8 *Openness, open innovation à la Chesbrough and intellectual property rights*

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8.1 Introduction

Intellectual property rights (IPRs) influence innovation and play an important role in diffusing knowledge and creating value (OECD, 2010). By definition, an IPR is an exclusive right designed to encourage private investment in innovation by enabling inventors to recover their investment costs. In the case of a patent, an exclusive right is granted to the inventor to preclude any third party's unauthorized use of her invention and thus personally make exclusive use of it. At the same time, the exclusive right is granted to the inventor as compensation for public disclosure of her invention. In both cases, it is expected that a patent right plays a major part in enabling exclusive use of an invention. These rights assist inventors in getting private returns for their innovation-related investments. In this setting, any free revealing or uncompensated 'spillover' of proprietary knowledge should reduce the innovator's profit from its investments.

Alternatively to this traditional view of the link between innovation and IPRs, new practices for inducing innovation, based on a more collective and open endeavour where exclusivity is not a prerequisite to investment into innovation, are gaining ground. Turning to the innovation strategy of private firms, open innovation has come under the spotlight in recent years. Indeed in a complex technological landscape, it is difficult for a firm to control, investigate and manage all critical constituencies of the innovation process. Thus it is necessary for a firm to find partners to cooperate with, leaving its borders more permeable to knowledge inflows and outflows. As a result, under this open innovation framework, a firm pursuing a profit from innovation may not necessarily stick to exclusive use of its intellectual property

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(IP) and, under some circumstances, it may happen that sharing IP without any charge would be a preferred strategy.

On the ground, open innovation is attracting a great deal of interest among US firms, and is spreading to European and Asian firms. Chesbrough (2003, 2006a) cited advanced efforts undertaken by several US corporations (including IBM, Intel, Lucent Technologies, P&G, Air Products, etc.) as examples of open innovation. Murofushi (2008) and Sone (2008) signalled that Japanese firms, albeit on a limited scale, are also seeking to move toward open innovation. In Europe, Rohrbeck *et al.* (2009) have shown how changes in the management process of Deutsch Telecom towards a more 'open' process have enhanced its innovation capacity by opening up its traditional development process and embracing external creativity and knowledge resources. Other case studies and empirical works have been conducted to analyse open innovation practices mainly among European firms (Kirschbaum, 2005; Laursen and Salter, 2006; Van de Meer, 2007; OECD, 2008; EC, 2012). Also, new knowledge exchange mechanisms are emerging, as illustrated by the Eco-Patent Commons, established by World Business Council for Sustainable Development (WVCSD) in 2008, where member firms donate environment-related patents into a pool, making patents available royalty free.[1]

Under open innovation, a high value is no longer attached to the notion of exclusivity that has traditionally been the case, as illustrated by the original motive of patent right. At first glance, one may interpret these phenomena as incompatible with the current IP system, the latter being surpassed by the evolving practices of innovation. The purpose of this chapter is to bring elements of response to this inquiry, with a particular focus on the concept of open innovation developed by Henry Chesbrough, which we call hereafter 'open innovation à la Chesbrough'. To begin with, we attempt to clarify the notion of 'openness', illustrated with the model of 'open science' and 'open source' (Section 2). We then focus on open innovation à la Chesbrough: we analyse the relationship between open innovation and IPRs (Section 3). Finally, we attempt to identify the major impacts of new approach to IPRs on the innovation system (Section 4), and then give our conclusions (Section 5).

[1] For Eco-Patent Commons, see the website www.wbcsd.org/web/epc.

Given that the discussions about open innovation are mainly concerned with technological innovation, what follows will be focused on the patent system, which is specifically designed to protect technological ideas, as opposed to other rights under the IPR regime, unless otherwise stated.

8.2 What does 'openness' bring to innovation?

'How does openness influence firms' ability to innovate and profit from their inventions?' is a question that plays an important role in recent research on innovation. Related to this research trend, a central question of this chapter is to understand the rationale of firms' choice to disclose openly some of their knowledge, the phenomenon we have observed more frequently in recent years. This question has already been posed by Nelson (1992, p. 65): 'It appears that, contrary to common beliefs, firms do not keep tight controls on all information about their new technology and in some cases they seem actively to divulge information. How come?'

Indeed openly disclosing knowledge may involve some costs; among others, it can provide useful information to potential rivals, or offer valuable information to other firms without being assured of any direct remuneration. On the other hand, open knowledge disclosure may trigger reciprocity, de facto standards, feedbacks from consumers, network effects or may enhance the reputation of the firm that discloses. Before entering into the heart of this debate, we start with a brief overview of the notion of 'openness'.

