CHAPTER 3
BALANCING COLLABORATION AND COMPETITION

Greater collaboration between firms in the innovation process is seen as one important element of the changing face of innovation. Survey evidence indicates that the great majority of research and development (R&D)-intensive firms pursue some form of collaboration. Joining forces with others is also at the heart of modern open innovation approaches – even if the significance of such approaches is still uncertain (see Chapter 1).

Private collaboration has the potential to improve societal welfare by most effectively utilizing the core competencies of individual firms. However, collaboration also creates a tension on two levels:

- Tension due to the competing interests of collaborators. Firms must weigh the efficiency gains from sharing efforts and knowledge against the risks that partners may act opportunistically.

- Tension between producers of intellectual property (IP) and the public good. Policymakers are eager to encourage the efficient introduction of new technologies, favoring cooperation; however, they must guard against harmful anticompetitive practices.

Drawing on the economic literature, this chapter explores these tensions and their implications for business decisions and policymaking. It first focuses on collaboration between firms in the production of IP (Section 3.1) and in the commercialization of IP (Section 3.2). Then, the chapter reviews how anticompetitive practices are addressed in the competition policy frameworks of certain jurisdictions (Section 3.3). The concluding remarks summarize some of the key messages emerging from the economic literature and point to areas where more research could usefully guide policymakers (Section 3.4).

3.1

COLLABORATING TO GENERATE NEW IP

Firms may collaborate at different stages in the innovation process (see Subsection 1.2.5). Conceptually, it is helpful to distinguish between collaboration in producing IP and collaboration in commercializing IP. This section focuses on the former and considers the following two forms of formal R&D collaboration:

- Contractual partnerships – These often take place in the context of a defined project and may involve the sharing of personnel and costs such as laboratories, offices or equipment. These arrangements are usually of a smaller scale and finite time span. Given their project-specific nature, collaboration objectives are usually relatively specific. For generating new IP, this is by far the most common mode of collaboration.

- Equity-based joint ventures – These involve two or more parent organizations creating and funding a third entity. Companies may establish such collaboration agreements specifically to make the entity more independent in governance. This form of collaboration represents a larger commitment and requires higher coordination costs. Although it makes the option of changing partners far less flexible, the entity's actual goals can be more flexibly defined at the organizational rather than the project level.

These two forms of formal collaboration – generally referred to as R&D alliances – do not always result in new IP. But frequently they do and provisions setting out who owns joint research output and how it is shared are often a central element of collaboration agreements.

Following a review of the available data on these forms of collaboration, the discussion explores what motivates firms to collaborate and the complications that arise in joint R&D undertakings. It also briefly reviews the phenomenon of open source software, which departs in important ways from more traditional collaboration approaches.

3.1.1

WHAT THE AVAILABLE DATA SAY ABOUT FORMAL R&D COLLABORATION

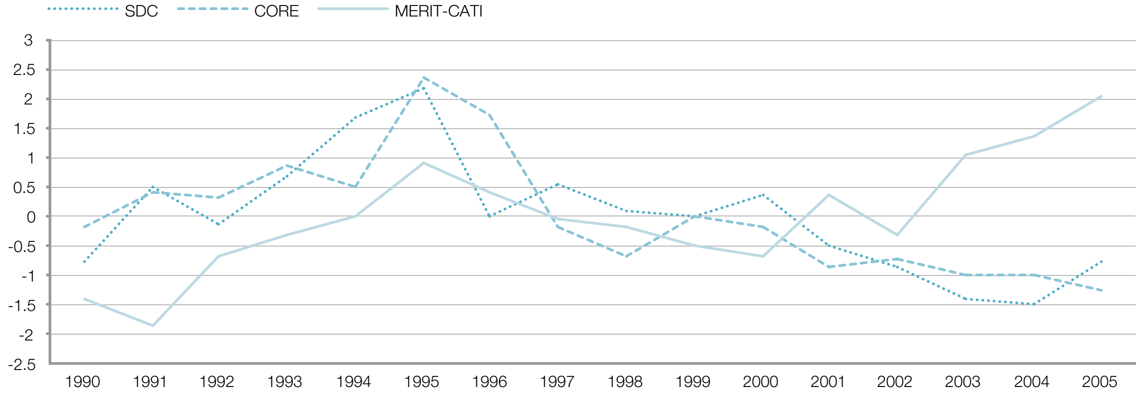
There is no perfect way to trace contractual R&D partnerships and joint ventures. Aside from a few exceptions, firms do not need to officially report information on their collaborative arrangements. Company annual reports may offer a window onto their collaborative activity, but the information available is typically incomplete and limited to larger firms.

Several non-official databases exist that track announcements of new R&D alliances. Figure 3.1 depicts the trend in new agreements over the 1990-2005 period for different industries, as suggested by three such databases. Two empirical patterns stand out. First, the formation of R&D alliances appears to have peaked in the mid-1990s. Second, the information and communications technology (ICT) industry accounts for the greatest number of agreements for most years, although one data source suggests that the biotechnology industry emerged as the top collaborating industry in the early 2000s. In addition to these industries, the chemical industry also exhibits substantial numbers of collaborative agreements across all three sources.

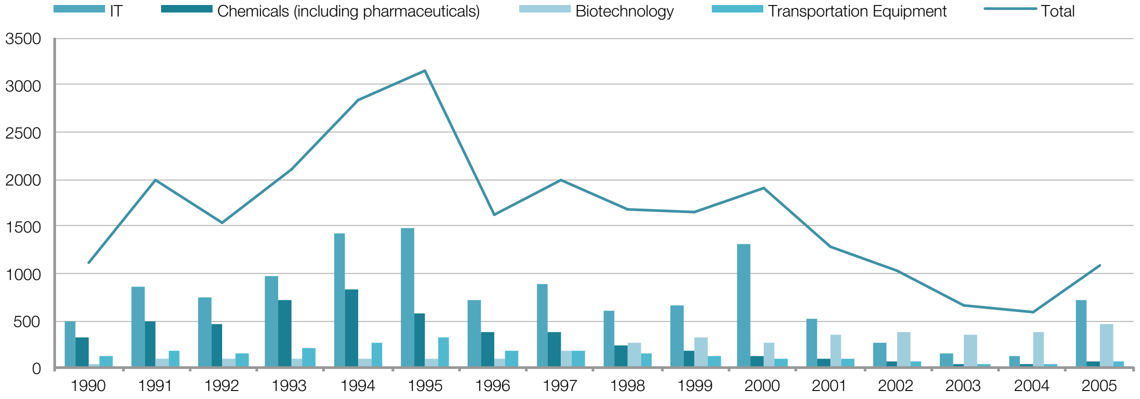
Figure 3.1: Did R&D alliances peak in the mid-1990s?

Number of R&D alliances (standardized), 1990-2005

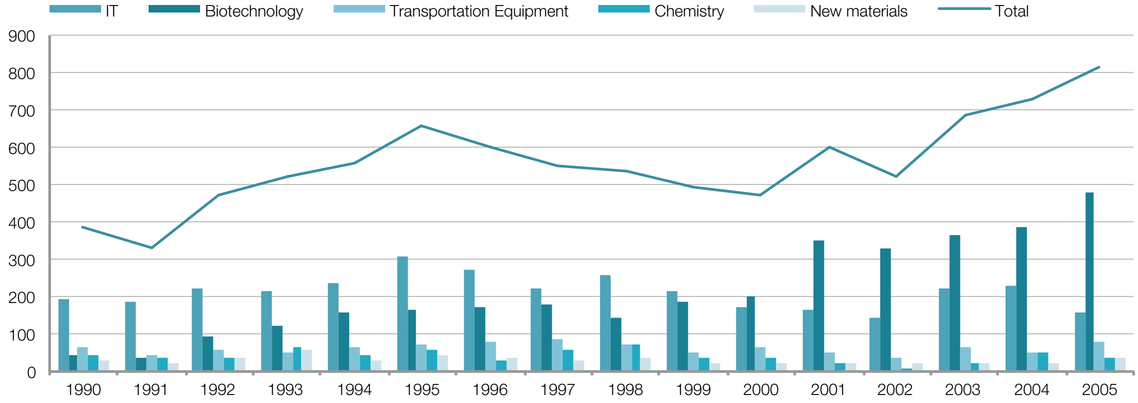
(a) Comparison of the MERIT/CATI, CORE and SDC R&D alliance databases



(b) SDC R&D alliance database by technology sector



(c) MERIT-CATI R&D alliance database by technology sector



Notes: Following Schilling (2009), panel (a) standardizes R&D alliance counts to allow for easier comparisons between the three different databases. As explained in the Data Annex to this chapter, the data collection methodologies of the three different databases differs in important ways. For easier presentation, panel (b) scales down the total count of R&D alliances by a factor of two. In panels (b) and (c), the technology sectors for the SDC and MERIT-CATI databases have been harmonized with a view to improve comparability.

Source: Schilling (2009).

Notwithstanding these similarities, several empirical patterns differ markedly across the three data sources for which there is no obvious explanation. In addition, relying on announcements of new R&D alliances to trace collaborative behavior introduces several biases that may lead to a distorted picture of actual collaboration (see Box 3.1). Another problem of simple alliance counts is that every agreement receives the same weight; in practice, the scope and underlying commercial value of alliances vary substantially. The above empirical insights thus need to be treated with caution.

Box 3.1: Challenges in collecting consistent and comparable data on collaborative agreements

While new open innovation approaches have highlighted the importance of collaboration, it is not a new phenomenon (Chapter 1). Indeed, it is difficult to conclude from the available data that there has been a continuous rise in collaborative agreements over the last decades. However, measurement challenges abound.

