Intellectual Property Access Systems*

Reiko Aoki
IER, Hitotsubashi University
and Department of Economics,
University of Auckland
aokirei@ier.hit-u.ac.jp

Aaron Schiff
IER, Hitotsubashi University
aschiff@ier.hit-u.ac.jp

28 March 2007

ABSTRACT

This paper reviews and compares patent pools and intellectual property clearinghouses as alternative systems for efficient access to licensable intellectual property in a 'market for technology' (Arora *et al* 2001). These systems improve aid downstream research and development by economizing on search and transaction costs faced by licensees, as well as potentially mitigating externalities among owners of complementary intellectual property that lead to the 'tragedy of the anti-commons' (excessively high license fees). We compare the features and economic effects of different systems, review some successful examples, and suggest directions for future economic research.

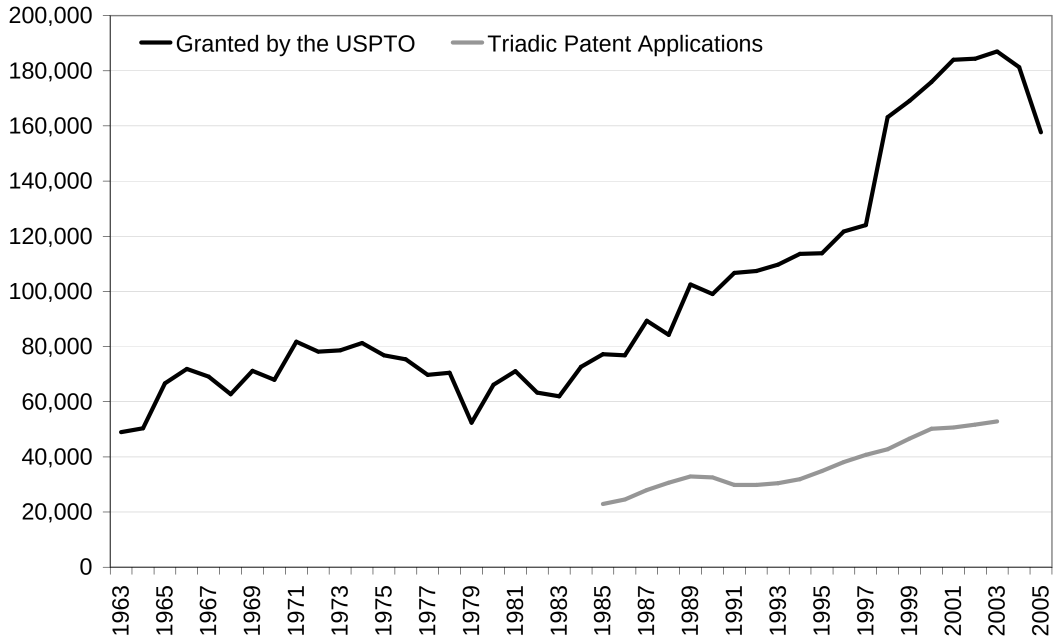
1 Introduction

Intellectual property (IP) rights are granted to give incentives for undertaking costly research and development. Legal institutions such as patents and copyrights reward innovation by temporarily restricting competition in the production of the resulting goods and services. These institutions have been generally successful in promoting innovation. For example, Figure 1 shows the number of patents granted by the U.S. Patents and Trademarks Office (USPTO) and the number of patent applications to all three of the USPTO, the European Patent Office (EPO) and the Japan Patent Office (JPO) ('triadic' patent applications) per year. Both data series exhibit an upwards trend over time with average annual growth rates over the periods shown of 3.4% and 4.9% respectively.

---

* The authors thank the Japan Society for the Promotion of Science for financial support.

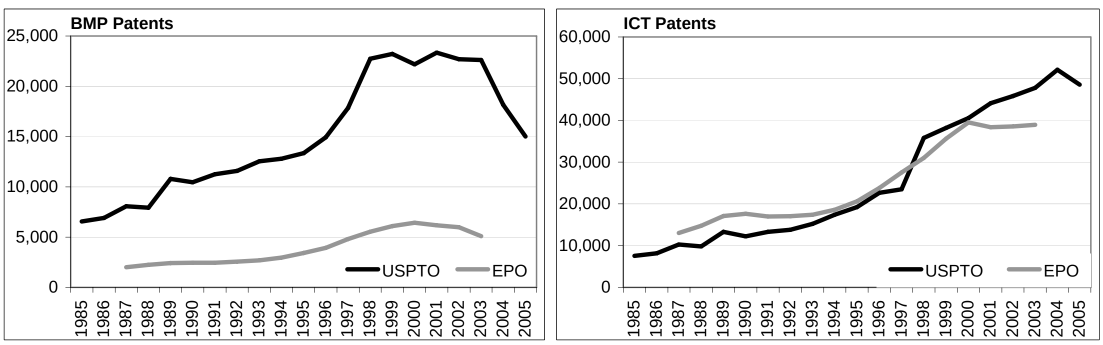
Figure 1 Total patents granted by the USPTO, and total patent applications made to all three of the USPTO, EPO and JPO.



Sources: USPTO (2005), OECD (2006).

More recently, there has been significant growth in the information technology and communications (ICT) and biotechnology, medical and pharmaceutical (BMP) sectors in many countries. Figure 2 shows the total number of related patents issued by the USPTO and applications made to the EPO per year. The number of ICT patents has grown relatively steadily, while BMP patents experienced rapid growth up to 1997, followed by a period of stagnation and then decline. A similar trend is observed in Table 1, which shows the number of patents issued by the USPTO to top biotechnology firms.

Figure 2 BMP and ICT patents issued by the USPTO and applications made to the EPO.



Sources: USPTO (2005), OECD (2006). The USPTO data were classified into BMP and ICT categories by the authors. The classification system used is available from the authors on request.

Table 1 Patents issued to top biotech firms by the USPTO, by date of filing.

	86-90	91-95	96-00	01-05
Amgen	25	270	374	203
Genentech	161	733	669	266
Serono	30	7	3	56
Biogen	48	115	87	58
Genzyme	13	119	255	108
TOTAL	277	1,244	1,388	691

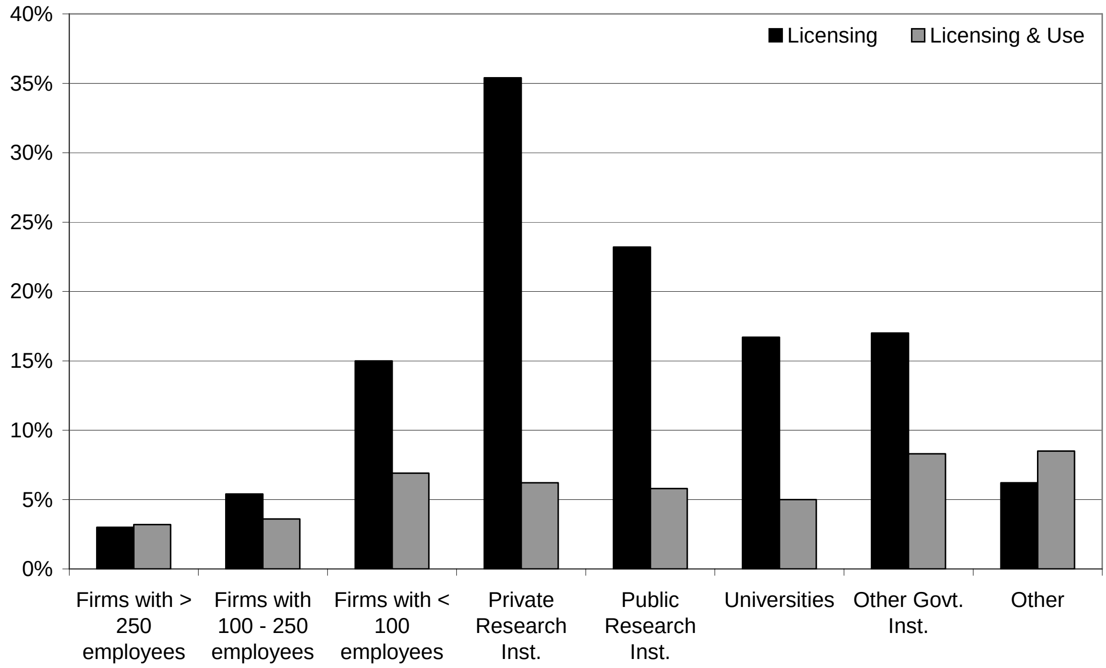
Sources: The firms are identified from the list of top ten biotech firms at www.researchandmarkets.com,[1] and patents were found via Google's patent search, www.google.com/patents/.