8.2.1 Different types of openness in innovation studies

The concept of innovation has been well analysed in the literature, given that it is at the centre of many debates. In a Schumpeterian way, innovation refers to the first introduction of a new product, process, method or system into the economy. The notion of openness, despite its recent appeal, is fuzzier. Openness is not a binary classification of open versus closed. It therefore needs to be placed on a continuum, ranging from closed to open, covering various degrees of openness. This discussion is partly related to the evolution from a vertically integrated innovation to a more decentralized approach of innovation, and is thus closely coupled to the debate of the transaction cost economics related

to the firm's boundary. In that respect, the question 'how firms make decisions on whether to develop innovation internally or partner with external actors' constitutes a central element in the open innovation literature (Dahlander and Gann, 2010). This creates the need to develop new ways of conceptualizing an innovation process, where the premise of firms vertically integrated is no more the norm, as stated by Langlois (2003): 'large vertical integrated organizations are becoming less significant and are joining a richer mix of organizational forms'.

The notions of openness and unrestricted information sharing may be new in the corporate culture and management literature, but among scientists they have long been identified as institutional norms that are critical to scientific progress (Merton, 1973). More recently, free and open source software initiatives have demonstrated that practising the norms of openness and information sharing in a peer-production setting can result in the creation of complex technological products that are competitive in the market (von Hippel, 2005). In the rest of this section, we will address these two phenomena in turn, 'open science' and 'open source', after offering a clarification of how the word 'open' can be comprehended.

Following Lessig (2001), a resource can be qualified as 'open' if: '(1) one can use it without the permission of anyone else; or (2) the permission one needs is granted neutrally'. This definition leads to two versions of the term, a strong and a weak one. In the strong sense, the owner of the resource has no control on who will have access to it, as no permission will be needed to use it. A typical example of such a process is a publication in a scientific journal. The information embedded in a publication is open in the sense that one cannot restrict its access. With respect to knowledge and technology, a piece of knowledge is open if it is available to all, i.e. all interested parties are given access to it (Pénin, 2007). In a weaker sense, one may have to ask permission, but this permission is not granted at the discretion of the owner of the information, but on a neutral basis. This does not imply that an open resource needs to be automatically free of charge, but that the owner is not able to choose arbitrarily to refuse or grant access to the resource. The famous Cohen–Boyer patent on recombinant DNA provides an example of a situation of a technology being open but not free of charge: under the patent protection, access to the invention was not allowed without permission by the owner; yet it was widely

licensed at a reasonable fee without discrimination (Feldman *et al.*, 2007). Anybody, if he/she wanted it, could be granted a licence. This technology was therefore open according to our weak sense, although it was not free of charge.

At this stage it is important to stress the distinction between being free of charge (concept of gratuity) and being open. What we want to understand here is why the latter, according to the Lessig's definition, is critical to fostering innovation and growth. The progress of scientific and technological knowledge is a cumulative process, one that stands on the widespread disclosure of research findings, so they can be tested by the scientific community, to be confirmed or discharged if found to be wrong. Newton's famous remark illustrates this perfectly: 'If I have seen farther it is by standing on the shoulders of giants.' This quotation highlights the cooperative and cumulative characteristics of scientific achievement. Furthermore, it can be argued that the more knowledge you have, the higher the probability that you are going to create new knowledge. This comes from the fact that knowledge can be recomposed in many different ways. In economic terms, this property reveals increasing return in use. Again, this open dimension is somehow different from knowledge being accessible without fee. It is possible that a technology is open, being diffused in a non-discretionary manner, but not free of charge. This open dimension as being constitutive to open innovation is clearly acknowledged by von Hippel and von Krogh (2006) who wrote: 'In our view, free [in the sense of open] revealing of product and process designs is a defining characteristic of "open innovation". Free revealing is the feature that makes it possible to have collaborative design in which all can participate – as is famously the case in open source software projects.'

We will now analyse the characteristics of two institutional arrangements in which openness is the central feature, 'open science' and 'open source software'.

8.2.2 Open science

The issue of openness in fundamental, upstream research is not new. The necessity to preserve the openness of fundamental knowledge, into which innovators can tap in order to generate innovation, has been acknowledged by economists and policy-makers for some time. This idea is, for instance, at the heart of the existence of the open science

model, a central dimension of which is the openness of scientific knowledge. 'Open science' is and always has been considered a central element of national systems of innovation, and now is a central theme of research as to how it can adapt itself to increasing interaction with industrial partners, and more proprietary models.

David (1998) refers to 'open science' as 'activities supported by the state funding, the patronage of private foundations and carried on today in universities and public (not-for-profit) institutes'. The notion of open science is an institutional arrangement with an essential collective character, based on an ethos of cooperative inquiry and the free sharing of results. Its comparative efficiency lies in the advantage of open inquiry and complete disclosure of research findings and methods as a basis for the cooperative, cumulative generation of reliable additions to the stock of knowledge. The openness reduces excessive duplication of research efforts, while wide sharing of information places knowledge in the hands of scientists who put them to use. This has the effect of enlarging the opportunities to exploit complementarity within the stock of knowledge, and promoting positive spillovers across research programmes.