In principle, three different types of data could offer empirical insights into collaborative behavior: counts of R&D alliances, innovation surveys and co-patenting behavior. Unfortunately, none of these captures collaborative behavior perfectly, and data collection methods often introduce biases that may even lead to a misleading picture of such behavior.

R&D alliance counts are the most direct way of measuring private collaboration. The available collections – such as the SDC Platinum and MERIT/CATI databases – use a variety of sources to trace R&D alliances, including company annual reports and media announcements (see the Data Annex to this chapter). They invariably miss out on collaboration that is not announced or that does not receive media coverage. In addition, they predominantly cover English-language publications, thus introducing an important geographical bias. Schilling (2009) further discusses the reliability of these data collections.

Innovation surveys offer, in principle, a more rigorous approach to measurement. For example, European Community innovation surveys have collected some information on collaborative behavior and provide important insights into how collaboration varies depending on firm size (see also Subsection 1.3.3). However, innovation survey data often do not distinguish between formal and informal forms of collaborating; in addition, they cannot be easily compared across countries and over time.

Finally, co-patenting data offer an indirect way of capturing collaborative R&D activity between firms. The bibliographical data published in patent documents offer, in principle, rich information on jointly owned inventions. However, not all contractual R&D partnerships and joint ventures may result in subsequent patenting, and co-patenting may not be linked to any formal R&D collaboration. Indeed, the relationship between formal collaboration and subsequent patenting is likely to differ significantly across industries and countries.

A more indirect way of capturing R&D collaboration is to look at co-patenting behavior. Many joint R&D undertakings will result in subsequent patenting, and patent databases can help to identify those patents that have two or more firms as applicants. An analysis of patent filings at the United States Patent and Trademark Office (USPTO) during the years 1989-1998 shows that co-patenting was most frequent in the chemical, ICT and instrumentation industries.[1]

Figure 3.2 depicts the technology breakdown of patents with two or more applicants filed under the Patent Cooperation Treaty (PCT) system for the period 1990-2010. Filings under the PCT system are not directly comparable to filings at national offices, as they only cover patents for which applicants seek protection in several countries. However, for the same reason, patents under the PCT are associated with more valuable inventions. The simple breakdown by technology – rather than industry – shows some similarity to findings in the US; co-patenting was most frequent in organic fine chemistry, computer technology and electrical machinery, followed by pharmaceuticals and basic material chemistry.

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[1] See Hagedoorn (2003). De Backer *et al.* (2008) report similar findings for patents filed at the European Patent Office. In addition, they show that “pharmaceuticals-biotechnology” and “chemical materials” have seen substantial increases in the share of patent filings with multiple applicants.

Normalizing co-patenting shares by total patent filings in given technology fields confirms the importance of co-patenting in chemistry. However, other top-ranked fields in this case include materials and metallurgy and semiconductors. In either case, Figure 3.2 shows that the top three technology fields account for less than a quarter of the total, indicating that co-patenting activity is relatively widespread.

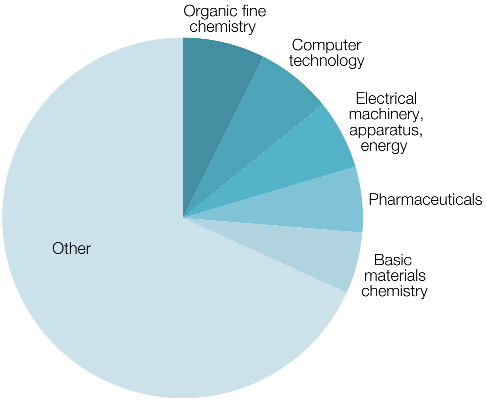
Even though sectoral patterns of co-patenting show some similarity to R&D alliance counts, the jury is still out as to how accurately co-patenting activity reflects underlying collaboration agreements (see Box 3.1). Studying this relationship at the firm level – while of interest in and of itself – could offer useful guidance on the appropriateness of employing co-patenting data as a measure of R&D collaboration.

Finally, neither R&D alliance counts nor co-patenting data offer any insight into the share of overall R&D that is undertaken collaboratively. The limited evidence discussed in Subsection 1.2.5 suggests that formal R&D collaboration is still relatively rare.

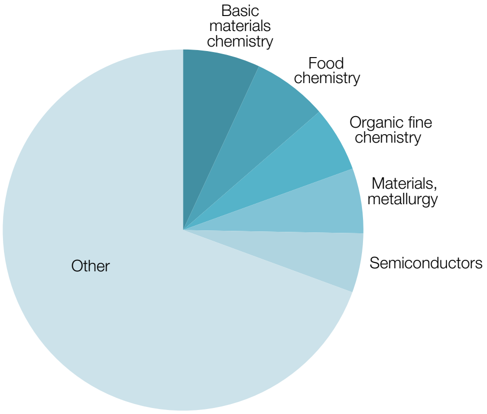
Figure 3.2: Co-patenting is widespread across technology fields

Distribution of PCT filings with two or more applicants, 1990 to 2010

(a) Absolute shares



(b) Shares normalized by total patenting in given technology field



Note: Co-patenting is defined as PCT filings with two or more applicants, where at least two of the applicants are not individuals, universities or public research organizations.

Source: WIPO Statistics Database, October 2011.

3.1.2

WHY FIRMS COLLABORATE FOR STRATEGIC REASONS

Collaboration may be strategically motivated. Alliances can provide a window onto the activities of competitors, giving firms information that could shape their R&D investment or product strategies. While alliance partners are typically careful to guard proprietary information – especially from competitors – it is difficult to obscure all sensitive information without choking off information flows completely. Such secrecy is hard to maintain with alliance partners and makes alliances useful for monitoring R&D activity.

In highly concentrated industries, firms might find the leakage of strategic information beneficial. Information shared within an alliance can provide useful signaling, and such disclosures may allow for tacit coordination. Indirect cooperation might include avoiding direct market competition, adopting common standards and coordinating product releases – particularly where product complementarities are strong.

Indeed, product complementarities can give firms compelling reasons to cooperate. Such interdependencies impact how technology producers think about investment. For example, it may not make sense to invest in technology for an external disk drive that enables faster writing than cable connection speeds would ever allow. Collaborating with technology developers of complementary products can help to coordinate investment schedules and promote interoperability in new product releases.

In some cases, firms may build alliances with partners they see as possessing complementary assets or skills that are important when technology under development reaches the commercialization phase. If producers of ideas anticipate that subsequent commercialization will require partnerships with those holding scarce, complementary assets, they may pursue collaboration to establish favored positions or agreements with potential allies.[2]

Alliances can be a means for improving efficiency, but they can also open the door to anticompetitive behavior. When joint ventures provide higher profits than non-cooperative arrangements, the threat of a breakup can be used as an enforcing mechanism to sustain tacit collusion in product markets.[3] Alliances can also be vehicles by which two firms can coordinate a lowering of R&D investment such that both delay the introduction of new technologies in order to extend higher prices on existing technologies.[4]

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[2] See Teece (1986).

[3] See Martin (1996).

[4] See Cabral (2000).

3.1.3

How collaboration can improve efficiency

In addition to strategic motives, firms seek to collaborate to improve R&D efficiency – notably by benefiting from others' experience, dividing efforts, sharing risks and coordinating with producers of complementary goods. This subsection discusses each of these efficiency motives in turn.

First, as discussed in Subsection 2.2.2, knowledge is often cumulative, and obtaining the foundational knowledge required to pursue cutting-edge innovation is costly. Benefiting from the experience of others can be much cheaper than obtaining the same experience firsthand. The time required to attain a PhD and to become a seasoned scientist or technologist is lengthening as the "burden of knowledge" grows.[5] Firms with complementary expertise can benefit by sharing. Collaborating with other firms can be a way to leverage others' experience without being locked into a commitment to build up knowledge internally. This option is particularly useful when exploring new markets, geographical regions or technologies.[6]

Sometimes, firms are interested not only in leveraging the capabilities and accumulated knowledge of partner firms, but also in learning from them. Collaborative arrangements may explicitly be put into place to facilitate knowledge spillovers between partners (see also Subsection 2.2.4).

Second, teaming up to *divide efforts* can provide efficiency gains where two firms want to explore the same area. In particular, cost sharing is an important reason for joining forces. R&D investment such as the cost of laboratories, instrumentation, testing equipment and technical specialists can be substantial. In some industries, such as those producing semiconductors and telecommunications equipment, the cost of a single R&D project can require investment that is so high that it is beyond the reach of most companies.[7] In the more typical case of smaller-scale R&D operations, effective facilities require not only direct laboratory equipment but also ancillary services – for example, administrative support, maintenance staff that can handle specialized equipment or hazardous materials, testing technicians and others. Collaborating with another player with similar needs helps to spread these costs.

Third, R&D is a risky, exploratory process; not all efforts result in ideas that can be commercialized (see also Chapter 2). In areas like pharmaceuticals, the development of successful products only emerges out of many unfruitful attempts. Collaborating with others during the exploration phase spreads development risk over multiple firms, making it feasible to undertake riskier projects. R&D project portfolios are similar to financial security analogues: firms pursue multiple projects with the understanding that some will fail, but that high-value projects will compensate for that. However, unlike the losses associated with poor security performance, unfruitful projects have a silver lining: researchers learn something about the problem and can use that knowledge to more accurately target successful outcomes. While the cost of this learning must be borne once, the lessons learned can have multiple uses if shared.[8]

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[5] See Jones (2009).

[6] See Veugelers (1998).

[7] See Hagedoorn (1993).

[8] For more basic research, such lessons can sometimes also be applied to projects unrelated to the objectives of the project initially commissioned.

Fourth, for firms with complementary offerings or R&D, cooperation can yield efficiency gains. In addition to the benefits of sharing knowledge and investment burdens, firms can coordinate by aligning their development programs. For example, cooperation on interface development can provide assurances with regard to interoperability as well as coordination in releasing new, improved technologies.