This paper is concerned with the effects that IP rights have on cumulative innovation and on the development of products that combine multiple innovations. In both cases, a proliferation of IP rights may result in a 'patent thicket' (Shapiro, 2001) that can increase costs for these downstream activities. For example, the above data indicate that that in the United States there are currently more than 300,000 active BMP patents and 500,000 active ICT patents. The more existing IP rights that cover a given downstream activity, the higher will be the search and transaction costs associated with obtaining licenses to existing innovations. In addition, as we will explain in section 2, when the upstream IP rights are complementary, potential coordination failures among IP owners can lead to excessively high licensing fees.

Another clear trend in IP has been the growth of licensing. Athreye and Cantwell (2007) report that worldwide royalty and license revenues reached almost 80 billion US dollars by the year 2000, up from around 10 billion US dollars in 1983. Similarly, significant amounts of licensing were reported by Razgaitis (2005) based on a 2004 survey of 472 firms engaged in licensing in the U.S. and Canada. In total, 14.4 billion US dollars of in-licensing payments and 9.0 billion US dollars of out-licensing revenues were reported by the firms surveyed for 2004. Finally, Figure 3 shows the uses of patented innovations reported by the holders of more than 9,000 European patents (Giuri & Mariani *et al* 2005), for different types of organization. On average, 10.1% of all patents were either licensed by their owner or both used and licensed by the owner. High rates of licensing occur among public and private research institutions, universities and other government institutions, and small firms. All this data points to 'markets for technology' (Arora *et al*, 2001), where innovations are bought and sold, becoming increasingly important.

[1] "The Top 10 Biotechnology Companies", August 2005. This list identifies UCB-Celltech as the fifth firm. However, UCB-Celltech undertakes many other activities in addition to biotechnology, thus it was excluded from the table.

Figure 3 Use of patents reported in the European PatVal-EU survey (Giuri & Mariani *et al* 2005).



The proliferation of IP rights is good news in the sense that these are broad indicators of growth in innovative activities, which are a key driver of economic growth. In addition, licensing IP is a substitute for an innovator doing its own production, and some firms may be more efficient at production than others. Thus outsourcing of production through licensing may be efficient. On the other hand, a patent thicket is likely to impose additional costs and inefficiency on downstream product development and cumulative innovation. For example, development of a new genetic diagnostic test typically requires licenses to a number of patents on gene sequences and related technologies (Scherer, 2002). The greater the number of licenses required, the greater the cost of developing the new test. This paper is concerned with ways that these costs can be reduced.

There is some evidence that markets for technology do not function as efficiently as their participants desire. In an earlier survey, Razgaitis (2004) reported that among organizations involved in significant licensing activities, 43% of licensing negotiations terminated unsuccessfully. Failure was reported to occur because there were either too many parties to the negotiation or because a useful bundle of IP could not be assembled in 9% of failed out-licensing negotiations and 12% of failed in-licensing negotiations. Among the patents in the PatVal-EU survey, 11% were licensed, and for a further 7% the owner was willing to license but had been unable to do so (Gambardella *et al*, 2006).
In this paper we focus on systems that facilitate access to IP in order to reduce the costs and inefficiencies identified above. We focus on economic systems that operate through

market mechanisms, rather than regulatory or legal approaches such as research exemptions and compulsory licensing. We will consider two basic types of system: patent pools and IP clearinghouses.[2] These operate as intermediaries in markets for technology and economize on search and transaction costs by aggregating information about technologies, as well as promoting economies of scale in licensing and negotiation. In some cases they also help to generate more efficient prices for licensing complementary IP. Some specific examples of include patent pools like the MPEG-2 and DVD pools, and clearinghouse businesses like Yet2.com which provide a platform for advertising licensable technologies. Further examples are given in section 3. Our objectives are to classify IP access systems, compare their organizational and economic features, review existing systems, and identify directions for future economic research.

Some similar issues are discussed by Shapiro (2001), who considers the strategies that firms may employ to reduce the effects of a patent thicket on their ability to innovate. Shapiro considers the strategies of cross licensing, patent pools, and cooperative standard setting. Our paper is complementary to Shapiro's in that our analysis is at the level of the market for technology, rather than an individual firm. We also consider IP clearinghouses that operate independently from the innovating firms, and our focus is on systems that could be centralized and operated by a third-party, so we exclude cross licensing.[3] There is also an extensive economic literature on the incentives of innovators to license intellectual property, and the optimal licensing contracts to use if they choose to do so.[4] In this paper we take the decision about whether or not to license as given, and focus on market mechanisms that bring licensors and licensees together.

The organization of the rest of this paper is as follows. The next section discusses the effects of a patent thicket on economic efficiency in markets for technology and downstream markets. Section 3 describes the general characteristics of an IP access system, their classification, and specific features of the systems discussed in this paper. Section 4 then compares the economic features of different systems and the effects on markets for technology. Section 5 concludes and suggests directions for future research.

---

[2] Another alternative is the idea of 'open source' innovation whereby each innovator licenses their innovation to others at no cost, on the condition that licensees use the same kind of license. The open source model has found some success in software development. However, much of this success has been due to the efforts of programmers who have a range of personal motivations. It is more difficult to see how the same model could be widely applied in the field of biotechnology, for example, where development costs are large, and many of the innovators are profit-driven firms. See Hope (2004) for a discussion of open source in the context of biotechnology.

[3] The lack of the potential for centralization is another reason for excluding open source.

[4] See, for example, Gallini and Wright (1990), Kamien and Tauman (1986), Katz and Shapiro (1985), and Arora and Fosfuri (2003).

2 Economic Effects of IP Proliferation

For downstream product development or cumulative innovation to occur, the owners of the necessary existing IP rights must decide to license them. Arora *et al* (2001) discuss the idea of a 'market for technology', where innovations available for licensing are supplied by innovators. We use this framework to analyze the effects of IP proliferation and the impact that IP access systems have on the downstream use of licensed innovations.

Figure 4 summarizes the basic conceptual framework, for the case where innovations are combined to make new final products. Upstream, innovations available for licensing are supplied into the market for technology. Demand for licenses comes from firms that produce final goods sold to consumers. The prices of licenses are determined in this market, which affect both the costs of producers and the revenues of innovators. Producers then supply final products to meet demand from final consumers. The prices determined in the product markets affect the revenues of producers and the expenditure (and hence welfare) of the final consumers. Although for illustration we show innovators and producers as separate, in many cases they may be vertically integrated.

Figure 4 Relationships between markets for technology and downstream product markets.