Dasgupta and David (1994) argued that the 'open science' arrangement has two fundamental and original economic properties that contribute to its efficiency. First, scientists are those most able to carry out validation and evaluation of their work, in peer-review procedures. They are themselves setting research agendas and evaluating each other's work, hence avoiding principal–agent problems between funding agencies and the research community. Second, since it is the very action of disclosing knowledge that induces the rewards, it creates simultaneous incentives for both knowledge creation and its broad dissemination within the community. On top of that, treating new findings as part of the public domain fully exploits the public goods properties that permit data and information to be concurrently shared in use and reused indefinitely, promoting faster growth of the knowledge stock. Yet the recent trend is for public research organizations increasingly to patent their research results, and this in turn influences their incentive to freely reveal their results. As a result, academic researchers have become more strategic in their choice of what information to disclose in their publications to avoid the possibility of a future patent application being compromised (Webster and Packer, 1997). Concerned by this trend, many voices have advocated the

necessity to keep science open, to preserve access to this common good in order to foster the pace of innovation. Fragmentation and appropriation of the scientific common may indeed increase the cost of accessing it and therefore impede the development of follow-on innovations.

8.2.3 Open source

The recent surge of literature about open innovation finds its roots to some extent in the success of free–libre open source software (FLOSS). Indeed, the importance of openness in fostering innovation and the emergence of novelty is well exemplified by this example, which has been extensively analysed in the economic literature (Lerner and Tirole, 2001; Dalle and Jullien, 2003).

The label 'open source' originates from the characteristics of most software. Software is composed of a machine-readable 'object code'; usually software is not written in this format but in a programming language whose 'source code' scripts can be executed by a computer. Most commercial software is distributed only in 'object code' format. The open source movement generally refuses the practice of keeping source code secret, holding instead that source codes should be open and accessible (Boettiger and Burk, 2004). Open source software has two distinct features. First, open source software comes equipped with licences that give existing and future users the right to use, modify and distribute modified and unmodified software to others (Raymond, 1999). Second, it displays a very specific development process. Open source software projects are typically initiated by a 'project leader' who plays a central role in initiating and coordinating the projects while keeping the production of codes by volunteers as decentralized as possible. Depending on their interest in the project, volunteers (or companies) join in and contribute to designing, testing, distributing, and documenting the software. Depending on their knowledge, these voluntary 'project contributors' perform tasks ranging from support, via administration and coordination, to technical development. These contributors, in turn, provide feedback to the open source software developers, share their ideas, report software bugs, indicate new opportunities for using the software, etc. (Raymond, 1999; Lerner and Tirole, 2002). It is a very cooperative and decentralized process, where participants in FLOSS projects intensively interact and exchange information, so that the projects are rapidly designed and debugged.

Open source projects have developed legal instruments to guarantee that the communally produced codes remains freely available and are not captured in proprietary forms. Open source software may be distributed in a variety of licence conditions, but they all have in common the requirement that the recipient of the licensed software is to be provided with the source code. The majority of such licences require licensees who modify or improve the software to make the modifications available on the same terms as the initial software was licenced. Such licences are sometimes termed 'copyleft' licences to indicate what proponents of the open source movement view as a fundamental difference from the system of copyright (Boettiger and Burk, 2004). For instance, in order to ensure that everybody can access the source code and modify and improve software without having to ask for permission from an 'owner', the Free Software Foundation developed an original exploitation licence: the General Public Licence (GPL), the first widely used 'copyleft' licence. The GPL ensures that everybody can use, modify, copy and even distribute software 'protected' by the licence on the sole condition that these changes are kept under the same regime, which means that improvements must remain accessible and free for modifications by everybody. Under this arrangement, everyone has to have free access to the program but it is protected from becoming someone's private IP. The system does not lie outside of the copyright system, it rather uses it in a different and new way to attain its goal of leaving it as open and cooperative as possible to favour cumulative innovation (Lerner and Tirole, 2001).

The success of open source software tends to demonstrate that openness is a sustainable strategy and can foster innovation in some cases. Open innovation frameworks in which competitors share knowledge and information are not specific to software. They have always existed and have often proved to be efficient. This phenomenon is not new. Using historical accounts of the nineteenth-century English blast furnace industry, Allen (1983) stressed that some innovators publicly revealed data on their furnace design and performance in professional society meetings and in published communications. He describes these behaviours as being part of a 'collective innovation' process; this has been illustrated in other historical contexts such as the mining industry during the Industrial Revolution (Nuvolary, 2004). More recently, Henderson and colleagues (Cockburn and Henderson, 1998; Henderson *et al.*, 1999) have highlighted the increasingly frequent publication of research results by some firms. Contemporary examples, such as the

sequencing of the human genome, also support this view of collaborative and open mechanism to support the creation of new scientific and technological knowledge (McElheny, 2010). Similarly, open source or free–libre biotechnology is an attempt to transpose the open source model to biology (Burk, 2002).