Collaboration for the development of new ideas can be doubly beneficial. First, the problem of underinvestment in R&D due to the appropriability dilemma introduced in Chapter 2 can be partially addressed through cost sharing; firms are more likely to invest sufficiently if the burden can be shared through partnerships. Second, joint activities facilitate knowledge spillovers, which is beneficial from a social welfare perspective. Some economists have advanced these twin benefits as reasons why joint R&D may warrant more favorable consideration by competition authorities (see also Section 3.3).[9]

3.1.4

The complications that arise in joint R&D undertakings

The preceding subsection described four rationales for collaboration based on efficiency gains: benefitting from the experience of others; dividing efforts; sharing risk; and coordinating with producers of complementary goods. For each of these rationales, conflicts of interests may arise.

First, in the case of disclosure, conflicts of interest may arise because individual firms seek to maximize their learning gains and minimize spillover leakages. It can be difficult to ascertain which information a partner firm chooses to withhold.[10] Empirical studies measuring joint venture failure rates have linked conflict of interest to collaboration viability; where partners compete in product markets, the failure rate of joint ventures increases markedly.[11]

In the second case – dividing efforts – monitoring R&D efforts can be difficult, in particular evaluating whether researchers are working hard or moving slowly. Conflicts of interest may arise because, while both parties benefit from the outcome of the joint effort, each has an incentive to let the other party do most of the work. This can be particularly pronounced where many partners are involved. Since it is difficult to both monitor R&D efforts and link each partner's contribution to the results of a joint venture, partners may exert less effort and free-ride on the work of others (see Box 3.2 for an example).[12]

[9] See, for example, Grossman and Shapiro (1986) and Ordover and Willig (1985).

[10] See Teece (1986).

[11] See Harrigan (1988) and Kogut (1988).

[12] See Deroian and Gannon (2006) and Goyal and Moraga-Gonzalez (2001).

Box 3.2: Conflict of interest in a pharmaceutical research alliance

In 1978, ALZA, a California-based drug company, and Ciba-Geigy, a large Swiss pharmaceutical firm, entered into a research agreement. In particular, Ciba-Geigy acquired a majority equity stake in ALZA and contracted the firm to conduct research. However, ALZA maintained activities with other parties which exploited technologies unrelated to the joint venture with Ciba-Geigy. Ciba-Geigy possessed significant control over ALZA – it had 8 out of 11 board seats, majority voting control, extensive information rights and the decision rights to guide 90% of ALZA's research activity through review panels which were mostly controlled by Ciba-Geigy employees. Despite such formal control rights, numerous conflicts arose regarding the kind of activities ALZA researchers participated in. Ciba-Geigy was particularly concerned about "project substitution", whereby ALZA scientists would devote too much time to other efforts outside their contract. Detailed accounting and monitoring of time had been stipulated in the contract, but delays in approving outside activities resulted in ALZA scientists circumventing the formal process.

Over time, Ciba-Geigy became increasingly concerned that its partner might misappropriate research results for extraneous use. As a result, it was reluctant to share information with ALZA. This disclosure problem, along with tensions related to control over outsideresearch, eventually led to the termination of their partnership at the end of 1981.

Source: Lerner and Malmendier (2010).

In the case of risk sharing, partners with a higher tolerance of risk might conceal this prior to joining a partnership. Even those partners who are risk averse may take on more risk with joint venture resources – a phenomenon economists refer to as moral hazard. Sharing cost exposure with partners can even lead to both parties taking on higher gambles, increasing the likelihood of alliance failure.

Lastly, product or technology complementarities expose partners to so-called holdup risk.[13] Joint development of complementary assets can provide mutual benefits, but partners may shape development in a way that locks in their technologies to the exclusion of others. Such strategic maneuvers to embed switching costs also represent a loss in social welfare, since consumers might be offered an inferior technology.

In the case of R&D alliances, Table 3.1 describes both the aligned objectives and conflicts of interest among collaborators and between technology producers and consumers.

Table 3.1: Aligned objectives and conflicts of interest in R&D alliances

	Aligned objectives	Conflicts of interest
Among producers of technologies	• Sharing experiences • Spreading costs • Spreading development risk • Coordinating the production of complementary products	• Free riding • Risk shifting and moral hazard • Holdup risk
Between technology producers and consumers	• Cost reduction • Ensuring compatibility among products	• Higher prices/less variety due to market power • Possible collusion to slow introduction of new technologies

Monitoring a partner's behavior can be difficult if not impossible. The connection between research effort and outcome is typically loose, making pay-for-performance contracting difficult to specify – especially where R&D is exploratory in nature. In addition, too much surveillance can have a chilling effect on knowledge exchange (see also Box 3.2) – the heart of what makes an R&D joint venture valuable in the first place.

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[13] See Gilbert (2010).

To the extent that contractual joint collaboration can be troublesome, firms may choose to create a third independent entity for which parents hold equity stakes. By using this arrangement, incentives are better aligned since both partners have a stake in the success of the third entity. Joint management and oversight make monitoring easier, and the ongoing relationship facilitates enforcement of good behavior. When contracting becomes more hazardous, independent management can be a more effective governance mechanism. One study that examines the organizational choice between contracting and equity joint ventures across national boundaries, finds that contracting risks are higher where enforcement of IP rights is more difficult.[14]

However, the equity form of organization is not without its own costs. Forming a separate entity is expensive, and the cost of "excessive bureaucracy" may outweigh the contracting hazards.[15] In addition, conflicts of interest may arise where joint venture activities affect the profits of one or more of its members.

3.1.5

HOW COLLABORATION DIFFERS IN THE CASE OF OPEN SOURCE SOFTWARE

The previous subsection discussed the complications arising in R&D alliances, implicitly assuming that partnering firms rely on IP exclusivity to appropriate their R&D investments. However, does exclusivity always have to play such a central role in R&D collaboration? Open source software development provides an important instance that appears to challenge this position.

Open source software development involves developers – either individuals or firms, from a variety of locations and organizations – voluntarily sharing code to develop and refine computer programs which are then distributed at no or low direct cost.[16] What makes open source so revolutionary is that it challenges the assumption that IP exclusivity is necessary to motivate the production of new and useful ideas – in clear contradiction to the appropriability dilemma highlighted by Kenneth Arrow (see Section 2.1). In addition, open source software development has shown that collaboration for innovation can happen without IP exclusivity.

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[14] See Oxley (1999).

[15] See Oxley (1997, 1999). The appropriateness of these organizational choices has been linked to performance outcomes. Sampson (2004) examines joint R&D activity with varying levels of opportunism risk. She uses transaction cost economics to predict that collaboration with higher risks for opportunism should adopt equity joint venture structures. Alternatively, straightforward collaboration may most efficiently be managed using contracts. Sampson finds that those alliances that fail to align governance mechanisms with the threat of opportunism underperform compared to those that do align.

[16] See Lerner and Schankerman (2010) for a detailed treatment of the economics of open source software.

Open source software development has undoubtedly grown in influence. The number of such projects has increased rapidly: the website SourceForge.net, which provides free services to open source software developers, has grown from a handful of projects ten years ago to over 250,000 today.[17] Open source is attracting attention in the public sector as well. Government commissions and agencies have proposed – and in some cases implemented – a variety of measures to encourage open source developers, including R&D support, encouragement of open source adoption, explicit open source preferences in government procurement, and even obligations regarding software choices.[18]

Systematic evidence on the effects of open source development on firm performance, consumers and economic growth is still in its infancy. Existing studies suggest that both producers and users of open source products often blend participation in open source and proprietary software. In the case of producers, it is common for firms to develop both proprietary and open source programs.[19] Such mixing is likely to create cost savings, whether in product development or marketing. Firms may also participate in open source software projects strategically to upset dominant players. Similarly, adopters of open source software use open source and proprietary products side by side. Users vary a great deal, both in their software needs and in how they evaluate costs. Although proprietary software may cost more upfront, the costs of switching, interoperability and support services can be greater for open source products. The comingling of proprietary and open source programs in both production and use suggests a complementarity between the approaches.

What drives participation in open source software projects? Unlike in other open innovation models (see Subsection 1.2.5), compensation for innovative open source efforts is not critical to success. At the same time, Lerner and Tirole (2005) argue that contributions to open source efforts are not inexplicable acts of altruism but can be explained by other incentives. For example, participating in open source projects can enhance the skills of contributors, and these improvements may translate into productivity gains in paid work. Open source projects may also provide some intrinsic benefit if such projects are more interesting than routine employer-assigned tasks. Finally, open source participation could give coders a chance to showcase their talents to future employers.

Finally, the spread of open source software development evokes the question whether similar practices are transferable to other industries. Indeed, models of the open source type have been applied to other innovative activity.[20] However, their uptake appears less spectacular than for software. One explanation may be that the success of open source software is closely linked to the special circumstances of software development: projects can be broken into small, manageable and independent modules; input by geographically dispersed developers can be easily shared; upfront capital costs are limited; and new products do not face lengthy regulatory approval processes.[21] Nonetheless, additional opportunities for open source types of collaboration may well arise in the future as technology and the nature of innovation evolve.

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[17] *http://sourceforge.net/about* (accessed March 21, 2011).

[18] See Lewis (2007).

[19] See Lerner and Schankerman (2010) and Lyons (2005).

[20] See, for example, Maurer (2007).

[21] See Lerner and Tirole (2005).

3.2

COLLABORATING TO COMMERCIALIZE EXISTING IP

Collaboration between firms extends beyond the joint production of IP. In many cases, firms only join forces when or even after they commercialize their technologies. This section focuses on such cooperation. It first describes what motivates firms to collaborate during the commercialization phase and the conflicts of interest that may arise between them. It then discusses two specific forms of collaboration: patent pools and standard-setting organizations (SSOs).