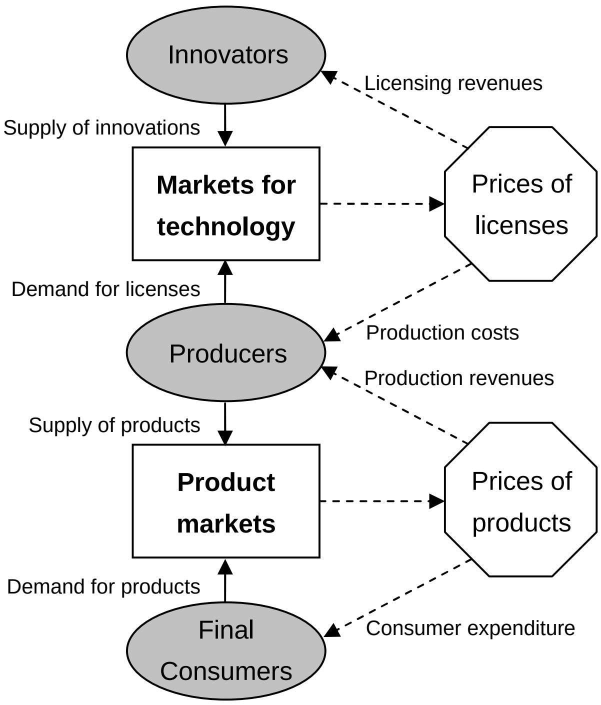


Figure 4 depicts the case where licensed innovations are used to produce final goods. Alternatively, licenses may be used to produce cumulative innovations. If the cumulative innovation is sold to final consumers, then the situation is essentially the same as shown in the figure. If the cumulative innovation is itself licensed for downstream use, then it will be sold in the market for technology.

In general, the more IP rights that exist within a given field, the greater the potential supply of licensable innovations and the greater the range of downstream products that can be produced. This is beneficial from an economic point of view. However, as the number of IP rights increases, it is possible that the licensing process can become 'congested', increasing the costs and inefficiencies associated with the licensing process. We can distinguish three costs that congestion may impose on the development of cumulative innovations or downstream products that combine multiple innovations.

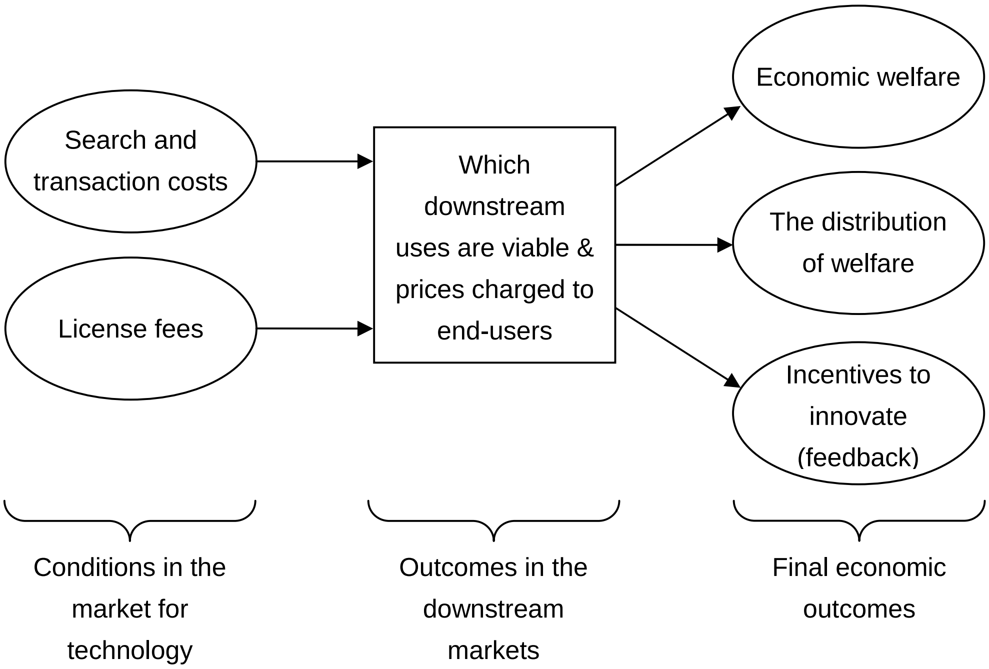
First, downstream users of IP will face increasing *search costs* as it becomes more time-consuming and difficult to identify relevant existing IP rights. Second, if relevant IP rights exist, licenses will need to be negotiated. Since negotiating licenses can be complex and expensive, the more licenses that need to be negotiated, the greater the *transaction costs* innovators and licensors will face. Third, if a new innovation or product needs access to multiple complementary IP rights, the *tragedy of the anti-commons* (Heller & Eisenberg, 1998[5]) may arise, whereby coordination failures among upstream IP owners result in the total fee charged to downstream users being excessively high.

Search and transaction costs and the tragedy of the anti-commons affect economic outcomes in the market for technology. The costs of licensing and the license fees that arise in the market for technology will determine, together with downstream demand, the downstream uses that are economically viable, and the prices charged to final users. This determines economic welfare and the distribution of welfare among consumers, producers and innovators. In addition, innovators will base their decisions about whether to invest in research and development and whether to license their innovations at least partially on expectations of licensing revenues. Thus the final economic outcomes feed back into the incentives to innovate. Figure 5 summarizes these effects.

Of the three adverse effects of IP proliferation that we have identified, increasing search and transaction costs are easy to understand. Both increase the cost of downstream uses of innovations. If these costs could be avoided or reduced, then the downstream activities would be cheaper, and the resources saved could be put to alternative uses, resulting in productive efficiency gains. In addition, if the search and/or transaction costs for a particular downstream use are too large, the project may become unviable and it may not be undertaken at all, resulting in further lost economic benefits.

[5] The basic idea traces back to Cournot (1838).

Figure 5 Linkages between conditions in the market for technology and economic outcomes.



The third effect, the tragedy of the anti-commons, needs some further explanation. Suppose that licenses to two existing complementary technologies, A and B, are required to produce a third technology, C. The producers of C must pay royalties r_A and r_B to the owners of the patents on A and B for each unit of C that is sold. Assume there are no other costs of producing C aside from the royalties. Assume also that C is competitively supplied, so that its price equals its marginal cost, which is $r_A + r_B$. In this situation, an increase in either r_A or r_B will increase the per-unit cost (and hence the price) of C and will result in fewer units of C being sold.

The tragedy of the anti-commons arises because the owner of the patent on A, for example, will not account for the fact that an increase in r_A reduces the royalty revenues received by the owner of patent on B, since fewer units of C will be sold when r_A increases. In other words, the choice of r_A by the owner of the patent on A imposes an externality on the owner of the patent on B, and vice versa. This means that the total royalty per unit of C, $r_A + r_B$, will end up being too high from the point of view of maximizing the *joint* royalty revenues.[6] On the other hand, if the royalties were set by the patent holders in cooperation to maximize their joint revenues then the externalities would be internalized. The total royalty per unit of C would be lower but total royalty

[6] Note that it is not just the proliferation of IP rights that causes the tragedy of the anticommons, but the existence of *complementary* IP rights. If all IP rights were independent or substitutes, or if the patents on A and B were owned by the same person, the problem would not occur.

revenues higher than when the royalties are set independently. Since this would also mean a lower price of C, it makes the consumers of C better off as well. In a more general example, it is also possible to show that the total royalty that results when IP owners act independently increases with the number of IP owners. In other words, the more property rights that bear upon a downstream use, the worse is the tragedy of the anti-commons.[7]

From a static efficiency point of view, production of the new innovation C will be inefficiently low when royalties are set independently. The tragedy of the anticommons may also generate dynamic efficiency losses. If the creation of C requires fixed costs (such as further research and development), this will only be undertaken if the profits from selling C are expected to exceed these costs. If the total royalty payments to A and B are too high, C may not be produced at all.

