 for the H01L patent class in semiconductors. More non-patent data would be needed to understand the more precise reasons for reassignment, but these data are consistent with a growing secondary market for IP.

However, a secondary market needs more than mere numbers. It needs information and connections to foster the beneficial exchange of patents from one firm to another. In the next chapter, we will examine four such "patent intermediary" firms.

Chapter 5

Patent Intermediaries in the US Market

Chapters 3 and 4 of this report document the reassignment of patents going on in both the US and in Japan. Another important vantage point for this activity, though, is to consider the emergence of a new class of firms that now are operating in the patent market. I refer to these new players as “patent intermediaries”, because they act as brokers or agents, and sometimes as owners, and facilitate the exchange of patents. In other words, they help to “make the market” for patents.

My discussions with knowledgeable people in Japan from JPO and from industry indicate to me that such patent intermediaries are not nearly so active in Japan. For this chapter, therefore, I will confine my analysis to activities and firms underway in the US.

5.1. Scouting for Ideas: Leveraging University Relationships

One important role for patent intermediaries is to help cultivate deep and ongoing university relationships. Faculty members typically are domain experts in fields that are potentially useful to many companies. Farsighted companies take the time to identify the academic thought leaders in the fields that they care about. Then, they invest time to get to know these thought leaders, offering to visit their classrooms to help them teach, and offering donated equipment, tools, and services to assist their research. Once a relationship has been formed, these thought leaders can help companies identify promising graduate students for summer internships, and later, possible employment offers.

University thought leaders can also play an important role for the company by serving on a technical advisory board (TAB). These boards are sometimes little more than window-dressing for the company, to make the company’s technology look more impressive. That is a waste of a potentially valuable resource. Some TABs play a vital role for their companies, by providing an independent perspective on technical trends and developments. These companies review their long term product development roadmaps with their TABs on at least an annual basis. External TAB members often know of other developments that the company itself had not heard of yet. They also may differ from the conventional wisdom inside the company about whether a technology is ready for commercial use or not. Unilever invites select university faculty into its labs in Manchester, England on a periodic basis, where they wander around and talk to individual researchers about their projects. These highly informal contacts stimulate the academic, and the academic in turn occasionally connects one project within a Unilever lab to a different project that the individual researchers did not know about previously.

An intermediary who has developed highly effective processes for working with universities and university technology is Utek.[101] Utek works with universities to create and launch new companies to commercialize promising university-based technologies. Utek's focus as an organization is clear from its Mission Statement on its website:

"UTEK Corporation is dedicated to building a strong bridge between university technology and companies that can bring useful new ideas to the marketplace. We strive to inspire our partners to push the envelope of technology to introduce new developments that improve the quality of life and create lasting value."

Utek was founded in 1997, and is based in Florida. The primary business for Utek is crafting technology transfer deals to take projects from the university to a pre-selected corporation via a specially created venture company. In doing this function, the company does not invest in its own R&D. Instead, they rely upon the corporate partner to invest whatever funds are needed to carry the university research through into the market.

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[101] This section incorporates material from chapter 7 in my forthcoming book, Open Business Models, HBS Press, 2006

UTEK is led by a former University of South Florida professor, Clifford Gross. Dr. Gross owns 34% of the company personally, and functions as the CEO and Chairman of the company. Gross himself has been an inventor, and has experienced first-hand the many problems that universities have in trying to commercialize university research.

To illustrate the problem that UTEK was created to solve, Gross points out that in 2003, the nation's top 200 universities reported approximately 15,500 new inventions. Approximately 70% of these inventions went unlicensed.[102] "This is a profound waste of human creativity and invention," said Gross. Gross is passionate on this subject, and recently wrote a book called "The New Idea Factory", as well as other books that explain the process of technology transfer to entrepreneurs.

What is brilliant about Utek is how it has crafted a business model that fits comfortably with the limits of both universities and startup companies in transferring technology from one to the other. Universities, for example, have no cash to invest themselves in commercializing a technology, and they similarly have no interest or expertise in managing equity stakes in small startup companies. Universities like royalties, because they provide an ongoing source of financial support to the activities of the university, without exposing it to any of the liabilities associated with owning illiquid equity stakes in young companies.

Small and midsize companies also face sharp constraints in technology transfer out of universities. For starters, they often don't know what technology there might be that would be helpful to them. For another, they also lack the cash necessary to buy a technology from the

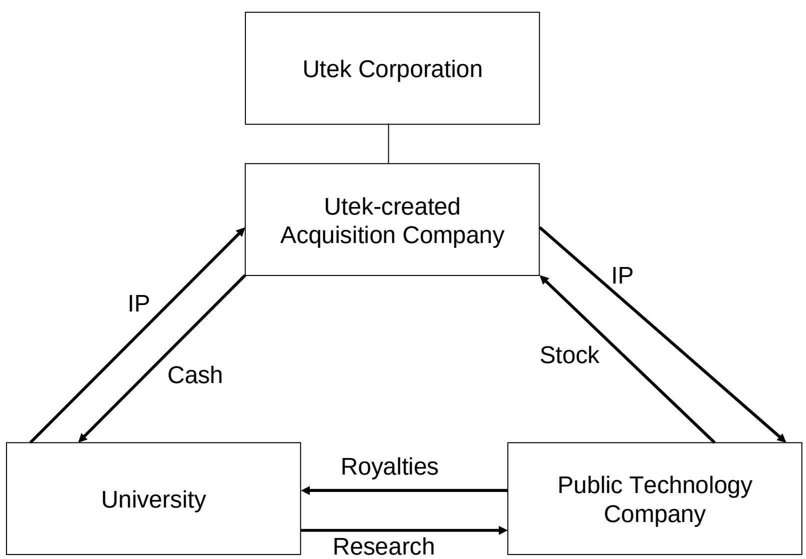
[102] In Chapter 3, we examined the low rate of utilization of patented technologies inside of companies. Here, a similarly low utilization rate is observed for invention disclosures within universities. Note, though, that invention disclosures must be patented prior to their being licensed. A more directly comparable statistic to the utilization measure in Chapter 3 would be to find out what percentage of invention disclosures are patented, and then what percentage of patented inventions are subsequently licensed. At UC Berkeley, for example, the university policy is to have one or more corporate partners defray the costs of patenting. So few of the patented inventions go unlicensed, since the corporation would not pay for the patenting costs unless it already had obtained a corporate sponsor to license the technology subsequently.

university, even if they did identify a promising technology. They also lack the time, experience, and patience needed to negotiate with university technology licensing offices to obtain access to a promising technology. Only large companies typically can develop these skills.