3.2.1

WHY COMPLEMENTARITIES REQUIRE COORDINATION

Innovative activity typically builds on previous innovation, and takes place simultaneously with similar innovative efforts by competing firms (see Subsection 2.2.2). In such an environment, so-called patent thickets may emerge: relevant IP rights are distributed over a fragmented base of IP holders, and those who wish to introduce products using such technologies face the high cost of negotiating with multiple parties. If each technology is essential, a negotiation failure with any of the IP holders is equivalent to a failure with all. New products are blocked, all IP holders lose an opportunity to commercialize and society misses out on new technology. Even in the case where an enterprising entrepreneur could strike a deal with each separate IP right holder, he or she is likely to overpay if the number of IP holders that could claim infringement is sufficiently large. Economists refer to this form of overcharging as “royalty stacking”.[22]

One potential solution for IP owners is to offer a license for their collective IP as a package. On the face of it, this form of collaboration would seem to benefit everyone. Suppliers can unlock the value of their IP holdings at a higher profit, and consumers benefit from new technology. However, as in the case of IP-generating collaboration, conflicts of interest invariably arise making it difficult for IP holders to agree on a deal; challenges also exist in balancing the interests of IP producers with the public good. Table 3.2 describes the aligned objectives and conflicts of interest in these two cases.

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[22] See Lerner and Tirole (2007).

Table 3.2: Aligned objectives and conflicts of interest in coordinating fragmented IP ownership

	Aligned objectives	Conflicts of interest
Among producers of complements	• Coordinate compatibility on collective offering • Manage the evolution of technological advance within the pool or standard • Accelerate technology adoption	• Compete for share of joint license revenues • Reduce alternatives of one's own technology, while increasing the substitutability of others • Increase competition by reducing transaction costs
Between technology producers and consumers	• Minimize adoption risk • Lower integration costs across complementary offerings	• Scope of interoperability with rival offerings providing complementary benefits • Introduction of greater choice of suppliers through more open standards

The following subsections discuss how patent pools and standard-setting institutions work to reconcile some of these conflicts.

3.2.2

HOW FIRMS COLLABORATE IN PATENT POOLS

Patent pools are organizations through which patent owners can share their patents with others, sometimes licensing them to third parties as a package. The terms of the patent pool agreement may specify licensing fees, the distribution of returns among the participants and the obligations of contributors regarding the use of their present and future patent rights. Patent pools can be seen as a market-based solution to the patent thicket problem. A firm's share in joint licensing revenue may be better than the revenue the firm could generate by licensing its patents individually. For consumers, such coordination brings technologies to market that would otherwise stay in the laboratory.

Available data suggest that patent pools have historically been concentrated in Europe and the United States (US).[23] Many date to the earlier half of the 1900s (see Figure 3.3). In the period after the Second World War, a more stringent regulatory environment viewed many patent pools as anticompetitive, which diminished the entry of new pools.[24] In the last decade, however, clearer pronouncements on the part of the US and European competition authorities have encouraged the creation of patent pools once again. More recently, Asian participation in patent pools has increased, reflecting their growing role in technological innovation. In addition, the ICT industry – broadly defined – accounts for the majority of patent pools established over the last two decades (see Figure 3.4).

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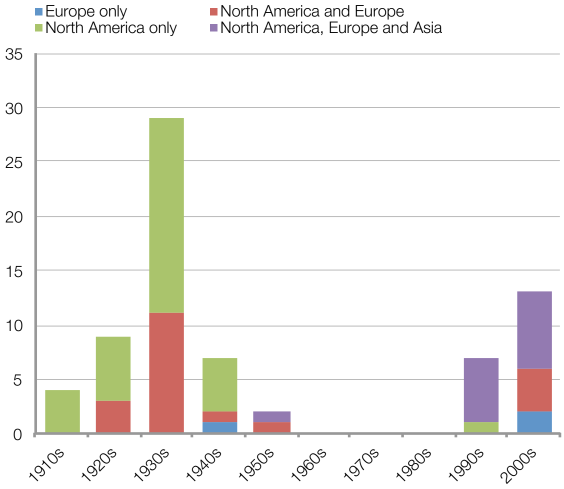
[23] However, the identification of patent pools underlying the data used in Figure 3.3 relied mostly on English language publications. The data may thus be biased towards US pools. The Data Annex provides further details.

[24] The linkage between increased scrutiny by US federal regulatory agencies and the diminished number of patent pools should be interpreted with caution, as patent pool activity not captured by news sources or regulatory reports may have occurred during the intervening time.

Figure 3.3: The popularity of patent pools varies over time

Number of patent pools by country/ region

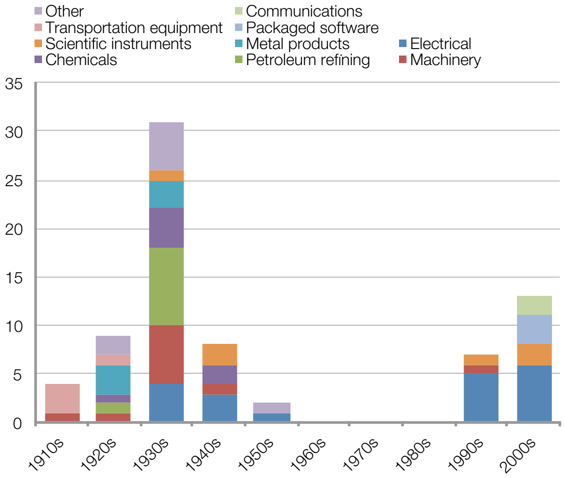


Note: Based on information for 75 documented pools. See the Data Annex for further details.

Source: Updated from Lerner *et al*. (2007).

Figure 3.4: The ICT industry dominates the recent wave of patent pools

Number of patent pools by industry



Note: Based on information for 75 documented pools.

Source: Updated from Lerner *et al*. (2007).

Notwithstanding the compelling rationales for IP holder cooperation, conflicts of interest can complicate the successful formation of patent pools. By lowering transaction costs and facilitating the commercialization of technologies, pools may intensify product market competition among members, leading to reduced profit margins.[25] Depending on their business model, members may also have different views on the design of pools. For example, pools can bring together players who participate in retail markets with those who only produce IP. Those who participate in retail market would be interested in trading lower licensing fees for cheaper access to the pool's IP, while pure R&D players might more likely aim to maximize licensing fees since they cannot recover their outlay through product sales. Pure R&D actors might prefer the broadest possible adoption, while competitors in retail markets may seek to exclude rivals. Box 3.3 offers an example of such conflicts of interest.

Box 3.3: Conflicts of interest in the MPEG-2 patent pool

The MPEG-2 patent pool offers an example of the complexities of cooperating with firms of varying levels of vertical integration. Contributing firm Sony also intended to license MPEG-2 patents; it was interested in maximizing the adoption rate of the standard. On the other hand, Columbia University and Lucent sought to maximize licensing revenues, since they did not participate in the downstream product market. Interestingly, the latter two acted in very different ways. Columbia University chose to participate in the pool for fear that negotiation failure would foreclose its hopes to gain any licensing revenue. Lucent, however, opted to withdraw from the pool. The firm believed that its two patents were critical to the MPEG-2 standard and that the pool's licensing fees were too low. Equipped with a sizable internal licensing department, Lucent was convinced that it could charger higher licensing fees independently.

Source: Lerner and Tirole (2007).

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[25] See Gilbert (2010).

As in the case of contractual partnerships and joint ventures, a second conflict of interest arises where pool members seek to maximize their return at the expense of consumers. Patent pools that charge too high a price effectively lower social welfare for the enrichment of pool members. Social welfare may also diminish if incentives to innovate are reduced. Pool members that enjoy monopoly status may have less incentive to release improved versions of their technologies, and their market power could raise barriers to entry for those who might step forward with better alternatives (see also the discussion in Subsection 2.2.3).

Should pools be allowed as a market-based solution to the coordination problem, or disallowed as a vehicle for collusion? The general principle is that competitive markets serve society's interest; however, complementarities present a special case for which coordination needs to be considered. The short answer is "it depends". Patent pools comprising complementary patents can be welfare-enhancing, because they solve the coordination problem. On the other hand, patent pools containing substitute technologies are not, since their main is to soften price competition among pool members.[26] Unfortunately, this is far from a clear litmus test in real situations; patents are rarely perfect complements or perfect substitutes.

One way to better differentiate beneficial pools from harmful ones is to look at the detailed provisions governing them. Two types of provisions are particularly relevant: so-called grant backs and independent licensing rules.

Grant backs commit pool members to offer future patents to the pool at no fee if such patents are deemed relevant to the patent pool.[27] This prevents individual members who patent technologies that become essential to the pool from holding up other members; it may also remove the incentive to hide development in progress. However, there is a cost to implementing such terms. Grant backs also lower the incentives to invest in future innovation; this not only works against the interests of pool members but also against the public interest. Policymakers need to be particularly concerned about grant backs restricting technological progress.

Independent licensing rules allow any pool member to license their patent outside of the pool. These can work in the public interest in at least three ways. First, the outside option to license the patents independently puts a ceiling on the fees the pool can charge. As mentioned earlier, in the absence of cooperation and where each IP holder licenses independently, royalty stacking may create inefficiently high prices. Certainly, policymakers would not want pool prices to be higher than this. Allowing pool members the option to independently license limits the bundled price to the sum of the independent licensing fees.