Note that cooperative determination of the royalties is only beneficial if A and B are complementary. Suppose instead that A and B are perfect substitutes. In this case, the producers of C will simply choose whichever has the lowest royalty and competition between A and B will force royalties down to the lowest level that just covers their research and development costs. If, however, the owners of the patents to A and B jointly set their royalties, they could collude to undermine this competitive process and increase their profits. This would be beneficial for them, but it would hurt consumers of C as the price of C would rise. It can be shown that this outweighs the gains of the patent owners, and so economic efficiency reduces. Therefore, cooperation in setting royalties is only desirable when the technologies are complements, not substitutes.[8]

To summarize, a proliferation of IP rights increases search and transaction costs for downstream uses. In addition, for uses that rely on licenses to complementary technologies, the tragedy of the anti-commons may result in inefficiently high license fees.[9] Any of these effects potentially result in both static and dynamic efficiency losses.

---

[7] To see this, suppose that downstream demand for a product is $Q = 1 - \rho$ where ρ is the total royalty payment to N patent holders. Suppose each patent holder i sets a royalty r_i, where $\rho = r_1 + r_2 + \ldots + r_N$. Patent holder i chooses r_i to maximize his royalty revenues of $R_i = (1 - \rho)r_i$. The first-order condition for maximization is $1 - \rho - r_i = 0$. In a symmetric interior Nash equilibrium where $r_i = r$ for all i, total royalties are $\rho = n / (n + 1)$, which increases with n.

[8] In the simple examples discussed here, the patents are assumed to be perfect complements or perfect substitutes. More general cases are analyzed by Lerner and Tirole (2004), who give specific conditions under which patent pools are efficiency-enhancing, in terms of the degree of complementarity of the patents.

[9] Some authors use the term 'anticommons' to refer to what we have called the tragedy of the anticommons as well as increased search and transaction costs. In this paper we will always refer to the tragedy of the anticommons and search and transaction costs separately.

3 IP Access Systems

In this section we describe some of the IP access systems that exist in response to the problems outlined in the previous section. As discussed in the introduction, we focus on systems that can be centralized for operation by a third-party: patent pools and IP clearinghouses. We consider four types of IP clearinghouse, of which one type encompasses copyright collectives. At the end of this paper we include three mini case-studies that examine successful examples of these systems.

The basic role played by an IP access system in the process of innovation is illustrated in Figure 6, which shows where IP access systems fit in the framework of Figure 4. In the absence of a system, IP is licensed in an ad-hoc manner, with innovators and users of IP finding each other and making licensing arrangements independently. When an IP access system exists, it provides a "platform" that facilitates interactions between innovators and IP users. As will be discussed in section 4, this kind of centralization may be more economically efficient than decentralized bilateral relationships between IP owners and users, as it can take advantage of economies of scale in search and licensing.

Different IP access systems can be distinguished along a number of dimensions. The important dimensions are shown in Figure 7. Systems may be collectives that satisfy a joint objective of the member IP owners, or third-parties with their own objectives. This may be profit maximization, or some other objective for non-profit systems. The systems may also be relatively open or closed in terms of their admission of IP rights, and may just provide information about IP, or may provide both information and licenses. We will discuss the differences between systems in terms of these dimensions.

Figure 6 Basic function of an IP access system in the market for technology.

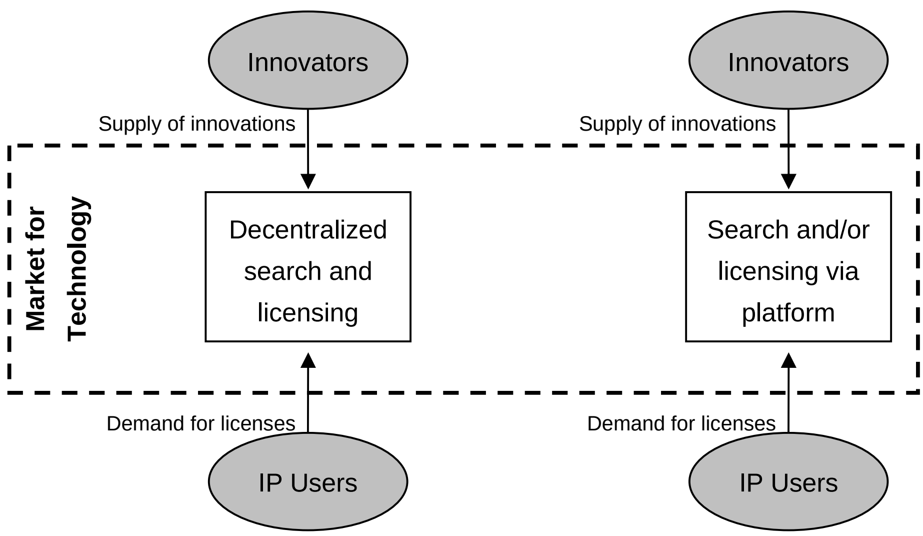


Figure 7 Key dimensions that distinguish IP access systems.

Ownership	Objective	Entry of IP	Function
Third-party	Profit/Revenue Maximization	Open	Information Only
Collective	Other	Restricted	Information & Licensing

3.1 Patent Pools

A patent pool is an arrangement between two or more patent holders in which the relevant patents are licensed jointly as a package. The licensees may be the patent holders themselves, other users of the technology, or both. Patent pools are often based around a specific technology or standard. Obtaining a single license from the pool means that the licensee has access to all of the IP covered by the patents in the pool and standardized licenses are typically offered to anyone who wants one. Recent examples include the MPEG-2 (video encoding), DVD and 3G (mobile telecommunications) pools.[10] In information technology industries, formation of a pool around a common technological standard is relatively straightforward, and it is possible to identify which patents are essential to the standard. In biotechnology and pharmaceuticals, pool formation may be more difficult as technical standards are harder to define precisely. Some working examples include the 'Golden rice' and SARS pools.[11]

It is common for patent pools to be either administered by third parties on behalf of the members, or by one or more of the members of the pool on behalf of all members.[12] One of the key administrative functions is to determine which patents are admitted to the pool. Patent pools are quite restrictive regarding the IP that is admitted. This stems from anti-trust concerns. As explained above, patent pools are efficiency enhancing provided that the patents within the pool are sufficiently complementary in nature. However, pools of patents that are sufficiently substitutable are anti-competitive and allow the member firms to increase profits at the expense of users of the patents. Therefore, membership of a patent pool is usually restricted to those patents that are deemed to be 'essential' to the pool. To satisfy anti-trust authorities, patent pools often employ independent experts to assess essentiality.

---

[10] See Aoki (2005) and Aoki & Nagaoka (2005) for summaries of these pools.

[11] See Verbeure *et al* (2006) for a summary of these pools and a discussion of issues relating to the formation of patent pools in medical diagnostic testing.

[12] For example, the MPEG 2 pool (currently 23 members) is administered by the independent MPEG-LA organization, while the DVD3C and DVD6C pools are administered by Philips and Toshiba respectively (Aoki, 2005).

3.2 IP Clearinghouses

The idea of an IP clearinghouse has recently been discussed by a number of authors.[13] A clearinghouse is like a middleman that facilitates exchanges between IP owners and IP users. Its scope is broader than a patent pool and it may have independent objectives. For example, a biotechnology clearinghouse could provide a database of biotechnology patents and allow searching and identification of IP owners. The clearinghouse could also facilitate licensing and handle the collection of royalties and monitoring of uses on behalf of the patent holders. In principle, the clearinghouse could raise revenues from both IP owners and IP users for its services.