8.3 Open innovation à la Chesbrough and intellectual property rights

After the discussion on the concept of 'openness', this section aims to define the concept of open innovation à la Chesbrough and to analyse the relationship between open innovation and IPRs.[2] It can be stated, as we shall soon demonstrate, that Chesbrough's view of openness is more restrictive in terms of the diffusion of knowledge than the previous constructions we have explained, the open science setting and open source software. His definition implies that there are actions of targeted knowledge disclosure, but its access can nevertheless be controlled by each stakeholder depending on the strategic goals of the firms. Creation of value by setting up a business model and by integrating internal and external knowledge to the firm is central in his model and there, as noted by Pénin (2008), 'knowledge is not available to all. It flows only within closed circuit.' The openness here puts emphasis on the distributive nature of innovation among a wide range of heterogeneous stakeholders rather than uncontrolled access to it, which may generate new perception and use of IPRs.

8.3.1 A changing paradigm

The concept of 'open innovation' has been introduced and put forward by Chesbrough (2003, 2006a). In his view, 'open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as firms look to advance their technology' (Chesbrough, 2003, p. xxiv). This definition is the most commonly used in the management literature. It underscores the fact that firms may take advantage of valuable ideas and technologies developed outside the firm for their internal

[2] From here, when using the term 'open innovation', we will refer, unless otherwise stated, to the definition introduced by Chesbrough (see above, p. 217).

use, or the other way round: they may make ideas and technologies internally developed available to outsiders.

The open innovation paradigm contrasts with the more traditional practice of innovation, where, from R&D to product sales, all activities are vertically integrated within the firm, a process that Chesbrough described as 'closed innovation'. In the closed innovation context, R&D activities are subject to economies of scale, with the central research laboratory playing an important role. However, the firm's own central research laboratory seems to lose its primacy over time. Rosenbloom and Spencer (1996) have illustrated how leading central research laboratories in the USA were in a dire state, and in the 1980s and 1990s were downsized, redirected and restructured, concluding that this model was 'the end of an era'. In the USA in 1981, 70.1% of all R&D spending was conducted by large companies with 25,000 or more employees. This share decreased to 39.4% in 2001 (Chesbrough, 2006a). Given such a trend, firms seeking innovation are more likely to exploit ideas available outside. Open innovation is an approach that could just meet these needs.

Indeed, in an environment where technologies grow in complexity, demands evolve and diversify rapidly and value chains develop at a global scale, it becomes increasingly difficult to fulfil in-house all competencies needed to ensure all phases of the innovation process. As a result, having access to external knowledge and partners became crucial for firms to maintain their innovation capacity. This is often referred to as 'Joy's law', from Sun Microsystems cofounder Bill Joy, who remarked: 'No matter who you are, most of the smartest people work for someone else' (Lakhani and Panetta, 2007). This new avenue for innovation is illustrated by Chesbrough (2006a, pp. 2–3) as 'there are many ways for ideas to flow into the process, and many ways for it to flow into the market.' The paradigm shift from closed innovation to open innovation leads to greater emphasis on horizontal cooperations, mobility of highly skilled workers, knowledge network and markets, and global value chains, leaving behind the Not Invented Here (NIH) syndrome.

8.3.2 Intellectual property management

The shift to open innovation prompts firms to review their ways of managing IP. Under closed innovation, firms have centred their IP management on pursuing rights to their own research results and using

such rights as a means of excluding others or, as a foothold if the right of another party is enforced against them, given that IP created internally will be used to develop their own product. As Chesbrough (2006a, p. xx) puts it plainly, 'if you want something done right, you've got to do it yourself'.

In contrast, open innovation encourages firms to make active use of licensing and transfer of their patents or to reduce information barriers to the public in order to facilitate inflow and outflow of technologies, including external use of unused patents and other IP. Management of IP puts greater emphasis on the marketability of IP rather than its right-to-exclude. Strong IPRs, and patents in particular, are fundamental in ensuring the rise of open innovation. Indeed, firms are more likely to be willing to collaborate and to exchange knowledge if they are protected. Strong IPRs are necessary to secure transactions and exchanges on markets for technologies as they prevent the appearance of free-riding behaviours (Pénin *et al*., 2011). As a result, open innovation does not require that IP should be opened or released under all circumstances; conversely strong IPR enforcements and the resulting emergence of a market for technology are crucial to the development of the open innovation paradigm.

Chesbrough (2006a) advocates IP management based on the technology life cycle. The latter, inspired by Utterback-Abernathy's product life cycle, is composed of four stages: early stage, growth stage, maturation stage and decline stage. He argued that the way in which IP is managed should be differentiated according to the stage of the product life cycle. For example, in the early stage where neither the marketplace exists nor is a business model in place for an emerging technology, protecting the technology to secure exclusive use has a limited effect on the advent of innovation. Thus more room should be made for sharing information. Exploiting the possibility for potential value creation prevails by getting technological information open to the public. Moving forward in the product life cycle, protection of IP should be strengthened in the course of the technology achieving the dominant market position in terms of design. In the maturation stage, efforts should be made proactively to apply the IP to other industrial fields. And finally, in the decline stage, efforts should be solely directed toward value capture from IP protection.