This is where Utek enters, with a cleverly adapted business model that bridges these widely separate parties. Figure 30 below depicts this model in action.

Figure 30

Utek Business Model



As the Figure shows, Utek acts as an intermediary between the university and the public technology company. Utek creates a specific acquisition company for every project that they work on. While Utek doesn't invest directly in technology development or in research, one area where it does invest directly is in building connections to leading academic researchers. This extensive academic network of contacts is used to stay abreast of promising technologies underway in various universities around the US. This is the intellectual feedstock for Utek, when it approaches small public companies that are looking for a technology differentiator. As of mid-

2005, this $7 million company had a Scientific Advisory Board of 35 people! So this is an area of real investment for the company, and one that would be difficult for small technology companies to replicate on their own..

In parallel with their extensive academic network, Utek identifies small technology companies who could benefit from an infusion of technology. As they work with the company, and identify its key technical capabilities, it looks for university research projects that are close enough to the company's skills that the company could commercialize it successfully. Since the company lacks cash to pay upfront, Utek establishes an acquisition company that takes a (typically minority) equity position in the young company upon completion of the transaction. They work with the university to transfer out the technology, being careful NOT to identify the intended recipient of the technology until the closing of the transaction. Utek's acquisition entity advances the cash to the university, receives the IP rights to the research, then transfers these rights to the technology company recipient, in return for equity. The recipient takes the commercial risks of applying a technology in their business, and to create pull through demand for the technology.

To give a concrete example, suppose Utek identified a young public company (typically listed on the Nasdaq OTC (over the counter) exchange) in the industrial cleaning business, who is competing against big industrial cleaning companies like Aramark. Suppose further that, thanks to their extensive academic network, they find a prion-based cleaning technology out of the University of Alabama. Utek has the insight to realize that this little company would have a better investment story if they had a proprietary technology to compete against the Aramarks in the cleaning industry.

So Utek approaches the cleaning company with the opportunity to differentiate themselves in the market and develop a stronger investment thesis for investors. Moreover, Utek will take its payment in stock, not cash, say at a rate of $10K a month for a year, cancellable on 30 days' notice. Utek and the company sign an agreement.

Then Utek approaches the University of Alabama, and negotiates for exclusive rights to the prion-based cleaning technology. UTEK pays the cash signing fee to the University in return for the technology rights. UTEK in turn sells the rights to the technology to their client in exchange for equity in the company, as per the agreement they signed above. Then the client company goes to their investment bank with the new technology, and the investment bank helps raise the money to pursue the technology (perhaps through a private placement or a secondary offering), and the stock value (hopefully) goes up as news of the new technology gets out. Utek cashes out its initial position, or perhaps it keeps a portion of the equity for further appreciation. So Utek's model requires them to function as a technology scout, a broker, and an investment banker, at various points in their business. In 2004, they had more than 10 agreements with technology companies, to help them identify and obtain promising university technologies for their businesses.

Under Gross' leadership, Utek is clearly on to something. Though only 8 years old, Utek generated more than $7 million in revenues and profits of more than $300,000 in 2004, supported by just 29 staff as of Dec. 31, 2004. The financial markets see the promise of much more success, assigning the young company a market capitalization of more than $112 million (an incredible 16 times 2004 revenue) as of July 26, 2005. . In addition to its small staff, the company spent only $50,000 on its own R&D in 2004.[103]

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[103] " the total capital invested in our intellectual property acquisition companies during the year ended December 31, 2004, $50,000 was expended on research and development costs, $753,700 was expended on license and consulting fees, and $347,500 remained in our intellectual property acquisition companies at the time they were sold to our portfolio companies. All of these items are reflected in the Consolidated Statement of Operations as sales and marketing expenses." Source: Utek 2004 10K, p. 21

5.2. Applying a Broker Model to Industry

Utek also applies its model to act as a patent intermediary between industrial companies. TRW is a good example of this. They were approached by a maker of gallium arsenide chips to gain access to their IP on RF technology for commercial purposes. This little company couldn't raise much capital on its own, so they said to TRW, give us access to your IP and your fab, and we'll give you 37% of the company. Armed with this IP and the fab, the company, RF Microdevices, goes public, and TRW cashes out its position at the top of the telecom boom at $675 million. TRW realized that it couldn't package and sell this technology to companies like Nokia and Samsung. So it was a tremendous win for them to partner with this small company to do that with the help of TRW's IP and know-how.

Raytheon is another example of engaging with an intermediary to monetize underused patents and IP, in this case the artificial sapphire that was initially developed for nosecones in aerospace. These were used in small volumes, and would never be scaled to a commercial business. Raytheon knew that they couldn't do this, so they contacted Utek to help them figure out how to commercialize this. Along with other patent mapping exercises, Utek helped them find a company, Surmet, who partnered with Raytheon to commercialize the Alon technology. Raytheon let out its IP to Surmet, in return for a piece of the venture, plus it gained a commercial volume supplier of this material, reducing its own costs of using the technology. So they got both lower costs internally and a piece of the upside externally if it hits.

5.3. Shanghai Silicon IP Exchange: An Unexpected Patent Intermediary

When one thinks of intellectual property in China, one's first impressions turn to phony Rolex watches, $2 DVDs for sale, and other evidence of extensive piracy. One certainly does not expect to find some leading edge practices that promote the identification and legal exchange of intellectual property in an industry like semiconductors. Yet this is exactly the purpose of the Shanghai Silicon Intellectual Property Exchange (SSIPEX).