The nature of a clearinghouse means that they are generally administered by third-party organizations and not by one or more members. The key question is whether or not the clearinghouse acts on behalf of the member IP owners. Copyright collectives are administered by third-party organizations that operate on behalf of the members of the collective. For example, ASCAP is administered as a voluntary association by a board of directors elected by the members.[14] In contrast, as we will see, other clearinghouses often operate as independent entities, with their own objectives.

In terms of classification, five different types of clearinghouse are distinguished by van Zimmeren *et al* (2006), depending on the functions performed. These range from an 'informational' clearinghouse that merely facilitates access to information about IP, through to a 'royalty collection' clearinghouse that provides information, as well as standardized licenses plus royalty monitoring and collection functions. This taxonomy is useful in that it distinguishes the range of different functions that a clearinghouse may perform. In our view, the most important functional distinction is whether or not the clearinghouse provides licenses to IP users directly. We distinguish two functional types of clearinghouse: an *informational clearinghouse* and a *licensing clearinghouse*. The former collects and provides access to information about existing IP. The latter provides information and also sells licenses directly, and may perform royalty collection functions.

Of the other dimensions identified in Figure 7, ownership of the clearinghouse is another important point of classification. Ownership will affect the incentives of a clearinghouse when setting the prices (if any) that it charges for its services, and the royalties that it sets, if applicable. The incentives of the clearinghouse will be very different if it is operated as a collective, compared to if it is an independent third-party. Overall, we distinguish four different types of clearinghouse as shown in Figure 8.

---

[13] See van Zimmeren *et al* (2006), Van Overwalle *et al* (2006), Krattinger (2004), OECD (2002), and Graff & Zilberman (2001).

[14] See www.ascap.com/about/.

Figure 8 Classification of clearinghouses.

OWNERSHIP	3rd Party	I	II
	Collective	III	IV
		Informational Clearinghouse Information Only	*Licensing Clearinghouse* Information & Licensing
		FUNCTION	

Copyright collectives are examples of collective licensing clearinghouses (type IV). These collectives, such as the American Society of Composers and Performers (ASCAP), Broadcast Music Incorporated (BMI), and the Japan Society for Rights of Authors, Composers and Publishers (JASRAC), are similar to patent pools in that they provide licenses to packages of IP. Aside from the fact that they apply to copyrights rather than patents, the main feature that distinguishes copyright collectives from patent pools is their scope. A license from a copyright collective typically permits the use of a wide range of copyrighted material, whereas patent pools are limited to a particular technology or standard. The collectives then monitor which works are performed and apportion the total revenues less operating expenses to the copyright owners in accordance with a set formula.

An example of a third-party clearinghouse is BirchBob,[15] which facilitates exchanges between the technology transfer offices of universities and other research institutions with firms that would like to use and license new technologies. In terms of the classification in Figure 8, it is a type I clearinghouse and earns revenues from both technology providers and users. BirchBob describes itself as an 'innovation agency' that assists innovators with commercializing and licensing their technologies. It also provides an online IP search engine using a subscription system.

Other examples include the Public Intellectual Property Resource for Agriculture (PIPRA)[16] and general patent search services such as the Google patent search.[17] The Google patent search allows online searching of the full text of the more than seven million patents issued by the USPTO since the 1790s, using specialized text search technology developed by Google. Google does not charge users for searching its

---

15 See www.birchbob.com.

16 See van Zimmeren *et al* (2006) for a summary.

17 www.google.com/patents/

database, nor patent holders for being listed, but instead earns revenues indirectly through advertising on its website. Like BirchBob, it is another example of a third-party informational clearinghouse (type I). PIPRA is a non-profit organization that aims to encourage agricultural development by facilitating access to relevant IP. It currently does this mainly by providing a database of relevant patents. Thus it is another type I clearinghouse, although it is non-profit. PIPRA also states that it has aims to create packages of complementary agricultural IP and license these to users.[18] If it does so, it would become a type II clearinghouse.

In contrast with patent pools, clearinghouses including copyright collectives are quite open in terms of the IP that they admit. For example, it is possible to join BMI online very easily, at no cost.[19] This may be explained because the value of a clearinghouse increases as more IP is admitted, everything else equal (see section 4.2 below). The only restriction typically encountered is with specialized clearinghouses that concentrate on a particular subject matter, such as PIPRA.

As explained above, copyright collectives fall into type IV in our classification of clearinghouses. We are not aware of any type II or III clearinghouses that currently exist. In principle, third-party licensing clearinghouses (type II) could operate in a similar fashion to copyright collectives. We are also not aware of any type IV clearinghouse that provides access to patents.[20] Table 2 summarizes the type I clearinghouses that we have been able to identify. We have separated them into two groups. The first, IP database search engines, provide either free or subscription services that permit searching of one or more databases of IP. The second group, IP exchange platforms, may provide database search services, but also permit IP owners with licensable technologies (consisting of one or more patented innovations) to advertise and permit IP users to search these advertisements. Thus the second group allows IP owners to take a more active role in their use of the clearinghouse.

---

[18] See www.pipra.org/main/activities.htm#3.

[19] See www.bmi.com/join/.

[20] A clearinghouse that provides standardized licenses has been suggested by van Zimmeren *et al* (2006) to facilitate innovation in genetic diagnostics, but as the authors acknowledge, the complexity of writing such licenses is a likely explanation for why such a clearinghouse has not yet emerged.

Table 2 Third-party informational clearinghouses (type I).

Name	Website	Field	Included IP	Information Sources	Pricing	
					Search	Advertising
IP Database Search Engines						
CAMBIA Patent Lens*	patentlens.net	General	Patents	Patent databases	Free	N/A
Delphion Research	delphion.com	General	Patents	Patent databases	Subscription	N/A
Google Patents	google.com/ patents	General	Patents	USPTO filings	Free	N/A
PatentCafe	patentcafe.com	General	Patents	Patent databases	Subscription	N/A
PIPRA*	pipra.org	Agriculture	Patents	Patent databases	Free	N/A
Thomson Dialog	dialog.com	General	Patents, trademarks, copyrights	IP databases	Subscription	N/A
Thomson MicroPatent	micropat.com	General	Patents	Patent databases	Subscription	N/A
Thomson Pharma	thomson pharma.com	Pharma	Patents	Patent databases	Subscription	N/A
WIPO Digital Library*	wipo.int/ipdl/en/	General	Patents, trademarks, designs	WIPO database	Free	N/A
IP Exchange Platforms						
BirchBob	birchbob.com	General	Licensable technologies	Submissions	Subscription	Free
Idea Trade Network	newideatrade. com	General	Licensable technologies	Submissions	Free	Per-listing fee
MVS Solutions	mvssolutions.net	General	Licensable technologies	Submissions	Free	Commission
Pharma-Transfer	pharma-transfer.com	Pharma & biotech	Licensable technologies	Submissions	Subscription	Subscription
TechEx	techex.com	Biomedical science	Licensable technologies	Patent databases, submissions	Subscription	Free
Yet2	yet2.com	General	Licensable technologies	Patent databases, Submissions	Free (basic), or subscription	Subscription, commission

* Operates on a non-profit basis.

4 Comparison of Economic Features

In this section we discuss and compare the essential economic features of different IP access systems. We are interested in the effect on economic outcomes illustrated in Figure 5 in the context of the framework from Figure 4. In general this depends on (i) the incentives of the system, which in turn depends on whether the system is a collective or independent third party, and (ii) the scope that the system has for realizing efficiency gains in terms of reducing search and transaction costs and solving the tragedy of the anticommons. We also discuss the role that 'network' effects play in the system's operation, and factors determining a system's stability.