Chesbrough (2006a) illustrates this argument through the Chinese piracy case of Microsoft Windows. In the Chinese market, Windows

and Linux are competing for dominance, and as long as the situation remains unchanged, Microsoft should welcome pirated versions of Windows. According to him, the installation of a pirated version of Windows on a personal computer would preclude installation of Linux and expand market opportunities for complementary products such as applications. If instead great efforts are made to exclude pirated editions, Microsoft may indeed win that battle but at the cost of losing the war for the position of dominance. However, leaving those pirated editions unattended in China is likely to serve as a bad precedent in other regions. Even taking this into consideration, he says, priority should be placed on achieving a dominant position in the Chinese market, until it attains a more mature stage

To make IP management operational under open innovation context, e.g. active use of licensing and transfer of IP rights, the prerequisite is the presence and good functioning of a knowledge market or an intermediate market for innovation wherein IP is traded. Although such a market is in its infancy, the increasing number of transferred patents has demonstrated that the knowledge market is actually growing (Chesbrough, 2006a). On that matter, recent trends show signs of the emergence of a secondary market for IP in the USA and Japan, as well as signs of the development of a small number of intermediary firms specialized in brokering IP resources (Chesbrough, 2006b).

8.3.3 Role of intellectual property rights in open innovation à la Chesbrough

This brief overview of open innovation leads us to recognize that open innovation does not render the IP system obsolete; on the contrary, the former is built upon the latter. With the rise of open innovation, however, IP is expected to fulfil a different role from that which it has traditionally been assigned. Consequently, open innovation requires firms to adapt their IP management to this new avenue.

Behind the debate on IPRs and open innovation, we often observe certain confusion about the interpretation and usage of the term 'open'. For example, the definition of Lessig (2001) ('one can use it without the permission of anyone else') implies unrestricted access to IPR, which goes against the notion of appropriability and restrictive use of IPRs. In the context of open science and open source software, individuals involved act following the norms of unrestricted sharing

and releasing of knowledge by putting them in the public domain, with minimal restrictions on those who may be the recipients. The definition of Chesbrough, however, is more restrictive and leaves room for strategic behaviour of knowledge retention, in the form of patents, alliances and joint ventures. In this respect, we can affirm that open innovation à la Chesbrough is not incompatible with the present IP system. In fact, the latter constitutes a basic premise to make open innovation à la Chesbrough viable.

Seen as a business model, open innovation does not preclude the need for an IP strategy. It rather builds on it. Indeed, the open innovation business model pursues a division of innovation labour in an environment in which knowledge is widely dispersed. In that process, it is vital for a firm to integrate internal and external knowledge. This involves two patterns of knowledge flow: an *outside-in* flow that involves the import of useful ideas and technologies that are available outside the company, and an *inside-out* flow that involves the export of unused ideas and technologies to anyone outside the company to make better use of them. As noted by Pénin *et al*. (2011), the outside-in flow is clearly not a new phenomenon; practitioners and researchers have long understood the importance for a firm to monitor and rely on external knowledge, as emphasized by the abundant literature on absorptive capacity (Cohen and Levinthal, 1989, 1990). What is new is the emphasis by the open innovation model of inside-out flows. In contrast to traditional theories, which consider innovation as a core activity that should not be shared or sold, open innovation strongly advocates using external paths to markets, using licences, creating spin-offs and more generally favouring the presence in a market for technology.

It should be also restated here that the term 'open', as used in the context of public opening of IP, does not necessarily mean 'free of charge'. Naturally, in some cases, the term 'open' does mean 'free of charge', as is the case of royalty-free patents release into the public domain. But public opening of patents is a strategy a firm employs for value creation and value capturing, as a part of overall profit maximization. In contrast, as discussed earlier, under open innovation, the active use of licensing and transfer of IP rights is encouraged and the term 'open' here means that a firm, as the owner of the relevant IP, is willing to utilize a third party's technology and let a third party utilize its technology. This departure from the NIH syndrome both

in the creation and utilization of technology is premised on a patent right being traded for value.

In this context, an essential prerequisite is that a patent right has been created as a tradeable property right and that a trading rule applicable to the deal has been established under the framework of patent law, which leads us to conclude that open innovation à la Chesbrough cannot properly exist without the IP system and a market for technology.

8.4 Institutional challenges

In the previous section, we argued that open innovation does not render the IP system obsolete. On the contrary, the former is built upon the latter. With the rise of open innovation, however, the role of IPRs is shifting from one traditionally assigned, that is 'the right to exclude any third party', to one 'facilitating knowledge transfer and sharing among stakeholders'. Consequently, open innovation requires firms to adapt their IP management to exploit these new avenues. Does it require a new framework for innovation systems? In other words, do any institutional challenges exist in pursuit of this new practice of IPR management as called for by open innovation? This section formulates some preliminary answers to this question.

8.4.1 Do any institutional challenges exist?

Institutional challenges may come from the fact that open innovation gives more weight to the tradeable property aspect of IP than its characteristic of exclusivity. As mentioned earlier, an essential prerequisite for trading an IPR under an open innovation regime is that an IPR has been created as a tradeable property right, and this under the framework of IP legislation. In other words, the latter shapes the rules of the game affecting transactions of IP. Recognizing that the patent system has the effect of facilitating market transactions by reducing their costs, as shown by the transaction cost theory (Heald, 2005; Merges, 2005), the question arises as to whether or not the present rules and scheme governing transactions of IP are effective in facilitating them.