SSIPEX is one of three centers created in China to facilitate the legal exchange of semiconductor IP. A sister center, called ICC, focuses on providing legal access for Chinese companies to design services platforms in semiconductors, such as EDA tools. Another sister organization, called ICRD, focuses on providing Chinese firms with authorized access to manufacturing process platforms, to help them build the designs they develop.

SSIPEX focuses on collecting, evaluating, and disseminating the technologies that bridge between the design of a new chip, and the foundry process that makes the chip. Like its sister organizations, SSIPEX is an IP intermediary. It operates by working with owners of semiconductor IP to accumulate libraries of manufacturing design tools, reference designs, and other useful knowledge. It then invites local Chinese companies to come in and try out this IP. If the Chinese company finds the IP useful, then SSIPEX helps to broker a license of the IP to the Chinese company. About 70% of the IP at SSIPEX comes from outside China, while 30% comes from within the country. It currently boasts more than 3000 individual pieces of semiconductor IP, making it the second largest commercial repository of its kind in the world. Unlike the repositories of private foundry firms (such as SMIC, the largest foundry in China), SSIPEX is open to all members, regardless of which foundry members choose to use for building their designs.

Though it may seem odd to Western readers, the reason that SSIPEX and its sister organizations were created is that the Chinese government strongly supports IP. A key issue that the Chinese government worries about is that many entrepreneurs do not know much about IP, and how best to use it. The government hopes that these Centers will allow entrepreneurs to use IP more effectively. The SSIPEX Center was built in 2003. It was funded by the Shanghai city government with 30 million RMB funding and the national government's Ministry of Industry and Information (MII) with 10 million funding RMB (this combined funding amounts to about US$ 5 million).

SSIPEX's revenue comes from three sources: first, a membership fee charged to companies who want access to the IP; second, a fee charged to IP owners who want to display their IP;, and third, transaction fees for brokerage transactions between the members and the IP owners. While the first two sources have been the dominant sources of revenue to date, SSIPEX expects the third source to grow as more Chinese companies learn about their services, and understand how to use them. The organization is only two years old as of this writing, with a budget of 10 million RMB, and a staff of 30 people.

While SSIPEX is still very young, it is beginning to make investments to add more value to its member companies, as they "kick the tires" on the extensive library of IP at the Exchange. The company now employs a handful of consultants and analysts to assist member companies. A new investment in 2006 will establish a laboratory inside SSIPEX. This laboratory will function as a "black box", such that customers can bring a sample of their design to the lab, and the lab will produce a partial layout (or other output, depending on the specific IP in question being tested). But the black box will prevent customers from seeing exactly how the output was obtained, and will keep them from trying to reverse engineer or otherwise appropriate the technology. So the customer will get more detailed information on the value of the IP he is trying to use, while the IP owner will remain protected from misappropriation.

How will the SSIPEX evaluate its own performance? The answer is going to be determined by its owners: the city of Shanghai and the MII. Both want to streamline the legal transfer of IP in the semiconductor industry, and make it as transparent and economical as possible. And the owners also want to promote the greater development of semiconductor IP in China, which they believe will enable the IC industry to grow. In addition, SSIPEX must achieve breakeven financial performance in 2006.

While the SSIPEX is an exciting experiment in innovative ways to facilitate the exchange of IP, the organization nonetheless faces some daunting challenges. One problem is that SSIPEX's customers are neither strong nor large, they are small companies. In China, many people believe that labor is cheap, so they think that it is more affordable to develop IP by their own. There is no appreciation among these companies that leveraging external IP could save time and improve the quality of the resulting product. This mentality is widespread, and will require extensive education before many companies will reconsider.

Another challenge is the underdeveloped legal system standing behind the legal protection of IP. SSIPEX takes careful steps to ensure that the IP it offers is legally obtained. However, it does not have the resources to monitor the usage of the IP by the small Chinese companies that are its customers. If the customers were illegally reselling or otherwise transferring the IP to others without proper authorization, SSIPEX might not know about it. And if it did detect such activity, it is unclear how effective any recourse would be to the Chinese courts. Of course, as a broker, SSIPEX might be able to avoid direct involvement, and leave any legal actions to the IP owners whose rights were infringed. But if IP owners determine that SSIPEX was undermining their ownership position in China, it would damage the development of legal IP exchange in the Chinese semiconductor industry for everyone.

5.4. Ocean Tomo – Market Makers in the Secondary Market for IP

In downtown Chicago, a small, growing company called Ocean Tomo is quietly laying the groundwork for what it hopes will be a revolution in the use of patents and associated IP. Jim Malakowski, who is the chairman of Ocean Tomo, along with his colleagues at the firm, progressively are narrowing the many barriers that currently hold up greater exchange of patents in the market.

Malakowski himself is no newcomer to the area of managing and valuing IP. Since he graduated from college more than 20 years ago, he has devoted his career to different aspects of how to manage these assets in a more effective way. Earlier in his career, he worked for accounting firms and advisory firms, analyzing how best to account for intangible assets like IP and know-how. These years of experience gave him first-hand knowledge of what some of the key problems were. For example, there is general consensus that patents can be valued on cost basis (how much it cost to develop the idea), an income basis (the stream of payments a firm could expect to receive from licensing) or a market basis (what similar patents have sold for in the past). Of these, the market basis is regarded as the best approach. However, patent sales are rarely published, making it nearly impossible to identify comparable sales. And there may be other terms of the sale that are idiosyncratic to that situation, which influenced the negotiations over the sale, and are no longer visible to observers. How can one value a patent when price information is not available?

Ocean Tomo knows the problems in managing and valuing patents, and it thinks it has come up with some of the answers. It is no exaggeration to say that the first is a full service merchant bank that is exclusively focused upon transacting IP. Here are some of the services that Ocean Tomo provides to its clients (and more are on the way):

- IP merger and acquisition advice
- A Patent Ratings System
- Advisory services for securitizing patents and trademarks
- IP risk management products
- The Ocean Tomo 300: A Publicly Traded Equity Index based on IP Assets
- The World's First Live Patent Auction, hosted on Ebay, to be held in San Francisco on April 5th and 6th, 2006.