Second, independent licensing can serve as a screening device for policymakers to separate anticompetitive pools with substitute patents from beneficial pools of complementary patents. In anticompetitive pools, the freedom of members to license their technology independently would break the pool's ability to fix prices above the competitive rate. Such pools would therefore not include independent licensing provisions. On the other hand, independent licensing does not negatively impact pools of complementary patents, since external licensing of any component is either not valuable without the remaining complements or occurs in a market that does not compete with the pool.[28]

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[26] However, Gilbert (2010) shows that substitute patents in a pool do not increase member profits if the pool also includes essential patents. In this case, the inclusion of substitute patents could affect the ability of the pool to influence the adoption of technologies that do not require the essential patents.

[27] See Layne-Farrar and Lerner (2010).

[28] See Lerner and Tirole (2004, 2007).

Third, independent licensing encourages alternative applications of patented technologies which may have alternative uses outside the patent pool. Independent licensing enables such multiuse patents to realize their potential rather than restricting them to pool-related licensing.[29]

Empirical research on patent pools has made some headway in assessing whether the above predictions hold true in the real world. One key empirical challenge is that patent pools are voluntary organizations, and the set of candidate patents for pooling is thus difficult to identify. One recent study overcame this challenge by focusing on patent pools emerging from standard-setting efforts.[30] Because SSOs typically identify all essential patents in a patent pool, the authors were able to construct the set of patents that could potentially be included in nine modern patent pools.

Using data on participating companies as well as the composition of the patent pools themselves, the study reports several interesting findings. First, using patents identified in a standard as the measure of potential participation, they find that most pools contain roughly one-third of eligible firms, underscoring the voluntary nature of patent pools. This finding also points out that the extent to which pools resolve the patent thicket problem is perhaps more limited in reality. Second, firms that are vertically integrated in both R&D and downstream product production are more likely to join a pool than are pure R&D players.

Third, the study examines the impact of royalty sharing terms. Where participants contribute patents of comparable value, it is more likely that sharing revenue based on the number of patents contributed will be accepted. Because sharing terms might be determined with the specific intent of attracting participation, the authors look at the subset of firms that join the pool after the terms were formed. They find that firms are less likely to join an existing pool that uses such numerical proportion rules.[31]

In relation to whether independent licensing can effectively screen for socially beneficial pools, another study analyzes 63 patent pools and finds support for the association between complementary patent pools and the existence of independent licensing provisions.[32] Since patent pools do not spell out whether they comprise either complementary or substitute patents, the study employs records of legal challenges to capture the extent to which pools reduce competition.[33] It finds that pools with complementary patents are more likely to allow for external licensing. In addition, among litigated pools, those without independent licensing are more likely to face more severe verdicts. These findings are consistent with the theory described earlier.

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[29] A possible fourth benefit of independent licensing rules is that they reduce incentives for "socially wasteful" inventive effort. Consider the "innovation for buyout" scenario, whereby an enterprising inventor produces a "me-too" innovation very similar to a patent contained in a patent pool. The entrepreneur pursues this marginal invention knowing that the patent pool member will purchase the entrepreneur's patent in order to remove the threat of being ousted from the patent pool. The effort to develop a me-too invention and prosecute this buyout strategy is socially wasteful, since it generates little new knowledge; the primary purpose of this tactic is essentially to blackmail pool members. Mandated independent licensing can provide a check on such wasteful practices. Such mandates limit the opportunity to accumulate excess profits within the pool, and this limits the potential reward for pursuing innovation for buyout strategies.

[30] See Layne-Farrar and Lerner (2010).

[31] Given that few pools have adopted other approaches to license revenue allocation, the study was unable to conduct similar tests with value-based allocation or royalty-free treatments for licensing. See Layne-Farrar and Lerner (2010).

[32] See Lerner *et al.* (2007).

[33] In particular, the study uses records of both private challenges and the memoranda from US federal prosecutions to formulate this measure. It considers both the occurrence of litigation and remedies in such cases to measure the likelihood that such pools have in fact reduced competition.

Finally, the same study shows that grant back provisions were more frequently used in complementary pools that allow for independent licensing. This finding also supports earlier arguments: grant back rules help remedy the holdup problem (see earlier discussion), which is more likely to arise in complementary pools.

3.2.3

WHY PATENT POOLS ARE EMERGING IN THE LIFE SCIENCES

As described in the previous subsection, the ICT industry accounts for the majority of patent pools formed over the last two decades. However, as patenting becomes increasingly common in the life sciences, coordination concerns for navigating patent thickets are also emerging in the biotechnology industry.[34]

The incentives to create biotechnology patent pools are similar to those in other industries. Overlapping patent claims can block the commercialization and adoption of technologies. The prospect of high coordination costs can also dampen research efforts in the first place. Patent pools offer a mechanism by which IP holders can coordinate to remove such roadblocks.[35]

However, there are additional motives for considering patent pools in the life sciences. Patent pools can be created for philanthropic purposes (see Subsection 1.3.4). For example, the Public Intellectual Property Resource for Agriculture (PIPRA) patent pool for genetically modified rice brings together over 30 different IP owners. Its purpose is to make patented technologies available to less developed economies free of charge. Similarly, the UNITAID patent pool focuses on making medicines for diseases such as HIV/AIDS, malaria and tuberculosis available to countries in need.

Patent pools may be created as a commons for encouraging research. In 2009, GlaxoSmithKline contributed over 500 patents to a patent pool for the study of neglected tropical diseases. In contrast to the UNITAID pool which concentrates on product availability, the GlaxoSmithKline patent pool focuses on the accessibility of its stock of ideas.

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[34] See Verbeure *et al.* (2006).

[35] See Lerner and Tirole (2004) and Verbeure *et al.* (2006).

Proponents of life science patent pools point out that pools can also be a means for setting standards. Following the example of the telecommunications industry, pools may be used to establish and legitimize, for example, standards for recognized genetic mutations.[36] They could also be used to codify best practice guidelines for genetic testing of particular diseases.[37]

While patent pools hold the potential to make technology more accessible – particularly to disadvantaged groups or countries – and to coordinate basic research efforts, the biotechnology industry is in the early stages of determining how best to use them. Resolving conflicts of interest is likely to be just as challenging, if not more so, as it is for other industries. At this stage, many pools appear to focus on more marginal technologies, which firms release at least in part because they are not part of their core business. Many patent pools have a largely philanthropic character; how patent pools will operate within the business models of the biotechnology industry remains to be seen.[38]

3.2.4

HOW FIRMS COOPERATE TO SET STANDARDS

As described earlier, patent pools in the modern era have often been formed around certain standards. In fact, patent pools can be the governing arrangement for a standard-setting group.[39] This subsection takes a closer look at the standard-setting process, exploring where standards are important, the role SSOs play, and the conflicts of interest that arise in the setting of standards.

Standards become critical where interoperability is important. They define which devices will work with others and the technology that enables them to do so. They might also specify not only the component technology, but also the interface requirements between technologies. Such interface standards allow producers to focus on improving their own module without constantly revisiting interoperability.

The link between standards and patent pools arises from the fact that many standards are based on complementary technologies, often developed by different firms. Patent pools that set out how technologies covered by a particular standard can be accessed are therefore a natural vehicle for cooperation among firms. One of the first patent pools associated with a standard was the MPEG-2 video coding standard pool. In 1997, the US Department of Justice issued a business review letter favorably responding to a proposal to license patents essential to the MPEG standard as a package. This decision – along with the positive response in 1998 to the DVD standard patent pool proposal – set the template for patent pools that would not run afoul of US antitrust laws.[40]

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[36] See Van Overwalle *et al.* (2005).

[37] See Verbeure *et al.* (2006).

[38] See *The Lancet*, "Pharmaceuticals, Patents, Publicity… and Philanthropy?" (2009).

[39] In the nine modern patent pools studied by Layne-Farrar and Lerner (2010) all were associated with standard-setting efforts.

[40] See Gilbert (2004).

Standards can be particularly important in the early stages of technology adoption, because they can reduce consumer confusion in the marketplace. Where consumers are uncertain about which technology provides the broadest compatibility, the rate of adoption is lower. Standards provide some assurance that certain technologies will continue to be supported in the future through upgrades and complementary products; they therefore inform development efforts and consumer decisions. Where industries adhere to standards, consumers can mix and match the best technologies to suit their needs.[41]

Standard-setting based on patented technologies generally require voluntary participation by patent holders; thus, many of the concepts and findings discussed in Subsection 3.2.2 apply to the standard-setting process. However, one economic characteristic associated with standards further complicates incentives for cooperation and has important social welfare implications: network effects (see Box 3.4 for an explanation). In particular, there is much to be gained by embedding one's patent in a standard and a great deal to lose by being excluded from it. As a result, technology producers are keen to influence the standard-setting process in their favor.

Box 3.4: What are network effects and how are they related to standard setting?

Network effects occur where the value of a product increases as more people use it. The classic example is the fax machine: such a device is nearly worthless unless others own one; however, as more consumers adopt the technology, it becomes increasingly valuable.

For a product to effectively exploit network effects, prior standard setting is often necessary – as is the case for the fax machine. Producers aligned with the standard have the advantage of remaining in the market as is, whereas those who are not so aligned must bring their offerings into compliance. Indeed, producers with a head start may be able to build a market share that makes it increasingly attractive for subsequent producers and consumers to adopt their standard. This positive feedback loop is referred to as an "indirect network effect", whereby the consumer benefit of a standard depends on the number of producers that adopt the standard, and producers' profits in turn depend on the number of consumers.[42]

Scholars who study network effects point out that, although according to theory there will be one or a handful of standards in a given segment where network effects are present, it is not clear which ones will be selected. Theoretical models which assume that producers and consumers make irreversible sequential decisions, predict that those who influence standards first will have the most to gain. Yet in other models, standards emerge from producers' and users' expectations about the future. In either case, these theories point to a critical implication for both producers and policymakers: the final standard adopted may not be the best one, but rather the one advanced by early movers.[43] Clearly, producers of goods for which value depends on complementary technologies have a strong interest in shaping standards.[44]

When the stakes are this high, it is not clear whether open market competition will lead to the best standard. IP holders will act to advance their own interests. Failure to reach an agreement could result in no coordination, even where it would be in society's interest. Rather than "voting with their money", potential consumers may simply choose not to adopt a technology, and the fear of poor adoption rates becomes a self-fulfilling prophecy.