A related concern is derived from open innovation business models that differ from a more traditional use of IPRs, one based on their exclusive use. The conventional role of a patent is to give a right holder

the power to use exclusively its IP. By exercising this power, vertically integrated companies managed to control the market of their patented products in a close innovation model. Legally, remedies for infringements lay the foundation of the exclusivity of IPR. In particular, injunctions enable patentees to effectively exclude the competing infringers from the market, by directly stopping their ongoing acts of infringements (e.g. by stopping the production of incriminated product) and preventing future infringements. In addition, patentees may demand damage reparations. The main purpose of damage compensation is, however, a monetary compensation for past infringements. Even though it may deter, to some extent, infringements and contribute indirectly to the exclusivity of a patented invention, it is only an indirect process as compared to injunctions which play a more critical role in protecting exclusivity.

Open innovation encourages right holders, through licensing or other IP transactions, to share technologies with external partners in a dynamic process of collaboration. In that setting, the IPR system functions as a vehicle for technology transfer, by creating a business model in which a right holder does not necessarily exclusively use their invention. This usage of the IPR system may raise the question about the necessity of granting an exclusive right to intellectual creations in the first place. Indeed, if right holders of patented inventions no longer persist in exclusive use of their IPR, is there any reason to grant an exclusive usage to intellectual creations which, by nature, are available for parallel use by any third party? In addition, emerging IP markets under open innovation may give rise to the concern that a patent may come into the hands of those who abusively exercise the exclusive power, as discussed later in this section in the case of 'patent trolls'. Given that injunctive relief is at the heart of the exclusive right of IP, these changes might make it necessary to reconsider the modality of injunctive relief.

It should be further noted that open innovation would have a wider variety of players involved, compared to the traditional closed innovation model founded on vertical integration of the research process. Among them, universities are becoming privileged partners as providers of new ideas and technologies. By definition, universities are repositories and drivers of science, and have the status of non-profit organizations. Entering into research collaboration and transactions with private firms, in particular while being in a position to negotiate

with them over IP issues, implies that universities need a clear rule defining the ownership of IPs created by their constituents, including students, and rules for sharing the cost and distributing the revenues generated by IP transactions. Also, this partnership may lead universities to depart from the principle of open science and one of its core elements, the unrestricted diffusion of research results.

In sum, we recognize that open innovation may raise some institutional challenges for existing innovation system. In what follows, we will focus on these three points: the development of the IP market, modality of injunctive relief, and universities as partners.

8.4.2 *Development of the intellectual property market*

Under open innovation, the volume of IP transactions is expected to increase. Therefore the presence of a well-functioning IP market becomes a critical underlying condition. Indeed, it can be argued that no division of innovative labour is possible without markets for technology (Arora *et al*., 2001). In that line of thought, recent studies from the OECD have stressed the importance of knowledge networks and markets as an enabler of new business models that take advantage of the greater reliance on outsourcing and insourcing of R&D (OECD, 2012). But given the novelty of such markets, there is a need for further research on their structure, dynamic and efficiency. For instance in the case of an IP transaction, it often occurs as a result of negotiation between two parties, through which they decide the terms of transactions, respecting the rules of the game fixed by the patent system; however, it does not necessarily mean that such transactions take place widely on the IP market. In fact, bilateral negotiation or intra-firm trade remain privileged channels for IP transactions. For a market that brings underutilized invention to potential buyers to emerge, tools to evaluate, report and trade IP need to be developed.

Additionally, the present situation of an undermobilized patent market is partly attributable to a lack of substantial need for right holders to trade their IP, reflecting the traditional dominance of players operating within a vertically integrated organization. However, the spread of open innovation will naturally increase the number of transactions in the IP market, and no further consideration would be required with respect to institutional adjustment, if there is no major market failure.

However, a fundamental problem arises when assessing the price and negotiating the deal. Indeed, firms often encounter difficulties in evaluating the value of invention, and, practically, the terms and conditions of the transfer contract or licence agreement are negotiated on a case-by-case basis in most cases. It increases transaction costs, which constitutes a barrier for the development of an IP market.

Nevertheless, a recent report by the World Intellectual Property Office (WIPO) points out the rise of an IP-based knowledge market (WIPO, 2011). It shows that international royalty and licensing payments and receipts are growing, and that their growth outpaces the growth in global GDP. However, it should be noted that the data include intra-firm payments. In addition, fewer data are available on domestic IP transactions. Recognizing data limitation in measuring the phenomenon, WIPO (2011) still suggests that the IP market is on the rise, although it starts from low initial levels and therefore is still relatively small.