While the array of activities is impressive, the thinking behind them is even more interesting. Ocean Tomo sees the economy shifting from physical assets to knowledge assets, and understands that IP is a core element underpinning the value of knowledge assets. Thinking of patents, trademarks and other IP as just another asset class suggests that financial instruments can devised that allow investors to participate in this asset class. As Keith Cardoza of Ocean Tomo put it, "What if investors could invest directly in Boeing's innovations, as opposed to investing in the company's stock overall? In the near future, pension funds will treat IP as an investment class. It will be the source of a new alpha, and a way to diversify one's portfolios more broadly."[104]

While most of the work that Ocean Tomo does relates to US patents, many of its clients come from outside of the US. Foreign companies have noted the increasing strength of US patents that we first examined in Chapter 2. They increasingly seek advice on whether they ought to purchase US patent portfolios from companies that might be willing to sell. Ocean Tomo helps

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[104] For those of us not expert in finance, this is what "alpha" means. "**Alpha** is a risk-adjusted measure of the so-called "excess return" on an investment. It is a common measure of assessing active manager's performance. The difference between the fair and actually expected rates of return on a stock is called the stock's alpha." Source: http://en.wikipedia.org/wiki/Alpha_(Investment), last accessed February 8, 2006.

these companies identify which patent portfolios might be of interest, and what an appropriate price might be to offer for the portfolio.

While the company has offered advice in this area for years, more recently it has decided to put its money on the line as well. In 2005, the company started soliciting investments for a $200 million fund that would provide financing (loans, acquisitions, recapitalizations, buyouts) to companies which, according to Ocean Tomo's methodologies, had substantially undervalued IP in their portfolio. This might be a firm with $100 million in revenue that is cash flow positive, but looking for capital to expand its business. Ocean Tomo would work with other lenders to obtain the IP rights as collateral for its portion of a lending facility or other investment participation to the firm. Ocean Tomo, in turn, might lend up to 25% of what it estimates to be the value of the company's IP. [105]

One of the first investors it solicited for investing in the fund was Ross Perot. To the company's great delight, Perot elected to provide the entire $200 million for the fund, which is now up and running. This level of investment from a respected investor confers significant credibility upon Ocean Tomo's concept. If returns are as good as expected, it is likely that others will soon emulate the model, making a far more liquid market for securitizing IP as collateral for financial transactions.

Another idea that has not yet gotten off the ground is the Sale/License Back vehicle for intellectual property. As we noted in Chapter 2, most companies don't fully utilize the patents that they own. Yet there are great inefficiencies that limit a company's ability to get more value from its un- and under-utilized patents and other IP.

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[105] This is entirely consistent with the data presented in chapter 2 on patent reassignments. There, we saw that the third more frequent reason for selling semiconductor patents was to obtain a security interest. Here, we see a firm that specializes in helping borrowers work with lenders where IP is to be part of the collateral in the financing provided.

The Ocean Tomo Sale/License Back concept could change all that. The company would sell its unused IP to Ocean Tomo, who pays cash for the IP. Ocean Tomo also licenses back the IP to the company on a non-exclusive basis, so that the company can continue to operate its business as before.

How would Ocean Tomo benefit from this? As Malakowski points out, "Patents don't just reduce risk of infringement when aggregated. They also increase in value. It's the only asset class that does that." By aggregating IP across hundreds of transactions like this, Ocean Tomo now has a broad portfolio of more valuable IP to offer to companies for many different kinds of transactions. One such offer might be in the form of IP insurance, to provide greater protection against infringement claims of third parties.

In a world of stronger patents, where patent trolls are cropping up in unexpected places and threatening businesses, it might be good to get to know the folks at Ocean Tomo.

5.5. Intellectual Ventures: A Well Founded, Well Funded Patent Intermediary/Owner

Intellectual Ventures was founded on the concept of "reinventing invention". Scientists Nathan Myhrvold and Edward Jung shared a vision of building a company that focused on inventing and investing in invention. While an invention company sounds unusual to modern readers, this type of venture was very popular at the beginning of the 20th century, as evidenced by the success of Thomas Edison's laboratories in Menlo Park, NJ. The job category of "inventor" was used by the U.S. Census until 1946, when the official title of "inventor" was replaced with the much less compelling title of "professional worker."[106]

After many years of working with startup companies in launching new technologies, Myhrvold, Jung and their partners recognized that there were some fundamental problems with the

[106] Source: Intellectual Ventures homepage, http://www.intellectualventures.com/home/default.asp; last accessed May 4, 2005.

invention process. For one, every technology was locked up within a single company, often a narrowly focused startup company. While the company would attempt to commercialize the most promising application of the technology, this was not always known in advance. Once the application was selected, the focus of the venture was to execute against that application. There was little time, money, or patience for exploring alternative ways to utilize the technology. And the investors in the company would be sure to lock up the technology in that company, further diminishing the chances of pursuing other applications through other parties..

Since 90% of startup ventures typically failed, this meant that many worthy technologies would never really have a chance to realize their potential in the market. "No one else gets to try that invention," noted managing director Greg Gorder.

Another set of problems arose in large companies. They viewed new technologies through the blinders of their current business and associated business model. Moreover, many companies were focusing on more near term, and more incremental innovation opportunities, leaving an increasingly large hole for longer term innovations. "Sure, there are inventors in large companies, as well as in universities and in startups", said Gorder. "But invention is not their primary focus. We saw an opportunity to build an organization where invention was the primary focus of everything that we do."

One early initiative that Myhrvold and his colleagues undertook was the creation of ThinkFire. ThinkFire sought to help companies monetize the value of their intellectual property beyond the value they obtained by using it in their own business. "We wanted to help companies make money off of their inventions," said Gorder. "How can you make more invention happen? Find a way to help make it profitable. Right now, most companies undervalue their inventions, and treat it simply as a raw material in their own product."