SSOs may intervene to facilitate coordination by providing a forum for communication among private firms, regulatory agencies, industry groups or any combination thereof. This can improve the chances of a cooperative agreement being reached in the first place.[45] In addition, market mechanisms may lead to an impasse or to failed adoption if important information on the technologies themselves is not taken into account. Standard-setting forums provide an outlet for such information to be considered.

However, coordination via standards organizations is not without its own challenges. Conflicts of interest in the formation of standards are somewhat analogous to those encountered for patent pools. Suppliers can withhold information about R&D in progress to steer the group toward their forthcoming patents. Similarly, suppliers can use the knowledge gained in the standard-setting process to adjust their patent claims such that they have greater power to hold up the group (see Box 3.5 for an example).[46]

Box 3.5: The case of Rambus and the Joint Electron Device Engineering Council

One controversial example of a patent claim amendment is the case of Rambus and the SSO, the Joint Electron Device Engineering Council (JEDEC). Founded in 1990 as a technology licensing company, Rambus was invited to join JEDEC shortly after its creation. Rambus dropped out of the SSO in 1996. By that time, it had had the opportunity to observe the SSO's proceedings and subsequently filed for patent continuations. Rambus claimed that the decision to file such continuations was independent from its participation in JEDEC; however, Rambus' patent claim language for these continuations meant that those adopting JEDEC's synchronous dynamic random access memory (SDRAM) standard risked infringing Rambus' patents.

In 2000, Rambus successfully filed an infringement suit against Infineon, claiming that its memory manufactured under the SDRAM standard infringed four of its patents. These patents were filed after 1997, but they were continuations of a patent application originally filed in 1990. Over the next decade, Rambus was the subject of an extensive investigation by the US Federal Trade Commission (FTC). The agency charged Rambus with antitrust violations originating from what was inferred to be its attempt to use knowledge gained while participating in JEDEC to strategically expand the scope of its patent claims. These claims were contested through the District Courts and the Court of Appeals for the Federal Circuit, until 2009 when the US Supreme Court rejected the FTC's final appeal.

Source: Graham and Mowery (2004) and FTC Docket No. 9302.
www.ftc.gov/os/adjpro/d9302/index.shtm

In a close examination of the US modem industry, one study finds that patent efforts may be the result, not the antecedent, of participation in standard-setting activities.[47] The study documents a high correlation between patents granted for modem technology and participation in standard setting. In addition, it finds that participation in standard-setting predicts subsequent patents granted, yet prior patents granted in the modem field are not indications of subsequent participation in standard setting.[48] These effects hold even when accounting for anticipated lags between patent applications and grants. While it is possible that companies lobby for technologies that they have not yet invented, the authors point out that such a strategy is risky, because another company may learn about the impending standard and overtake them in the patenting race.

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[45] See Farrell and Saloner (1988).

[46] A different conflict of interest arises in the case of interface standards: firms can adopt "one-way" technical standards in which the interface on one side is openly disclosed but concealed behind a "translator" layer on the other. Such maneuvers allow some firms to enjoy protected positions within the standard while exposing others to competition.

[47] See Gandal *et al.* (2007).

[48] In particular, Gandal *et al.* (2007) employ a Granger causality test. In a nutshell, this test establishes that X "causes" Y if lagged values of X are significant in explaining outcome Y, where lagged values of Y are also included as controls.

Finally, there may also be conflicts of interest between SSOs and society. Notably, SSO members may charge higher royalties to non-members than to fellow members. One may argue that this would not be in the SSO's interest, as it could discourage wider adoption of a standard. However, there are more subtle means of creating disadvantages for non-members. For example, delaying disclosure can severely raise costs in a rapidly developing industry, harming competitive market forces (see Box 3.6 for an example).

Box 3.6: Delayed disclosure in the case of the Universal Serial Bus standard

One prominent example of delayed disclosure concerns the development of the Universal Serial Bus (USB) 2.0 standard. USB 2.0 improved speeds of the peripheral-to-computer connections by as much as 40 times. USB 2.0 was only compatible with a new controller interface, the Enhanced Host Controller Interface (EHCI). Consortium members like NEC Technologies, Lucent and Phillips all announced their new USB 2.0 and EHCI-compliant host controllers well in advance of the full release of the EHCI specification. In the fast-moving market of consumer electronics, such a head start can create a significant competitive advantage.

Source: MacKie-Mason and Netz (2007).

In the presence of network externalities, standards help to increase societal welfare through the mutual adoption of an agreed path for technological development. However, the same network externalities can trap society in an inferior standard (see also Box 3.4). Even were society to be better off collectively absorbing the cost of upgrading to another technology standard, no single firm may have the incentive necessary to initiate such an upgrade.[49] Private incentives may thus be insufficient for ensuring socially optimal outcomes.[50] This raises the question of which organizational attributes of SSOs best serve the public interest and the appropriate form and level of government intervention in the standard-setting process. Difficult trade-offs exist. For example, it may seem more efficient to decide on standards quickly; converging on this allows producers to focus on performance improvements rather than standard-setting. On the other hand, encouraging more competition among alternative standards prior to selection could help to ensure that the best standard emerges.

3.3

SAFEGUARDING COMPETITION

The previous discussion pointed to a number of situations in which private collaborative practices may conflict with society's interests. In particular, collaborative practices can curtail the functioning of market competition to the extent that consumers face higher prices, lower output, less choice, the adoption of second-best technologies and reduced innovation.

There is thus a role for competition policy to play in identifying and prohibiting those collaborative agreements which impose a net cost on society. Indeed, in many countries, competition policy addresses the interface between private collaboration, IP and competition. While there are important differences across jurisdictions, most policy frameworks explicitly recognize that collaboration can promote societal welfare; they are thus generally permissive of collaborative practices, unless they trigger certain warning signs. Even then, only a few collaborative practices are expressly prohibited – mainly those associated with the formation of hardcore cartels. In most cases, such warning signs prompt authorities to further examine the competitive consequences of collaborative agreements.

[49] See Farrell and Saloner (1985).

[50] See Katz and Shapiro (1985).

Competition policy frameworks often spell out in some detail the types of agreements that raise concerns in the national context. This section reviews some of the key rules and guidelines that have emerged in a number of jurisdictions – namely, the European Union (EU), Japan, the Republic of Korea and the US.[51] The discussion is not meant to be comprehensive from a legal viewpoint, but merely seeks to illustrate the different approaches and key legal concepts applied. Following the structure of the previous discussion, the section first looks at collaborative R&D alliances, followed by patent pools and standard-setting agreements.

3.3.1

THE TYPE OF COLLABORATIVE R&D ALLIANCES THAT MAY BE CONSIDERED ANTICOMPETITIVE

There are three types of criteria that competition agencies employ to identify potentially anticompetitive collaborative R&D alliances: whether the combined market share of participants exceeds certain concentration thresholds; how the joint research undertaking might affect market competition; and whether an agreement includes certain provisions that may be unduly harmful for competition.

First, several jurisdictions have established critical market share thresholds above which collaborative agreements may trigger closer scrutiny by competition authorities. For example, EU guidelines refer to a combined market share threshold of 25 percent. In Japan and the Republic of Korea, similar thresholds stand at 20 percent. Competition authorities in the US do not employ a market share threshold, but use threshold values for a broader measure of market concentration, in particular the Herfindahl-Hirschman Index.[52]

Implementing such threshold criteria is often not straightforward, as authorities need to define what constitutes a relevant market. One possibility is to define markets in relation to a specific technology – for example, combustion engines. Other options are to define markets in relation to specific products and their close substitutes – for example, car engines – or broader consumer markets – for example, cars. Further complications arise where R&D agreements concern radically new technologies that have no close substitutes. Competition authorities sometimes calculate market shares using alternative market definitions, though the precise practice varies across countries.

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[51] See guidelines on joint research practices for the EU (2010, 2011), Japan (1993, 2007), the Republic of Korea (2007, 2010) and the US (1995, 2000). The US Department of Justice and Federal Trade Commission (2007) reported and reviewed the practices in this field.

[52] The Herfindahl-Hirschman Index is calculated by summing the squares of individual firms' market shares thereby giving proportionately greater weight to the larger market shares.

Second, in assessing the competitive consequences of collaborative agreements, some competition authorities look at the nature of the joint research undertaking. In Japan, for example, an agreement is more likely to raise concerns the closer the joint research activity is to the commercialization stage. Similarly, US competition authorities are more circumspect of agreements that assign marketing personnel to an R&D collaboration. In the EU, R&D agreements that cover basic research are less likely to raise concerns than agreements covering the production and marketing of research results. In addition, many competition authorities are more lenient towards agreements involving firms that clearly possess complementary assets and for which the rationale for collaboration is thus strongest.

Finally, the inclusion of certain provisions in collaborative R&D agreements may trigger action by competition authorities. As already pointed out, provisions that facilitate the formation of hardcore cartels – notably, price-fixing, market sharing or joint marketing – are illegal *per se* in most countries. In addition, authorities may investigate agreements that impose restrictions on collaborating partners which could result in reduced innovative activity. For example, in the EU and Japan, authorities may question agreements that limit participants' research activity in areas different from those of the joint project, or that takes place after the joint project is completed. In addition, EU authorities may challenge agreements that do not allow all participants access to the results of the joint research or that prevent participants from exploiting research results individually.