4.1 The Economic Value of IP Access Systems

As illustrated in Figure 6, all systems provide a 'platform' that facilitates licensing arrangements, and reduce search and transaction costs in the licensing process. For example, a user of a technology covered by a patent pool need not worry about the specific IP rights contained within the pool. This reduces the licensee's costs because it only needs to identify and negotiate with the pool, rather than all members individually. Similarly, an access agreement with a licensing clearinghouse such as a copyright collective immediately identifies exactly which IP can be used under the agreement. Informational clearinghouses may also give users the ability to search for existing IP more efficiently than they could through independent search, if the scale of the clearinghouse allows it to deploy a more effective search technology. For example, Google's patent search technology is arguably more effective than what most small-scale licensees could implement independently. This is because aggregation of the search function into a single entity means that more sophisticated and expensive search technologies can be employed as the costs can be recovered from a broader base of users.

In terms of transaction costs, patent pools and licensing clearinghouses create value by exploiting economies of scale in licensing and negotiation. If a product or downstream innovation requires licenses to N existing innovations and there are M potential licensees, then $N \times M$ licensing arrangements must be made in the absence of an IP access system. Even if each licensor offers standardized licenses, there are still a potentially large number of transactions that must occur when the innovation is complex (N is large) and/or there are many licensees (M is large).

In comparison, suppose that with an IP access system, each licensor and each licensee makes a single agreement with the system. In this case there are $N + M$ agreements that must be made. The access system reduces the number of agreements that need to be made if $N + M < N \times M$, or if $M > N / (N - 1)$, that is, if the number of licensees is sufficiently large relative to the number of licensors. There may be additional savings if the system offers standardized licenses, compared to if each licensor has to write its own license agreement.

In addition, the marginal cost of adding an extra licensee to the system does not change with the number of licensors that use the system (the marginal cost of increasing M does not depend on N). In contrast, with bilateral negotiations, the marginal cost of increasing M is higher the greater is N. These reduced costs are likely to mean that there will be greater entry of licensees under an IP access system, which will mean increased competition in the market for the final good or service that is being produced, further enhancing economic efficiency.

In the case of complementary IP, an IP access system may also create value by internalizing the externalities that lead to the tragedy of the anticommons, if license fees are set centrally. In effect, joint setting of license fees aggregates the multiple overlapping IP rights into a single right, which eliminates the source of the tragedy of the anti-commons. However, as was shown, this does not hold true when the IP rights are substitutes. Thus it is more difficult to say in general whether licensing clearinghouses including copyright collectives that set license fees centrally would improve economic efficiency by mitigating the tragedy of the anticommons. It would depend on the particular mix of IP that is included in the system, but in general if a broad range of IP is included then the individual rights are more likely to be substitutes rather than complements.

In summary, all IP access systems improve economic efficiency by reducing search and transaction costs. This reduces the cost of downstream innovation and developing new products based on combinations of existing IP. Patent pools can further improve efficiency if the member patents are sufficiently complementary. However, by their nature of incorporating a broad range of IP, it is less likely that the IP available through a licensing clearinghouse such as a copyright collective will be sufficiently complementary that joint license fee setting will be efficiency enhancing. Nevertheless, such clearinghouses can still be desirable, if there is a net gain in economic efficiency due to reduced costs.

4.2 Incentives of the System

The extent to which the potential efficiency gains of an IP access system are realized depend in part on its own incentives. The incentives of the system determine the prices that it charges to its customers – downstream users and/or IP owners – for the services that it provides. The crucial question is whether the system operates on behalf of a group of licensors, or whether it is a truly independent third-party. In the former case, the system will seek to achieve the goal of the licensors, such as maximization of their joint revenues. If it is a third-party then its objective may be to maximize its own profit, or some other objective if it is a non-profit entity.

Patent pools and type III and IV clearinghouses such as copyright collectives operate in the interests of the members who have contributed IP. Typically, any revenues earned by the pool or collective are redistributed to members according to some formula, minus the cost of administrative expenses. For example, ASCAP states that its objective is to "maximize payments to members", and claims that it redistributes 88% of its revenues to members.[21] Similarly, the royalties received from patent pool licenses such as those sold by MPEG-LA and the DVD pools are redistributed to the members of the pool. In contrast, third-party clearinghouses (type I and II) operate according to their own objectives. The profit-making informational clearinghouses (type I) in Table 2 revenue directly or indirectly from either of these two groups. For example, Yet2.com raises revenues by charging subscription fees and/or commissions to both IP owners and IP users for its services.

The other factor affecting the system's incentives is the 'demand' that it faces. Since the value of an IP access system comes from the licensing platform that it provides to IP owners and downstream users, the demand that the system faces is likely to be characterized by 'network' effects. The demand for a good or service exhibits network effects when it becomes more valuable to its consumers the greater the number of people who consume it. This has important implications for the behavior of firms and market outcomes. Consumer expectations become important, and different levels of demand can be supported at a given price depending on whether expectations about the uptake of the good or service are optimistic or pessimistic. Markets with network effects also often 'tip' towards one good or service and tend to be characterized by a single dominant firm at any one point in time, and inferior products may be able to survive longer than they otherwise would in the face of superior competition.

In the general case of an IP access platform as illustrated in Figure 6, these network effects operate *across* the platform. That is, there are two distinct groups that the platform serves: IP owners and IP users. Each group would like to join a platform that has more of the *other* type using the same platform. Specifically, IP owners would like to join a platform that has more IP users, everything else equal, because this will increase the royalties that they expect to receive. Similarly, IP users would like to join a platform that has more IP owners, everything else equal, because it gives access to a greater range of IP that can be exploited. That is, a general IP access system operates what has become known as a 'two-sided platform' (Rochet & Tirole 2003, 2005, Caillaud & Jullien 2003).

However, this observation that does not apply to the specific cases of patent pools and collective clearinghouses (types III and IV) such as copyright collectives, due to the way that these systems operate. First, a patent pool serves the interests of its members. The pool itself does not seek to earn any revenues from patent holders, and therefore only targets one side of the market – the IP users. Admission to the pool is also not based on willingness to pay a price, but rather an assessment of essentiality. Conceptually, pools

---

[21] See www.ascap.com/about/payment/paymentintro.html.

do not exist independent of patent holders and do not seek to attract patent holders to raise revenue. Rather, pools are formed by the patent holders themselves.

Collective clearinghouses such as copyright collectives are similar to patent pools in that they exist to maximize the joint royalty revenues of the members, and do not raise revenues from members. As with a patent pool, a collective clearinghouse is not a two-sided platform because it operates on behalf of one side of the market, rather than seeking to raise revenues from both sides. However, collective clearinghouses do exhibit network effects. As discussed above, the collective promotes more efficient access by the users to the IP held in the collective. A collective with more works will therefore be more valuable to users than a smaller collective, everything else equal. Similarly, joining a collective will be more attractive to an IP owner if more IP users get licenses from the collective, as the amount of royalties that the IP owner expects to receive will increase.

Unlike patent pools and collective clearinghouses, third-party clearinghouses are examples of two-sided platforms. Such a clearinghouse can raise revenues from both IP owners and IP users, and seeks to maximize its own profits, rather than the joint royalty revenues of the IP owners. As has been discussed in the literature (for example, Rochet & Tirole 2005), operating a two-sided platform is more complex than a firm that produces a single product or that produces multiple but unrelated products. A two-sided platform must consider the demands on both sides of the market simultaneously when making its pricing decisions. This is because an increase in the price charged to one group, for example, will reduce the number of members of the platform from that group, which will then affect the willingness to pay of the other group, via the cross-platform network effect. Two-sided platforms also face the same problem that all network businesses face in that since the value of the platform partially or completely comes from network effects, it may be difficult to get established, particularly if IP right owners and users have pessimistic expectations about the likely success of the platform.