To pursue this vision, Intellectual Ventures hired some of the brightest minds in business, technology, computer science, physics, biotechnology, mathematics and intellectual property. Employees explore invention and investment opportunities in a wide variety of technology areas ranging from software, semiconductors, electronic devices, consumer products, lasers, biotechnology and medical devices. A particular focus of the invention process for the company was to target the areas where different scientific disciplines were coming together, such as computing and biology, where a deep understanding of each field opened up new avenues of exploration in the other.

While the exact parameters of the Intellectual Ventures business model are still in development, the model anticipated selling its diversified portfolio of inventions as a foundation for pursuing a variety of business models. This too was not unlike the business models of the early inventors of the late 19th and early 20th century, where devices like the automobile, light bulb, car, and television were sold to others through business models such as licensing, spin-outs, joint ventures, selling outright, or investing to develop the inventions themselves. In the main, however, the company expected to act as a technology supplier to other companies, rather than practicing the technology in its own businesses.

Even the invention model of Intellectual Ventures (IV) had evolved in the five years since its founding. "We have changed a number of aspects of our model over the past five years", noted Gorder. Early on, we spent more time trying to understand the exact state of the art in whatever fields we were interested in inventing in. We've learned that the state of the art is not always known, particularly from public sources. We now rely more on experts to help us here. They often know not only the public literature in their areas of expertise, but much of what is in the pipeline that has not yet reached the public."

Intellectual Ventures has a rather distinctive process. The focus of the organization is uniquely focused around invention. The people hired by the firm were unusual. The external parties played a role that differed from the one that they usually played. While the output was still a patent, it was produced through a very different process.

One key process that IV had created was the Invention Session. "This is the most fun part of my job," said Laurie Yoler, who was the Chief Development Officer of the company in 2004 and 2005. "While I have to worry about a lot of other things, this is my chance to get close to the science, and to the things that we do that differentiate us from everyone else." It was hard for Yoler to describe an Invention Session. While it was a key aspect of Intellectual Ventures' process of invention, it had to be experienced, in order to be understood. So I went to one to see for myself.

The Intellectual Ventures Invention Session[107]

On the table, cans of diet Vanilla coke, Pepsi One, Dr. Pepper and bottled water sat alongside dishes of peanuts, bags of beef jerky, and muffins. Around the table sat a group consisting primarily of theoretical physicists, engaged in a process created by Intellectual Ventures that they termed an "Invention Session". The conference room was lit in a low light, as the computer projector was turned on. A variety of web links to relevant papers and prior research were shown on the wall. Two whiteboards were in the room, both of which would shortly be filled up with notes from comments in the group.

Nathan Myhrvold stood at one board, rapidly scribing notes on how high energy physics could enable a new class of optical materials, utilizing photons and plasmons to do the work formerly done by electrons. For anyone who had not studied physics in nearly thirty years, it was impossible to keep up (part of the "firehose"). Even if one were current on modern physics, ideas

[107] This section incorporates material from Chapter 7 of my forthcoming book, Open Business Models, HBS Press, 2006.

came thick and fast. Since the conversation moved fast, audio recorders and periodic photos of whiteboards also helped to reconstruct the insights of the session later on.

The invention session was something like a musical jam session. There were soloists, explaining their ideas to others about how properties of one material could be harnessed to provide a useful function. And the conversation did not move in a strictly linear fashion. Inspirations would spark asides, or jokes, or references to classical physicists (Hipparchus, Archimedes, Newton), early astronomers (Galileo), or even Horatio at the Bridge. Every once in a while, Nathan would stop the group just to capture the last set of thoughts expressed, or to sum up the work done so far in the discussion.

Myhrvold was a former CTO of Microsoft, a wealthy individual, and a very successful business man. Myhrvold was a man of many interests. He was also an intellectual polymath, with deep knowledge and interest in such disparate intellectual fields as physics, the life sciences, computer science, and photography. An inventor with more than 17 patents to his name (as of December 2004), he was the chief instigator at the invention sessions, introducing the agenda, limiting the field of exploration (to at least some modest extent), and often pushing the group to chase ideas that were "cool as hell". Myhrvold's enthusiasm, the breadth and depth of his knowledge, and his comfort with a wide range of ideas were critical ingredients to the success of the session.

Lowell Wood also was enjoying himself. A world class physicist from Lawrence Livermore National Laboratories, he had known Myhrvold for nearly thirty years. Wood was a close associate of Edward Teller's from the Labs, and Teller was a powerful role model: "Wood notes that there are many generalists who know a little about many things, but "Edward knows a lot about everything." Because Teller is expert in so many fields, he sees connections and relationships between disciplines. Says Wood, "Other scientists can be king of the hill for their narrow specialty, but Edward has the `intellectual bandwidth' to be pretty good in a lot of areas and tops in any area he chooses." In that respect, says Wood, "Teller is similar to other 20th-century greats like Enrico Fermi, Leo Szilard, and John von Neumann, who all made sizable contributions to more than one field."[108]

This was very much the inspiration behind the recruitment of "high bandwidth" experts like Wood, to participate in the invention sessions. Most of Wood's work was done within the government, and most of that work was classified. He would sometimes allude to work done on weapons systems, high energy lasers, electromagnetic pulses and the like, but would quickly shift back to the point he was making. He also had timely and thoughtful insights into human biology, current brain surgery techniques, and the effects of radiation on human tissue. One sensed that he found it very refreshing to be in an environment where he could explore non-defense applications of ideas, materials, and tools that he had worked with for decades.

Supporting these two soloists were two other accomplished inventors. Rod Hyde and Chuck Whitmer had worked with Wood and Myhrvold respectively for many years. Each had made many contributions to the thinking of these two, corrected inspirations when they extended beyond reality, and filled in the holes left open by the rapid movement of conversation in the discussion. While Myhrvold and Wood did much of the talking, both listened with respect when Rod or Chuck had something to say. While the ideas were far ranging and sometimes outrageous, the prior experience of the participants and the recent research done to prepare for the session provided substantial data to anchor the participants, and help them ground their insights.