3.3.2

HOW COMPETITION RULES TREAT PATENT POOLS AND STANDARD-SETTING AGREEMENTS

As pointed out in Subsection 3.2.2, competition authorities have become more lenient towards the formation of patent pools in the last two decades, which partly explains their historical resurgence (see Figure 3.3). Nonetheless, they still scrutinize such agreements for potential anticompetitive effects.

As in the case of collaborative R&D alliances, most jurisdictions prohibit agreements that facilitate the formation of hardcore cartels, that is, participants jointly determining prices or quantities in product markets. In addition, many competition frameworks may question agreements that unduly slow innovative activity and, interestingly, they sometimes employ the criteria outlined in Section 3.2.

Specifically, in the US, provisions that discourage participants from engaging in further R&D – for example, through grant back obligations – may be considered anticompetitive.[53] In the Republic of Korea and Japan, authorities may challenge agreements that do not allow for independent licensing. In addition, EU, Korean and US authorities may investigate patent pools if the technologies included are seen as substitutes.

Relatively few countries have developed detailed competition rules on the treatment of patent rights in standard-setting agreements, although certain business practices by patent holders may be covered by general competition law principles such as price gouging or refusal to deal. Nonetheless, competition policy frameworks in some countries address the patent-standards interface. Thus, in the Republic of Korea, standard-setting agreements that disclose only limited patent information or that do not spell out the detailed licensing conditions affecting participants may be considered anticompetitive.

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[53] At the same time, the US Department of Justice has expressly considered grant back provisions in its business review letters, without rejecting them.

Similarly, China's Standardization Administration has issued draft rules requiring patent holders to disclose their patents if they are involved in standard-setting or if they are otherwise aware that standards under development cover a patent they own. These rules also foresee that patents relevant to a national standard be licensed either free-of-charge or at a below-normal royalty rate.[54]

3.4

CONCLUSION AND DIRECTIONS FOR FUTURE RESEARCH

Firms increasingly look beyond their own boundaries to maximize their investment in innovation. From society's perspective, private collaboration promises clear benefits: it encourages knowledge spillovers; promotes an efficient division of labor; reduces innovation risks; and fosters the interoperability of complementary products. However, leaving the formation of collaboration arrangements to private market forces may not lead to socially optimal outcomes; firms may either collaborate below desirable levels or they may do so in an anticompetitive manner.

Insufficient levels of collaboration may occur where there are conflicts of interest between potential collaborators. Fears of free riding, risk shifting and other forms of opportunistic behavior may lead firms to forgo mutually beneficial cooperation. Differences in business strategies between specialized R&D firms and vertically integrated R&D and production firms may contribute to negotiation gridlock.

In principle, the failure of private markets to attract an optimal level of collaboration provides a rationale for government intervention. Unfortunately, economic research provides no universal guidance to policymakers on how such market failures are best resolved. This is partly because the benefits of and incentives for collaboration are highly specific to technologies and business models, and also because it is difficult to evaluate how many potentially fruitful collaboration opportunities go unexplored in different industries.

Some governments promote collaboration through fiscal incentives for firms and related innovation policy instruments. In addition, there are incentive mechanisms for sharing IP rights – for example, discounts on renewal fees if patent holders make their patents available for licensing. However, as greater technological complexity and a more fragmented IP landscape have increased the need for collaboration, there is arguably scope for creative policy thinking.

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[54] See Standardization Administration of the People's Republic of China (2009).

The problem of anticompetitive collaborative practices seems easier to address from a policymaker's viewpoint. Such practices are generally more observable, and authorities can assess the competitive effects of collaborative agreements on a case-by-case basis. In addition, some consensus exists about the type of collaborative practices that should not be allowed or at the least trigger warning signs. For instance, the inclusion of grant back provisions and restrictions on independent licensing have emerged as differentiating markers between beneficial versus potentially anticompetitive agreements.

Nonetheless, evaluating the competitive effects of specific collaborative agreements remains challenging – especially where technologies move fast and their market impact is uncertain. In addition, many low- and middle-income countries have less developed institutional frameworks for enforcing competition law in this area – although they may benefit from the enforcement actions of high-income countries where most collaborative agreements with global reach are concluded.

Areas for future research

Seeking a better understanding of how collaborative practices involving IP affect economic performance is a fertile area for future research. In guiding policymakers on how best to balance cooperation and competition in the generation of new ideas, further investigation in the following areas would seem especially helpful:

- Much of the available evidence on collaborative R&D alliances is based on case studies. This partly reflects the fact that the impact of these alliances is critically dependent on specific business strategies and technology properties, but it also reflects inadequate data. Collecting more and better data through carefully designed firm surveys could generate more systematic evidence of the patterns, motives and effects of collaborative R&D, thereby usefully complementing the available case study evidence.

- The economic literature provides only limited guidance on situations in which governments should consider intervening in market processes for selecting standards. This is a long-standing policy question, and countries have opted for markedly different approaches. Clear-cut answers may seem elusive; however, it would be useful to further investigate the effects of the different structures and decision-making rules of SSOs on the speed and quality of standard adoption where underlying IP landscapes are highly fragmented.

- Little insight exists on the effectiveness of government programs that support collaboration. For example, as pointed out above, many patent offices offer incentives to patent owners for making their patents available for licensing; no research has sought to systematically evaluate whether such incentives matter and, if so, how. More generally, no research exist on how other elements of the IP system – above all, firms' prospect of effectively enforcing IP rights – affects incentives for different forms of collaboration.

- As many collaborative agreements have a global reach, national enforcement of competition law is bound to have international spillovers. However, the precise extent and nature of these spillovers is not well understood. Generating evidence on this question would be important in assessing the need for low- and middle-income countries to further develop competition rules in this area.

- Finally, available evidence on collaborative practices focuses almost entirely on high income countries. In the case of patent pools, this may be because many of the patent families behind patent thickets do not extend to low- and middle-income countries – though this is an important research question in its own right. In the case of R&D alliances, innovation surveys in middle income countries suggest that local firms do collaborate frequently. However, no evidence is available to assess whether the motivations and effects of such collaboration differ systemically from high income countries.

REFERENCES

Arthur, W.B. (1989). Competing Technologies, Increasing Returns, and Lock-in by Historical Events. *The Economic Journal, 99*(394), 116-131.

Bresnahan, T.F. & Yin, P. (2007). Standard Setting in Markets: The Browser War. In S.M. Greenstein and V. Stango (Eds.), *Standards and Public Policy*. Cambridge: Cambridge University Press, 18-59.

Cabral, L.M.B. (2000). R&D Cooperation and Product Market Competition. *International Journal of Industrial Organization, 18*(7), 1033-1047.

Carlson, S.C. (1999). Patent Pools and the Antitrust Dilemma. *Yale Journal on Regulation, 16*, 359-399.

Commerce Clearing House. (various years). Trade Regulation Reporter. New York: Commerce Clearing House.

Dahlander, L. & Gann, D.M. (2010). How Open is Innovation? *Research Policy, 39*(6), 699-709.

De Backer, K., Lopez-Bassols, V. & Martinez, C. (2008). Open Innovation in a Global Perspective – What do Existing Data Tell Us? *OECD STI Working Paper, 2008/4*.

Deroian, F. & Gannon, F. (2006). Quality-Improving Alliances in Differentiated Oligopoly. *International Journal of Industrial Organization, 24*(3), 629-637.

Dun and Bradstreet (yearly). Who Owns Whom. In Dun and Bradstreet WorldBase (Ed.).

European Commission. (2010). Commission Regulation No. 1217/2010 on on the Application of Article 101(3) of the Treaty on the Functioning of the European Union to Certain Categories of Research and Development Agreements.

European Commission. (2011). Communication from the Commission: Guidelines on the Applicability of Article 101 of the Treaty on the Functioning of the European Union to Horizontal Co-Operation Agreements.

Fair Trade Commission Republic of Korea. (2007). Guidelines for Cartel Review.

Fair Trade Commission Republic of Korea. (2010). Review Guidelines on Undue Exercise of Intellectual Property Rights.

Farrell, J. & Klemperer, P. (2007). Coordination and Lock-in: Competition with Switching Costs and Network Effects. *Handbook of Industrial Organization, 3*, 1967-2072.

Farrell, J. & Saloner, G. (1988). Coordination through Committees and Markets. *The RAND Journal of Economics, 19*(2), 235-252.

Federal Trade Commission & US Department of Justice. (2000). *Antitrust Guidelines for Collaborations Among Competitors.*

Gandal, N., Gantman, N. & Genesove, D. (2007). Intellectual Property and Standardization Committee Participation in the US Modem Industry. In S.M. Greenstein and V. Stango (Eds.), *Standards and Public Policy.* Cambridge University Press, 208-230.

Gilbert, R.J. (2004). Antitrust for Patent Pools: A Century of Policy Evolution. *Stanford Technology Law Review, 3*, 7-38.

Gilbert, R.J. (2010). Ties that Bind: Policies to Promote (Good) Patent Pools. *Antitrust Law Journal 77*(1),1-48.

Goyal, S. & Moraga-Gonzalez, J.L. (2001). R&D Networks. The RAND *Journal of Economics, 32*(4), 686-707.

Graham, S. & Mowery, D. (2004). Submarines in Software: Continuations in U.S. Software Patenting in the 1980s and 1990s. *Economics of Innovation and New Technology, 13*, 443-456.

Grossman, G.M. & Shapiro, C. (1986). Optimal Dynamic R&D Programs. *The RAND Journal of Economics, 17*(4), 581-593.

Hagedoorn, J. (1993). Understanding the Rationale of Strategic Technology Partnering: Inter-organizational Modes of Cooperation and Sectoral Differences. *Strategic Management Journal, 14*(5), 371-385.

Hagedoorn, J. (2002). Inter-firm R&D partnerships: an overview of major trends and patterns since 1960. *Research Policy, 31*(4), 477-492.