Chesbrough is optimistic about the future growth of the IP market, noting the presence of agents acting as intermediaries to operate this market. Through their practices, they may gain professional expertise in valuation of inventions. Given the high frequency of unused patents, an increase in the number of these intermediate agents could be considered as a remedy to this problem of IP market. At the same time, however, the increasing importance of intermediate agents may have a bearing on eventual patent trolls, given that an intermediate agent does not utilize a patented invention himself, and consequently his interest resides in the transaction itself and not in the use of invention. There is concern that the increasing number of intermediate agents facilitates the existence of patent trolls.

8.4.3 Patent trolls: modality of injunctive relief

Although no clear definition exists, the term 'patent troll' is generally used to mean a party who, with no intent of utilizing patented inventions, purchases patents from firms, often in a state of bankruptcy, and imposes outrageous licensing fees on firms who are utilizing the patented invention(s) under the threat of injunction. Thus, the term patent troll refers to patent holders who try to provoke hold-up situations, i.e. who use the threat of an injunction to extract excessive value far beyond the true economic value of the invention, taking

advantage of the sunk cost the infringers have to bear. They should be differentiated from non-practising entities (NPE) such as universities or public research institutions that are actively engaged in technology transfer. They develop technology by themselves or play a role between technological firms and manufacturing companies on markets for technology. Their aim is to transfer technologies through the license of the IPRs they manage. On the other hand, patent trolls keep their patent portfolio hidden and seek to be infringed (Reitzig *et al*., 2010). Trolls are not engaged in licensing activities for technology transfer, but instead they speculate on patent litigation. Normally, in cases where a patent dispute arises between parties utilizing a patented invention, they settle by entering into a cross-licence contract to prevent either party's business from being suspended by virtue of the other party's patent right. If the right holder is a patent troll who does not actually utilize the invention, however, it becomes impossible to enter a cross-licence contract between the parties concerned.

In the context of open innovation, Chesbrough (2006a) recognizes the potential risk of patent trolls as a side-effect of the emergence of an active IP market. As a defensive measure for forestalling patent trolls, he suggests pre-emptive buying of patents. In fact, according to news reports, large US firms have established an organization dedicated to buying patents as a form of self-defence.[3] In the USA, a decision of the Supreme Court in 2006 held that, even if the infringement of a patent right is found by the court, it should not automatically grant an injunction but rather determine whether to grant or deny injunctive relief, within its discretion in accordance with equitability, thereby leaving the door open to impose restrictions on the granting of injunctions.[4] This is one example of how, in the USA, where the problem of patent trolls has come under close scrutiny, people appear to have started taking measures against it.

Fundamentally, the current patent law does not explicitly require a patentee to utilize the patented invention. Given this, it ought to have

[3] According to the *Wall Street Journal*, 30 June 2008, 'Tech giants join together to head off patent suits', the newly established organization is named Allied Securities Trust. Currently it has 25 members from Europe, North America and Asia, mainly in IT sectors (www.alliedsecuritytrust.com/ASTMembers.aspx). Another example of a defensive patents aggregator is RPX which has 50 members (www.rpxcorp.com/index.cfm?pageid=11).

[4] *eBay Inc*. v. *MercExhange*, 547 US 388 (2006).

been anticipated that a patentee failing to make use of the patented invention can still have his patent right enforced. Under the regime of closed innovation with a predominance of vertically integrated organizations, this issue did not have any reason to be addressed. Simply, the phenomenon of patent trolls is becoming apparent, as the number of players non-vertically integrated has increased with the advent of open innovation.

As we stated earlier, if a business model in which a right holder does not use his own invention exclusively prevails, then the necessity or validity of granting an exclusive right for intellectual creations may be challenged; that is not the case for the time being. Also, the transaction cost theory suggests that the creation of an exclusive property right would also have a promotional effect on the trading of inventions under open innovation. Consequently, it would not be necessary, for the time being, to walk away from the principles underlying the patent protection framework based on the idea of exclusive rights or injunctive relief. However, it is not to say that the exclusive-right or injunctive-relief framework of IP protection should be regarded as an absolute essential (Nakayama, 1996). On the contrary, it would suggest that the focus of discussion should be shifted from whether to limit injunctive relief to in what circumstances such right should be limited, to whether such question should be clarified beforehand in legislation or be decided upon by the courts on a case-by-case basis,[5] and what would be the appropriate amount of compensation for damages in cases where injunctive relief is limited.

8.4.4 Universities as partners

It is increasingly stressed that universities have to contribute actively to their respective national innovation system. They should not only create new scientific and technological knowledge, but they have also to be actively involved in transferring their research results into

[5] Or falling somewhere in between, a framework similar to government use (28 U.S.C. §1498) in the USA, for example, is possible in which patentees shall not seek injunction against not only the government that infringed the patent, but also those who infringed it for the government and with its 'authorization or approval' while the court decides on compensation for damages (Nakayama, 2008).

commercial success. The notion of 'entrepreneurial university' or 'academic capitalism' refers to universities being involved in the transfer of their research results through patenting, licensing, collaborative work with industry and more generally a greater involvement in economic and social challenges (Harayama and Carraz, 2012). Following this trend, in line with the rise of the open innovation paradigm, universities have emerged as potential partners vis-à-vis private firms for sourcing knowledge and technologies, accompanied by the recent trend of universities pursuing patent registration and licensing with respect to inventions created through joint efforts by the government and others. This trend seems to be consistent and coherent with the concept of open innovation; however, a careful analysis indicates that it may be a new source of contingency.