Clarence (Casey) Tegreene was also tracking the output of the session. He was the Chief Patent counsel of Intellectual Ventures. Unlike most patent counsels, though, Tegreene was also an

[108] Source: LLNL website, http://www.llnl.gov/str/Shaker.html; last accessed May 4, 2005.

inventor himself, having been chief technology officer of Microvision. He held 15 patents himself as of December 2004. "I love this guy. This is a patent attorney who also has his own invention ideas!", exuded Myhrvold. Although Tegreene was a very active participant and contributor, that was just the tip of the iceberg of his involvement.

He had done a great deal of work prior to the session to prepare the materials for the day's discussions. He worked with Corrie Vaa, a recent Ph.D. physicist from State University of New York-Stonybrook (and who had recently passed the patent bar exam). Together, they had conducted a thorough scan of interesting research papers in areas of interest to the topics to be explored in the session. Casey would frequently reference papers that had been reviewed prior to the session. Vaa could pull up papers in near real time when it helped advance the discussion. And together, they would have the task of capturing specific invention proposals from the session, and then perform the arduous work of prioritizing, researching, and finally writing up any patents that might flow from the day's activities. "There is a real art to pulling one of these sessions together," stated Tegreene. "We limit the number of people in the room, and we are careful to control the mix of inventors to non-inventing observers. If you get too many of the latter, the inventors feel like they are on stage, instead of being engaged in an invention process."

"Today's session is something of an outlier", said Tegreene. "Today, everyone in the room is a theoretical physicist. Usually, we try to mix up two or three types of experts in a single session, and target the interstices between technology areas. Today is also unusual because it is a 'high reach' session, dedicated to exploring ideas that are pretty far out there." Tegreene explained that a typical day-long invention session might generate as many as a 100 ideas ("plus or minus 50" he would add). It was not economical to pursue each invention, so he and his team would have to sift among the many inventions to select those to pursue further. The quality of the idea, the amount of supporting material on hand to support the filing, and the market potential were all criteria evaluated in this decision.

Those selected would be compared to the prior art in the area, and would also be assessed in terms of the market potential that seemed addressable with the invention. While not an exact science, these criteria enabled Tegreene to set priorities for his inventions, and decide which of those to pursue and submit patent applications. “We try to build a portfolio of patent applications”, he commented. “Some of these might be ‘low reach’, and be something that might turn into a real business in a short period of time. Other applications look farther out. We also try to build a range of application areas into our portfolio.”

Internal invention sessions are not the only means by which Intellectual Ventures obtains patents. The company is also an active buyer of external patent portfolios as well. They participated in the Commerce One patent auction in December of 2004, but declined to match the winning $15.5 million bid of Novell for the Commerce One patents. Intellectual Ventures attends bankruptcy auctions of failed startup companies as one source of new patent portfolios. It was able to purchase all of General Magic’s patents recently (in computer software and semiconductors), for example. Intellectual Ventures is able to be such an active buyer because it has raised hundreds of millions of dollars from external investors to back its approach to the invention market.

Notwithstanding all of its innovative approaches to developing IP, to date the company does not really have a business model through which it will commercialize its patent portfolio. In part, this lack of an articulated business model is by design: IV does not want to tip off others prematurely about how it plans to convert its IP into money. That could drive up its costs of acquiring IP (if, for example, others began to bid against them), and might complicate its subsequent transactions.

However, one can surmise that the company has already staked out a couple of approaches to the problem of converting patents into cash. First, the company hopes to develop licensing packages for potential users of its patents. Intellectual Ventures' breadth and scope of patents might enable it to be a "one stop shop" for companies looking to enter into a new area. Second, the company generally hopes to avoid having to practice any of its patents directly in its own businesses.

5.6. Issues for Patent Intermediaries

Being a patent intermediary is not an easy business. There are many questions that companies must face, if they are to work effectively as intermediaries. One challenge every intermediary must face is how to help its clients define the problem that needs to be solved. This definition must be sufficiently clear to outsiders that they can recognize whether they know enough to answer the problem, without being so clear as to reveal sensitive client information (a variation of Arrow's Information Paradox discussed earlier).

A second issue that every intermediary must manage is the problem of identity: whether and when to disclose the identity of one party to the other party. Companies might prefer to remain anonymous for as long as possible, yet in some circumstances a buyer or seller might be unwilling to complete the transaction unless they know who the other party is.

A third issue for intermediaries is how to demonstrate the value of their service to their clients. Other processes must occur in order for an idea or technology to become valuable, so how can one measure the contribution of the intermediary to whatever value was subsequently created?

A fourth issue for innovation intermediaries is how to create or access a two-sided market, with lots of buyers and lots of sellers. When markets are thick, with many sellers and many buyers, they function very well. But when markets are highly illiquid, they do not function nearly so well.

A related fifth issue is how to establish a strong, positive reputation early on in the company's operation. Since the concept of an innovation intermediary is itself something of a novelty, how can an intermediary develop the trust and reputation necessary to convince buyers and sellers to confide in them?

Chapter 6

The Emerging Secondary Market for IP

The Rise of Intermediate markets

One key force that is affecting the external innovation environment is the growth of what Ashish Arora and his colleagues called "intermediate markets", or markets for innovations.[109] In the closed innovation model, companies had to take their new discoveries to market themselves, both because they would obtain more money that way, but also because there weren't many other companies who knew enough to utilize the technology successfully. Innovation markets in the closed innovation system were sparse. In an open innovation world, where useful knowledge is widespread, there are many companies with many potential ways of using a new technology, and many potential technologies that might be utilized in a company's business model. No company can hope to exploit all of the many ways a new technology might be used, so open innovation companies typically license technologies liberally to other companies.