Hagedoorn, J. (2003). Sharing Intellectual Property Rights—An Exploratory Study of Joint Patenting amongst Companies. *Industrial and Corporate Change, 12*(5), 1035-1050.

Harrigan, K.R. (1988). Strategic Alliances and Partner Asymmetries. In F. Contractor and P. Lorange (Eds.), *Cooperative Strategies in International Business*. Lanham: Lexington, 205-226.

Japanese Fair Trade Commission. (1947, amended 2009). Act on Prohibition of Private Monopolization and Maintenance of Fair Trade (Act no. 54 of April 14, 1947).

Japanese Fair Trade Commission. (1993, updated in 2009). Guidelines concerning Joint Research and Development under the Antimonopoly Act.

Japanese Fair Trade Commission. (2007). Guidelines for the Use of Intellectual Property under the Antimonopoly Act.

Jones, B.F. (2009). The Burden of Knowledge and the"Death of the Renaissance Man": Is Innovation Getting Harder? *Review of Economic Studies, 76*(1), 283-317.

Kaysen, C. & Turner, D.F. (1965). *Antitrust Policy: An Economic and Legal Analysis.* Cambridge: Harvard University Press.

Kogut, B. (1988). A Study of the Life Cycle of Joint Ventures. In F. Contractor and P. Lorange (Eds.), *Cooperative Strategies in International Business*. Lanham: Lexington Books, 169-186.

Langlois, R.N. (2007). Competition through Institutional Form: The Case of Cluster Tool Standards. In S.M. Greenstein and V. Stango (Eds.), *Standards and Public Policy*. Cambridge: Cambridge University Press, 60-86.

Layne-Farrar, A. & Lerner, J. (2011). To Join or Not to Join: Examining Patent Pool Participation and Rent Sharing Rules. *International Journal of Industrial Organization, 29*(2), 294-303.

Lerner, J. & Malmendier, U. (2010). Contractibility and the Design of Research Agreements. *The American Economic Review, 100*(1), 214-246.

Lerner, J. & Schankerman, M. (2010). *The Comingled Code: Open Source and Economic Development.* Boston: MIT Press.

Lerner, J., Strojwas, M. & Tirole, J. (2007). The Design of Patent Pools: The Determinants of Licensing Rules. *The RAND Journal of Economics, 38*(3), 610-625.

Lerner, J. & Tirole, J. (2004). Efficient Patent Pools. *The American Economic Review, 94*(3), 691-711.

Lerner, J. & Tirole, J. (2005). The Economics of Technology Sharing: Open Source and Beyond. *The Journal of Economic Perspectives, 19*(2), 99-120.

Lerner, J. & Tirole, J. (2007). Public Policy toward Patent Pools. *Innovation Policy and the Economy, 8*, 157-186.

Lewis, J.A. (2007). Government Open Source Policies. *Center for Strategic and International Studies.*

Link, A. (2005). Research Joint Ventures in the United States: A Descriptive Analysis. In A. N. Link & F. M. Scherer (Eds.), *Essays in Honor of Edwin Mansfield*. New York: Springer, 187-193.

Lyons, D. (2005). Has Open Source Become a Marketing Slogan? *Forbes.*

MacKie-Mason, J.K. & Netz, J.S. (2007). Manipulating Interface Standards as an Anticompetitive Strategy. In S.M. Greenstein and V. Stango(Eds.), *Standards and Public Policy.* Cambridge: Cambridge University Press, 231-259.

Martin, S. (1996). R&D Joint Ventures and Tacit Product Market Collusion. *European Journal of Political Economy, 11*(4), 733-741.

Maurer, S. (2007). Open Source Drug Discovery: Finding a Niche (or Maybe Several). *University of Missouri at Kansas City Law Review, 76*(1-31).

Merges, R.P. (1999). As Many as Six Impossible Patents before Breakfast: Property Rights for Business Concepts and Patent System Reform. *Berkeley Technology Law Journal, 14*, 557-616.

Merges, R.P. (1999). Institutions for Intellectual Property Transactions: The Case of Patent Pools. *University of California at Berkeley Working Paper.*

Ordover, J.A. and Willig, R.D. (1985). Antitrust for High-technology Industries: Assessing Research Joint Ventures and Mergers. *Journal of Law and Economics, 28*(2), 311-333.

Oxley, J.E. (1997). Appropriability Hazards and Governance in Strategic Alliances: A Transaction Cost Approach. *Journal of Law, Economics, and Organization, 13*(2), 387-409.

Oxley, J.E. (1999). Institutional Environment and the Mechanisms of Governance: The Impact of Intellectual Property Protection on the Structure of Inter-firm Alliances. *Journal of Economic Behavior and Organization, 38*(3), 283-309.

Pharmaceuticals, Patents, Publicity… and Philanthropy? (February 2009). *The Lancet*, *373*, 693.

Sampson, R.C. (2004). Organizational Choice in R&D Alliances: Knowledge-Based and Transaction-Cost Perspectives. *Managerial and Decision Economics, 25*(6-7), 421-436.

Schilling, M.A. (2009). Understanding the Alliance Data. *Strategic Management Journal, 30*(3), 233-260.

Shapiro, C. (2000). Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting. *Innovation Policy and the Economy, 1*, 119-150.

Standardization Administration of the People's Republic of China. (2009). Regulations on Administration of Formulating and Revising National Standards Involving Patents.

Teece, D. (1986). Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy. *Research Policy, 15*(6), 285-305.

US Department of Justice & Federal Trade Commission. (1995). Antitrust Guidelines for the Licensing of Intellectual Property.

US Department of Justice & Federal Trade Commission. (2007). Antitrust Enforcement and Intellectual Property Rights: Promoting Innovation and Competition.

Van Overwalle, G., van Zimmeren, E., Verbeure, B. & Matthijs, G. (2005). Models for Facilitating Access to Patents on Genetic Inventions. *Nature Reviews Genetics, 7*(2), 143-154.

Vaughan, F.L. (1925). *Economics of Our Patent System.* New York: The Macmillan Company.

Vaughan, F.L. (1956). *The United States Patent System: Legal and Economic Conflicts in American Economic History.* Norman: University of Oklahoma Press.

Verbeure, B., van Zimmeren, E., Matthijs, G. & Van Overwalle, G. (2006). Patent Pools and Diagnostic Testing. *TRENDS in Biotechnology, 24*(3), 115-120.

Veugelers, R. (1998). Collaboration in R&D: An Assessment of Theoretical and Empirical Findings. *De Economist, 146*(3), 419-443.

War and Peace and the Patent System (1942). *Fortune, 26*, 102-105,132,134,136,138,141.

DATA ANNEX

R&D alliances

The SDC Platinum, CORE and MERIT-CATI databases are the three most used sources for measuring R&D-specific alliances between firms across technology fields and industrial sectors.

The SDC Platinum database is maintained by Thomson Reuters and provides information on financial transactions between firms, including merger and acquisition (M&A) activity. Data on alliance activity, a section of the M&A, capture a wide range of collaborative agreements, including agreements between industrial partners on distribution, licensing, manufacturing, marketing, R&D, sales and supply, as well as joint ventures and strategic alliances. They also comprise of alliances between governments and universities. The data shown here represent the count of R&D alliances classified in one of the following four categories: R&D alliances, cross-licensing, cross-technology transfer and joint ventures. Information is collected based on Security and Exchange Commission (SEC) filings, trade publications as well as news sources.

The Cooperative Research (CORE) database, from the National Science Foundation (NSF), collects information on industrial partnerships which are filed under the National Cooperative Research and Production Act (NCRPA) in the US. Disclosure of any research and/or production collaboration with other firms under the NCRPA limits the possible antitrust liabilities arising from those activities. NCPRA filings are published in the Federal Register and include information on R&D partners as well as partnership objectives. The CORE database catalogues those filings and is further described in Link (2005).

The MERIT-CATI database refers to Cooperative Agreements and Technology Indicators (CATI) alliance data administered by the UNU Maastricht Economic and Social Research Institute on Innovation and Technology (MERIT) in the Netherlands. Information on agreements that cover technology transfer – including joint research agreements and joint ventures involving technology sharing between two or more industrial partners – is collected on a worldwide basis. It relies on print publications including newspapers, company annual reports, the Financial Times and Who Owns Whom, published yearly by Dun and Bradstreet. Further description of the database is available in Hagedoorn (2002).

These databases are likely to capture only a fraction of the total instances of collaboration between firms worldwide. One weakness is that they predominantly cover R&D alliances documented in English-language publications, although the MERIT-CATI database also includes announcements in Dutch and German. The language bias also limits the geographical coverage of collaborative agreements. By definition, the CORE database covers only US agreements.

Patent pools

The patent pool data presented in this chapter were kindly supplied by Josh Lerner and Eric Lin from the Harvard Business School. They build on an earlier database described in Lerner *et al*. (2003), since updated to 2010.

No official reporting requirement exists for patent pools. One therefore needs to rely on a variety of secondary sources to track the formation of such pools. The patent pool database relies on a variety of English-language publications, reports by US government agencies, and company news releases. Some of these publications include Carlson (1999), Commerce Clearing House (various years), Kaysen and Turner (1965), Merges (1999), Vaughan (1925, 1956) and Fortune (1942). The coverage of pools is clearly biased towards those formed in the US. However, even for the US the data may be incomplete.

Patent pools are defined as patent-based collaborative agreements of the following two types: (i) at least two firms combine their patents with the intention to license them, as a whole, to third parties; and (ii) at least three firms come together to share their patents among themselves. The count of patent pools captured here does not include cross-licensing agreements, new entities established to manufacture products based on different firms' IP, firms that acquire patents and license them to interested parties, or patent pools dominated by non-profit entities (such as universities).