By the fact that the purpose of open innovation is to utilize external knowledge, Chesbrough takes a positive view of the promotion of industry–university cooperation, but he remains cautious about the pursuit by universities under the US Bayh–Dole Act of patenting activities with respect to inventions resulting from such cooperation. Chesbrough (2003) argues that kernels for next-generation technologies should be disseminated widely and rapidly, noting that the priority given by universities for patenting and licensing activities, may hinder the dissemination of useful knowledge, in particular in the field of basic research. The same concern is formulated by David (2003) who analyses at length the potential pitfalls of such trends on the open science mechanisms and incentive structure.

The fact is that, in the last 30 years, there has been a radical increase in the number and share of academic patents has been noticed first in the USA, then in Europe and more recently in Japan (Mowery *et al*., 2001; Geuna and Nesta, 2006; Takahashi and Carraz, 2011). Between 1969 and 1986, universities owned 1.1% of US patents issued, and by 1999 that number had risen to 4.8% (Eisenberg, 2003). In Europe, the share of public research institutions' filings (including universities) in total patent applications at the European Patent Office has jumped from about 0.5% in 1981 up to nearly 4% in the early 2000s (Zeebroeck *et al*., 2008). It must be kept in mind that these figures are lower-bound measures, as many university-invented patents are assigned to non-academic institutions.

This increase has been induced by an active institutional level engagement of universities in the creation and management of IPRs.

A major symbol of this trend is the legislative frenzy that started with the US Bayh–Dole Act in 1980, and went through subsequent similar provisions in Europe and Japan (Verspagen, 2006; Takahashi and Carraz, 2011). The Act allowed universities to claim ownership of inventions made as a result of federally funded research. The motivation of Congress in passing the Act originated from the proposition that patents resulting from federally funded research were unexploited due to lack of clear rules on their ownership. It assumed that university ownership of faculty inventions facilitates their commercialization, thus enhancing economic efficiency. This institutional change induced an increasing pressure to translate the results of their work into privately appropriable knowledge. In that sense it collides with the free diffusion of research results, a crucial element of the ethos of open-academic science (as we have seen in Section 2). The resulting question is how this limitation of the free flow of academic knowledge, departing for the open science norms, can be offset by the economic gains of increasing pool IPRs to be traded in the knowledge market. The research exemptions could be a response to this problem, but the debate on how to translate them in terms of operational rules, ensuring a right balance between 'research use and patent holder's rights' is far from closed (OECD, 2006).

8.5 Conclusion

In this chapter, after a brief review of the concept of 'openness' and the discussion around three different perspectives of openness, e.g. open science, open sources and open innovation à la Chesbrough, we examined the relationship between open innovation and the IP system, with a particular focus on patent. Then we identified and analysed some major institutional challenges induced by this changing practice of IPR management, namely the development of an IP market, modality of injunctive relief, and universities as partners in the IP market.

As observers have occasionally suggested, the vertically integrated closed innovation model has exposed its own limitations. The significance of open innovation lies in setting out a new model in which, based on the premise of a non-vertically integrated model, equal importance is attached to external knowledge and internal knowledge and efforts are made to create and capture value by combined use of the two, together with other resources. Open innovation is also characterized by its emphasis on the need for firms to have strategic IP management.

By capturing open innovation in their development strategy, firms opt for using the patent system as a means of pursuing profit. In the first place, the term 'public opening' has a strategic and equivocal meaning, which implies that open innovation prompts users of the patent system to further improve their patent management. So, basically, open innovation sends a message specifically to users of the patent system. While conventional wisdom puts a focus on exclusivity of a patent right, open innovation à la Chesbrough urges company managers to reconsider the role of patents and use them as vehicles for technology transfer in IP markets.

Policy-makers should also pay attention to what these changes bring about. The patent system, with the concept of exclusivity at its heart, has been considered consistent with closed innovation for some time. However, open innovation à la Chesbrough makes it clear that patents are tradeable property rights. Keeping this in mind, policy-makers should carefully revisit institutional design to make sure that technology transfer through IP markets contributes effectively to accelerating innovation. More generally open innovation practices entail many opportunities for firms, as well as some threats and costs, leading to new challenges for managers and policy-makers. Firms need to develop practices to deal with external knowledge flows and to build strategies of knowledge integration tailored to different partners and level of openness. Depending on the circumstances and partners, firms should diffuse their knowledge on an unrestricted basis, build long-term cooperation with different actors such as universities, or monetize their inventions on IP markets and networks. Further studies on these topics should investigate how firms should organize their organizational boundaries to fit their innovative strategies and produce guidelines from managers to manipulate different options brought about by a more open and decentralized model of innovation.

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