An economy full of technologies being licensed for others to use is one in which one can say there are highly developed intermediate markets for those technologies. These markets are termed "intermediate", because one firm initiates a technology and develops it to a certain extent, and then a different firm might carry that technology from that point through to the market. The presence of these intermediate markets expands the number of ways a new technology can be used,

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[109] See Arora, Fosfuri and Gambardella, Markets for Technology, MIT Press, 2001. The bulk of their research considers the development of markets for technology in the chemicals and petrochemicals industry. But their more general point is that there are many situations where economic markets have developed in which a supplier of a technology can sell that "product" to others, who turn around and use it to develop new products. A related model can be found in Gans, Hsu and Stern, 2001, who analyze when an inventor of a new technology will use it to compete in a product market as a new competitor, and when the inventor would instead choose to sell it to the existing competitors in the market.
A more recent article by Arora and Merges (2004) explores the role of new entrant startup firms in stimulating innovation, and discusses conditions under which strong intellectual property rights help enable the formation and entry of such firms. This entry stimulates the growth of intermediate markets for innovation.

and promotes specialization among the different participants in the market. So some companies specialize in creating new technologies, others specialize in developing new products, and still others focus on special niches, services, or applications along the way.

As Arora and his colleagues found, a pronounced division of innovation labor has emerged in the chemicals industry. When new chemical plants are built, the company building the plant typically hires a specialized engineering firm to design the new facility. These specialized firms work on virtually all of the new chemical plants being constructed around the globe, so they are up-to-date on the latest ideas and techniques for making the plants as efficient as possible. Since these plants are extremely expensive, amounting to billions of dollars each, no one chemical company builds them very often. So the specialized firms are able to accumulate knowledge and learning much faster than even the biggest of the chemical companies.

Another example of this specialization of innovative labor can be seen in the semiconductor industry. Back in the 1960s, the major semiconductor firms were captive subsidiaries of product firms, such as IBM or AT&T. There were markets for the final product systems, but no markets for the components of these systems. By the late 1970s, independent firms like Intel and Texas Instruments specialized on making chips, and selling them to product companies, who used these chips to create new computer systems, or cell phones, or videogame players. Markets had emerged for chips, which were purchased and integrated to make systems products. By the 1980s, the manufacturing function in developing chips became separated from the design function, as semiconductor fabrication companies (known as “fabs”) like TSMC built chips that were designed by so-called “fabless” companies, who effectively outsourced their manufacturing. Now there were markets for semiconductor manufacturing capability, and associated markets for assembly, packaging, and testing capabilities. In the 1990s, companies like

Qualcomm and ARM Holdings began selling intellectual property such as tools and designs to the companies that were designing and building chips. So now a company could buy a design from ARM, have it built by TSMC, and then offer it to the market, creating a market for semiconductor designs themselves.

One such example is Rambus, a virtual semiconductor design firm offering a technology to speed up DRAM chips inside computers, have profited significantly by exploiting loopholes in the rules of its standards setting body. After that body settled on a standard for how to accelerate the speed at which DRAM chips transferred data to the system, Rambus revealed that it had received patents on important elements of that standard.

What Rambus did has been found to be entirely legal, in a series of court cases regarding its conduct, and the legal rules around its intellectual property. The company's stock price is something of a "pure play", in that the intellectual property of the company is the only business it has. Therefore, Rambus' daily stock price reflects the market's current assessment of the value of its IP. As Figure 31 shows, the valuation of the company has experienced wide swings, from more than $100 to below $10, even though the IP itself has been well-publicized for many years now.

[Figure 31]

Surrounding this vertical separation of functions in the semiconductor value chain are still more companies offering design tools, test equipment, and other services to the industry. This specialization has migrated around the world. In China alone now, there are more than 600 specialized semiconductor design houses, and a number of new manufacturing facilities are being built as fabs for other companies around the world to use to build their chip designs.

Yet another example of this innovation specialization comes from the life sciences. Thirty years ago, drugs were discovered, developed, tested, and marketed by large pharmaceutical manufacturers. By the 1980s, however, specialized biotechnology firms began to discover and patent new compounds. They would then partner with a pharmaceutical company who would take the compound through the clinical trials required by the Food and Drug Administration, and then sell the drug to prescribing physicians. More recently, there have emerged a group of contract research organizations that partner with the biotech and pharmaceutical companies to conduct the clinical trials for them. In the 1990s, Millennium Pharmaceuticals began doing contract research for pharmaceutical clients, but reserving residual fields of use for a compound for itself, and began developing new drug applications for these compounds in the year 2000. Still other firms offer specialized equipment, tools, tests, and other services that assist in the drug development process.

This specialization of innovation also is emerging in the consumer products sector. Procter & Gamble has had a long tradition of great internal science, which it has used to create differentiated products to offer to its customers. More recently, though, P&G has realized that its core strengths are not in science, but in its ability to create strong brands. In some of its new brands, such as the Spinbrush and the Swiffer, P&G has created new and large businesses with technologies that it acquired from outside the company. Through its new innovation processes, which it calls Connect and Develop, P&G seeks to exploit the market for external technologies, as it seeks opportunities to create new brands for its customers.

This innovative specialization needn't be based upon products per se. There are intermediate markets that have developed for services too. Based on a longitudinal study of the US mortgage banking industry, Jacobides (2003) found that intermediate markets became a powerful force in the mortgage securities market. As with the chemicals industry, he found that markets arose through firm efforts to exploit gains from specialization of different intra-organizational functions and trade with different firms. This in turn lead to the standardization of information and the simplification of coordination between firms. Unlike chemicals, the government also played a role in disintermediation of the mortgage market, through creating an *information standard* (in the case of US mortgage banking, this standard was the Federal Housing Administration (FHA) regulations for conforming loans).

If you think back just a generation ago, you'll realize that a lot has happened to the mortgage industry in the US. Throughout the 20^{th} century up through the 1970s, most people obtained a mortgage from their local bank. This was necessary because only a local bank knew the local market well enough to be able to assess the proper value for the house (and hence, the amount that safely could be lent against the property). The local bank could also assess the risks of the individual lender, and service the mortgage appropriately. At that time, there were few "standards" for these items, so mortgage lending was a local business. Most mortgages were originated by the local bank, serviced by the local bank, and held by that bank until the mortgage was paid off.