4.3 Stability

A final important economic consideration is the stability of the different systems. Instead of participating in an IP access system, any IP owner can choose to be an 'outsider' and license his or her IP to users directly. The incentives for IP owners to join or remain in a system are therefore crucial in determining the ability of the system to get off the ground in the first place, and its ongoing stability once it is established.

For clearinghouses, including copyright collectives, there is likely to be a tendency towards stability, due to the network effects among IP owners (Aoki, 2006). That is, given that other IP owners are members of the clearinghouse, any individual IP owner's incentive is to belong, rather than becoming an outsider. Such stability of clearinghouses is partly evidenced by the longevity of copyright collectives such as ASCAP (established in 1914) and BMI (established in 1939).

The issue of stability is more critical for patent pools. Recall that patent pools solve the tragedy of the anticommons problem by internalizing the externalities that exist among pool members. However, this same mechanism means that any individual pool member has an incentive to become an outsider and 'free ride' on the pool, at least when royalties are distributed to members in proportion to the number of patents that they contribute to the pool (Aoki, 2005, 2006). Starting from the royalty level that is optimal for the pool (i.e. the level that maximizes joint royalties), any individual member would prefer to leave the pool and set a higher royalty for its patent(s). Since an outsider would not choose the pool royalty level, it implies that an outsider could make more profits, given that all others remain in the pool. Therefore, each member has a unilateral incentive to leave the pool once it is formed, which undermines the pool's stability.

Instability of patent pools can also arise from heterogeneity among members. If some members are research-only firms while others are integrated research and manufacturing firms, then the marginal effect of a change in the pool royalty on these two types of firms is different. This is because the royalty affects only revenues for a research firm, but both revenues and costs for an integrated firm. This means that research-only firms prefer to remain outsiders rather than joining a pool with integrated firms, unless the research firms receive disproportionately higher royalty payments (Aoki, 2005).

In spite of these problems, since formation of a pool consisting of all the essential patents for a given standard or technology is jointly beneficial to the members, then the above problems can be overcome with appropriate royalty distribution arrangements and legally binding commitments with suitable punishments for leaving the pool. Nevertheless, additional problems may arise in the process of pool formation, due to the fact that smaller pools consisting of only some of the essential patents may have an incentive to block the formation of a larger pool of all essential patents. In particular, Aoki and Nagaoka (2005) show that if the number of firms with essential patents is large enough, a smaller pool consisting of only some essential patents makes its members better off than the absence of a pool, and that the members of the smaller pool would be made worse off if additional members were admitted. This may explain why patent pools are less common than they otherwise would be, or that some pools do not include all essential IP and thus do not achieve the maximum benefits of pool formation.

5 Conclusion

In this paper we have reviewed patent pools and IP clearinghouses as systems that promote access to IP. These systems assist cumulative innovation and the development of products based on multiple innovations by reducing search and transaction costs, and helping to solve the tragedy of the anticommons that occurs with complementary IP. Each system has different features and each is more suitable in certain situations. Patent pools are ideal in situations where complementary patents must be combined to produce a new product or innovation. This reduces transaction and search costs for licensors and licensees, and mitigates the tragedy of the anticommons. The disadvantages of patent pools are that they are generally limited in scope by antitrust concerns, and they can be difficult to set up and maintain stability especially when there is heterogeneity among the pool members.

Collective clearinghouses such as copyright collectives have worked well to reduce the costs of licensing and monitoring the use of copyrighted works. Copyright collectives typically contain a much broader range of IP than patent pools. Due to network effects, we also expect that copyright collectives are inherently more stable than patent pools. However, copyright collectives have come under some legislative and antitrust scrutiny as collectives set license fees centrally, and many of the works in a collection are likely to be substitutes.

Other third-party clearinghouses dealing mainly in patents are a relatively new phenomenon, due to the reduced costs of collecting and disseminating information over the Internet. The existing third-party clearinghouses do not sell licenses directly, but simply provide a 'matching service' of varying degrees of sophistication between IP owners and users. This helps to economize on search and transaction costs, but without centralized licensing cannot solve the tragedy of the anticommons problem. Third-party clearinghouses usually operate as independent profit-maximizing firms, and as such have an incentive to maximize the economies of scale in licensing and negotiation that they can generate. Third-party clearinghouses also exhibit network effects, which flow across the platform that they provide, from IP owners to users and vice versa. This makes such clearinghouses an example of a two-sided platform, which face relatively complex problems in setting prices for their services.

In terms of future economic research, this brief overview of these different IP access systems raises a number of interesting questions. First, a better understanding of the economics of third-party IP clearinghouses is needed. It would be useful to apply the lessons of the two-sided markets literature to this type of platform. One possible complication is that the two sides of the market are not always clearly separated in the case of IP, as licensors are often also licensees. It would be also interesting to compare directly the economic incentives of a third-party clearinghouse versus a collective clearinghouse.

Of further interest would be a more detailed comparison of the economic aspects of the different systems in terms of their effects on reducing costs of cumulative innovation and product development, and in solving the tragedy of the anticommons. Ultimately, a consistent framework within which the different systems can be compared is needed. Using such a framework, the effects of the different types of system on innovation and welfare could be assessed, which may lead to more specific policy recommendations.

Brief Case Studies

Here we briefly describe the features and identify some of the success factors of the IP access systems that we have discussed in this paper.

1. Third-party informational clearinghouse (type I): Yet2.com

Yet2.com was founded in 1999 with joint investment from Siemens, Bayer, Honeywell, Dupont, Procter & Gamble, Caterpillar, and NTT Leasing. It describes itself as a 'technology marketplace' and provides an online platform where technologies covered by one or more intellectual property rights that available for licensing can be listed and searched. There is also a facility for organizations with particular technology needs to advertise their requirements. It currently enjoys the support of most of the seven founding firms, as well as other leading R&D firms such as Agfa, Microsoft, Philips and Sony, and claims to have over 100,000 members.[22]

Yet2.com operates independently as a private profit-maximizing firm and aims to raise revenue from both potential licensors and licensees. Potential licensees can perform basic searches of the database of listed technologies for free, but more advanced searching and viewing complete details of listings requires purchasing a subscription. Listing technologies also requires a subscription, and Yet2.com charges a commission on any successful licensing arrangement made through its services, with a minimum charge of US$5,000. Exact details of the subscription prices and commissions are not publicly disclosed by Yet2.com.

At the time Yet2.com was started, it was in competition with a number of similar online exchanges.[23] Soon after the dotcom crash in 2001, most of these competing exchanges disappeared, including BioStreet, The Patent & License Exchange, and the Virtual Component Exchange.[24] Of the survivors, Yet2.com appears to be one of the most successful. A key factor underpinning its success is likely to have been its early establishment of a broad network of users, including well-known leaders in R&D. Achieving a critical mass in terms of its network of potential licensees and licensors meant that it was able to survive when other exchanges failed.

2. Collective licensing clearinghouse (type IV): ASCAP

---

[22] See www.yet2.com/app/about/about/members and www.yet2.com/app/about/about/products.

[23] "Corporate secrets up for grabs at new exchanges", *cnn.com*, 15 November 2000, edition.cnn.com/2000/TECH/computing/11/15/secret.exchanges.idg/index.html.

[24] "I will survive", *Electronic Business*, 1 February 2002, www.edn.com/article/CA192491.html?partner=eb.

ASCAP was established in 1914 and accepts membership from composers, songwriters, lyricists and music publishers in the U.S. It currently claims to have more than 270,000 members.[25] It sells licenses to radio stations, television networks, restaurants, and other businesses that wish to play ('perform') its members' works. It then monitors the performances and distributes the license revenue less operating expenses to the members according to a set formula.