This all began to change in the 1980s. An innovation by an investment bank in New York, Salomon Brothers, realized that, under certain circumstances, one could create intermediate markets where mortgages could be traded after they were originated. However, certain characteristics of mortgages would have to be carefully defined, in order to know the risks of trading them. By defining an information bundle – which they took from the regulations established by the FHA - the prior information asymmetries that confounded the ability of out-of-area lenders to fully evaluate the risks of locally originating loan were reduced to an acceptable level. Another important insight by Salomon was that individual mortgages' risk characteristics became more tractable as they were bundled together.

This changed the basis of competition within the mortgage industry. Local knowledge became less important. The ability to access capital more cheaply now became more important in competing for loans. With more recent credit scoring algorithms based upon all consumer debt obligations that provide more accurate measurements of the ability of borrowers to repay their debt obligations, out-of-area lenders are at even less of an information disadvantage in lending. The mortgage industry's market structure has now changed dramatically. Seldom is a mortgage originated, serviced, and held until the end of its life by a single bank or other lender. Instead, there are specialist firms who originate the mortgages, other firms who purchase groups of these loans from the originators, still other firms who service the loans, and other brokers and advisors in the mix as well.

In countries like the UK, this evolution has gone still further. UK borrowers can link their consumer debt together with their mortgage, creating a securing credit facility with the holder of their debt. This reduces credit risks for lenders, because of the security interest in the home, and lowers interest rates for borrowers, owing to the greater security. Current regulations in the US have prevented this latest step from occurring here, but it is likely only a matter of time before most US consumers have access to similar credit facilities.

Another services industry that has evolved a remarkably complex ecosystem of innovation is the entertainment industry. Back in the days of the Hollywood studio system, actors, directors, and other support functions were all organized within vertically integrated studios. Stars were under long term contracts to the studios, who manufactured the rising stars' image and (hopefully) popularity, chose the next acting projects for them, and handled distribution of the movies to their own captive movie theaters.

Fast forward to today, and every vestige of the studio system has vanished. Actors, directors, screenwriters, special effects specialists and many other functions are organized from project to project, and a thick market of reputations and agents facilitate the process of selecting the next team of people for the next project.

One of the most critical limiting factors is the simple lack of information about the extent and terms of trade in secondary markets for patents and associated IP. Markets require information in order to function well, and much of the requisite information needed for coordinating market exchange of innovations is not yet available. For example, while there is an estimated trade of more than $100 billion annually in licensing for technologies,[110] there is no place where this trade is reported and tracked. What we know of the licensing market today comes from occasional surveys of companies (which ask the companies to report their trade in total) or from the occasional IP dispute in court, where the terms of a particular contract become part of the court record, and made available to the public.[111]

Factors Limiting the Emergence of Secondary Markets

The situation is somewhat analogous to the condition of the mortgage market in the US prior to the advent of Salomon's bundling of mortgages. There is no information standard for technology licensing and associated IP trade. There is no FHA that defines a template or format for such trade. And given the wide range of terms and conditions for trading IP,[112] it would be difficult to aggregate statistics on this trade, unless and until one or more information standards arise.

Without these data, it is hard for companies to know what technology is available in the market. It is also very challenging to know how to value available technologies, once they are located. Such value is determined by what a willing buyer would pay to a willing seller. Markets aggregate suppliers and customers, so that any individual technology can go to the highest bidder, and bidders know what similar technologies have sold for in the past, giving them a basis for calculating their bid price. There is no systematic reporting of previous prices paid for external technologies and their associated IP. This makes it hard for sellers to know what price to expect to receive, or what price would be reasonable, given similar transactions in the past. So too for the buyers. Jeff Weedman of Procter & Gamble speaks of this as the "hopes and dreams" problem,

[110] Cite to BTG study in 1998(?), from Pl-x case.
[111] Cite to Deepak Somaya's ICC article, which utilized court records of IP disputes to make inferences about whether and when companies will settle with each other, or take a dispute through a court trial.
[112] Cite to Simon Wakeman's dissertataion research on the presence or absence of specific contract terms in individual biotechnology licensing agreements.

where both sides to a transaction have unrealistic expectations, and there is little or no objective data to align those expectations more closely.

Conclusion: It will take time, but secondary IP markets coming

What the patent intermediaries, and the alert large companies like P&G and IBM are doing, is fostering the conditions that slowly are improving the conditions under which a true secondary market for IP can emerge. Today, prices are difficult to obtain. Tomorrow, companies that engage frequently in patent transactions will have a broad feel for the market, and what patents are selling at which prices. Today, companies' processes take little or no account of patent utilization outside of the company itself. Tomorrow, alert managers will seek the most valuable ways to deploy the patents they own, and will similarly be on the lookout for opportunities to acquire more related patents, if the price is right. Today companies primarily adopt a defensive posture towards IP management. Tomorrow, companies will simultaneously license some patents, publish or donate others, and litigate still others. Today, individual inventors struggle mightily to get their patented technologies licensed on attractive terms. Tomorrow, a variety of intermediaries will be available to help them sell their ideas to the highest bidder.

While it has been outside the scope of this study, it is worth noting the vital role that public policy will play in creating a secondary market. The patent renewal fees have created incentives for companies to reconsider the "buy and hold" default strategy for all of their patents. The criteria for issuing new, valid patents confers strong incentives on the strategies of intermediary firms, and all firms, in deciding where to invest their funds, and what processes to use to maximize the returns to those funds. As of this writing, for example, eBay is in court with MercExchange over the question of whether a judge can rightfully issue an injunction to a patent plaintiff who has a patent claim that bears on another company's operations. Decisions like these will strongly determine the future bargaining,licensing, and litigation strategies of patent-owning firms. If patents continue to get stronger legal protection and standing, secondary markets can be expected to flourish.