ASCAP typically sells 'blanket' licenses that give licensees the right to perform any of the works of its members. Royalties are then usually collected as a set percentage of the licensee's gross revenues. For licensees that only require occasional access to the copyright collection, 'per-program' licenses are also available that permit performances for a specified period of time. A license from ASCAP is convenient for licensees, because it gives them access to the entire collection under a single agreement. Similarly, membership of ASCAP allows copyright holders to avoid the expense of making individual license agreements with licensees, and allows the members to exploit economies of scale in monitoring performances of their works.

Since there are network effects in membership of a copyright collective, a factor in ASCAP's success has been its ability to establish a large membership base. The larger the membership base, the greater the convenience to licensees, and the more they are willing to pay for a license, which flows through to the members. Although ASCAP faces competition for members from BMI and SESAC, it has been able to maintain a large membership in part due to its established network.

3. Patent pool: MPEG-2

MPEG-2 is a digital standard for encoding audio-visual information, and is used to specify the format of digital television and DVDs. The MPEG-2 standard is covered by hundreds of worldwide patents. In response to this patent thicket, the MPEG-2 patent pool was formed in 1997. It has expanded over time and currently includes 23 licensors that together own almost all of the relevant patents. The pool is administered by MPEG-LA, an independent limited-liability company that also administers several other patent pools.

A license from the MPEG-2 pool grants access to more than 810 patents worldwide,[26] and the existence of the pool has been instrumental in the success of adoption of the MPEG-2 standard, with currently 1,155 licensees of the pool.[27] The license agreement specifies per-unit royalties for equipment that uses the MPEG-2 standard (such as DVD players) and for media encoded in the MPEG-2 format (such as DVD movies). Licenses are issued by MPEG-LA and it collects royalties and distributes them to the pool members. MPEG-LA also conducts the assessment of patents to determine whether they are essential to the standard.

MPEG-LA attributes its success as being due to its independence from members, its rigorous assessment of essentiality, its non-discriminatory treatment of licensees, and the convenience that it provides to licensees who would otherwise have to negotiate a large number of license agreements.[28] Although the details of the MPEG-2 licensor agreements are not public, we also assume that rigorous structures must be in place to maintain stability of the pool, especially as some pool members are manufacturers of equipment that uses MPEG-2 and some are not.

---

[25] See www.ascap.com/about/.

[26] See www.mpegla.com/m2/m2web.ppt.

[27] See www.mpegla.com/m2/m2-licensees.cfm.

[28] See www.mpegla.com/aboutus.cfm.

6 References

Athreye, S. & J. Cantwell (2007). Creating competition? Globalisation and the emergence of new technology producers. *Research Policy*, **36**: 209-226.

Aoki, R. (2005). Intellectual property and consortium standard patent pools. *Journal of Intellectual Property Rights*, **10**: 206-213.

Aoki, R. (2006). Clearing houses and patent pools -- Access to genetic patents. *Department of Economics Working Paper* #264, University of Auckland.

Aoki, R. & S. Nagaoka (2005). Coalition formation for a consortium standard through a standard body and a patent pool: Theory and evidence from MPEG2, DVD and 3G. Institute of Innovation Research, Hitotsubashi University, *IIR Working Paper WP#05-01*.

Arora, A. & A. Fosfuri (2003). Licensing the market for technology. *Journal of Economic Behavior and Organization*, **52**: 277-295.

Arora, A., A. Fosfuri & A. Gambardella (2001). *Markets for Technology*. MIT Press: Cambridge.

Caillaud, B. & B. Jullien (2003). Chicken & egg: Competition among intermediation service providers. *The RAND Journal of Economics*, **34**: 309-328.

Cournot, A. (1838). *Researches into the Mathematical Principles of the Theory of Wealth*. Macmillan: New York.

Gallini, N. & B. Wright (1990). Technology transfer under asymmetric information. *RAND Journal of Economics*, **21**: 147-160.

Gambardella, A., P. Giuri & A. Luzzi (2006). The market for patents in Europe. *LEM Working Paper*, No. 2006/04, Sant'Anna School of Advanced Studies, Pisa.

Graff, G. & D. Zilberman (2001). Towards an intellectual property clearinghouse for ag-biotechnology: An issues paper. *IP Strategy Today*, **3**: 1-17.

Giuri, P., M. Mariani, S. Brusoni, G. Crespi, D. Francoz, A. Gambardella, W. Garcia-Fontes, A. Geuna, R. Gonzales, D. Harhoff, K. Hoisl, C. Lebas, A. Luzzi, L. Magazzini, L. Nesta, O. Nomaler, N. Palomeras, P. Patel, M. Romanelli, B. Verspagen (2005). Everything you always wanted to know about inventors (but never asked): Evidence from the PatVal-EU survey. *LEM Working Paper*, No. 2005/20, Sant'Anna School of Advanced Studies, Pisa.

Heller, M. A. & R. S. Eisenberg (1998). Can patents deter innovation? The anticommons in biomedical research. *Science*, **280**: 698-701.

Hope, J. (2004). *Open Source Biotechnology*. PhD thesis, Australian National University. Downloaded from sss.anu.edu.au/~janeth/OpenSourceBiotechnology27July2005.pdf.

Kamien, M & Y. Tauman (1986). Fees versus royalties and the private value of a patent. *Quarterly Journal of Economics*, **101**: 471-491.

Katz, M. & C. Shapiro (1985). On the licensing of innovations. *RAND Journal of Economics*, **16**: 504-520.

Krattinger, A. F. (2004). Financing the bioindustry and facilitating technology transfer. *IP Strategy Today*, **8**: 1-45.

Lerner, J. & J. Tirole (2004). Efficient patent pools. *American Economic Review*, **94**: 691-711.

OECD (2002). *Genetic Inventions, Intellectual Property Rights and Licensing Practices: Evidence and Policies*. Downloaded from www.oecd.org/dataoecd/42/21/2491084.pdf.

OECD (2006). *Compendium of Patent Statistics 2006*. Downloaded from www.oecd.org/sti/ipr-statistics.

Razgaitis, R. (2005). U.S./Canadian licensing in 2004: Survey results. *Les Nouvelles*, **35**: 145-155.

Razgaitis, R. (2004). U.S./Canadian licensing in 2003: Survey results. *Les Nouvelles*, **34**: 139-151.

Rochet, J.-C. & J. Tirole (2003). Platform competition in two-sided markets. *Journal of the European Economic Association*, **1**: 990-1029.

Rochet, J.-C. & J. Tirole (2006). Two-sided markets: A progress report. *The RAND Journal of Economics*, forthcoming.

Scherer, F. M. (2002). The economics of human gene patents. *Academic Medicine*, **77**: 1348-1367.

Scotchmer, S. (2004). *Innovation and Incentives*. MIT Press: Cambridge.

Shapiro, C. (2001). Navigating the patent thicket: Cross licenses, patent pools and standard setting. In Jaffe, E., Lerner, J. & Stern, S., *eds*, *Innovation Policy and the Economy, Volume I*. MIT Press: Cambridge.

USPTO (2005). *US Patent Statistics Report 2005*. Downloaded from www.uspto.gov/web/offices/ac/ido/oeip/taf/reports.htm.

Van Overwalle, G., E. van Zimmeren, B. Verbeure, G. Matthijs (2006). Models for facilitating access to patents on genetic innovations. *Nature Reviews Genetics*, **7**: 143-154.

Verbeure, B., E. van Zimmeren, G. Matthijs & G. Van Overwalle (2006). Patent pools and diagnostic testing. *TRENDS in Biotechnology*, **24**: 115-120.

van Zimmeren, E., B. Verbeure, G. Matthijs & G. Van Overwalle (2006). A clearing house for diagnostic testing: The solution to ensure access to and use of patented genetic innovations? *Bulletin of the World Health Organization*, **84**: 352-359.