

Networked enterprise, organization and innovation.

The functions of intellectual property rights

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Abstract: The networked enterprise simultaneously seeks to develop new knowledge in order to be able to compete on international markets thanks to its innovation capacity and to improve its process of allocation of resources, notably by reducing its costs of production and of organization. In this paper, we study the functions of intellectual property rights in these productive and organizational objectives of the networked enterprise. We consider that they have an important '*coordination function*', making easier the relationships between all the fragmented parts of the networked enterprise. This coordination role is moreover gaining ground in the context of collaborative innovation (innovation networks). It is thus associated to the '*incentive/defensive function*' of IPRs, aiming at protecting and thus giving incentives to the constitution of the firm's innovation potential, called here 'knowledge capital'. This coordination function is also associated to the '*offensive one*', relying on the construction and the reinforcement of entry barriers which largely contribute to define the place of the networked enterprise within the innovation network to which it usually belongs. The paper concludes by stressing the relationship between the functions of IPRs in networked enterprises and the extension and strengthening of IPRs at the global level.

Key words: networked enterprise, innovation network, intellectual property rights, coordination, innovation, knowledge capital

1.Introduction

“Put simply, patents and copyrights are often the crown jewels in a high tech company’s collection of assets” C. Shapiro (2003, p.391)

In spite of the diversity of organizational models that can be found in the economic reality (Berger, 2005, Lung, 2008), there is no doubt that the organization and the management of activities through networks have gained ground. In particular, the big hierarchical firm seems to be part of past history, being replaced by the ‘networked enterprise’. Today, most companies are more and more concentrated on a very small part/ or on small parts of the value chain: conception/design of new products (final products, or intermediary goods), production (of pieces or final assembling); commercialisation (services). Secondly at each step of the value chain (conception, production, commercialisation), most firms try to reduce the ownership of assets to the core activities (the most profitable but also often the most risky) and use contractual relations to manage the rest of the activities.

This type of organization has been well studied in sociology (Castells 1996, Mariotti 2004) and in economics and management of innovation and of organizations, certainly because it seems to be particularly adapted to the economic context characterized by the globalisation of competition based on innovation (see notably Porter 1990; Chesnais 1994; Uzunidis et al. 1997; Sturgeon 2002; Langlois 2002; Gaffard 2003; Baudry 2004; Berger 2005).

In the same time, in the field of economics and management of innovation, a set of legal instruments: Intellectual property rights (IPRs) have obtained to the status of “assets” (see the quotation heading this introduction) showing their crucial role in innovation strategies, as well as in innovation policies (Foray 2004, Scotchmer 2004, Shapiro 1998, 2001, 2003, Lévêque and Ménière 2004).

In this paper, based on a review of literature, we want to better understand the functions of intellectual property rights (IPRs) in the particular case of the networked enterprise building innovation networks. IPRs are often studied in relation to the innovation dynamics and strategy, notably focusing on the strategic roles of IPRs (incentive/defensive role, aiming at protecting and thus giving incentives to the constitution of the firm’s innovation resources; offensive role, aiming at defining the place of the firm in competition). The organizational functions of IPRs and particularly their role in the coordination of activities are more rarely studied. Neo-institutional theories and transactions costs approaches of the firm explain the coordination function of property rights. As a consequence intellectual property rights may play this role in the networked enterprise, making easier the relationships between all the fragmented parts of the networked enterprise. This coordination function is moreover revealed to be fundamental in a context of collaborative innovation, i.e. the construction of innovation networks. This paper thus offers a new point of view on the strategic but also on the organizational functions of IPRs, in the particular case of the networked enterprise.

Part 2 comes back to the origin of the networked enterprise and defines its main characteristics. It also defines IPRs and presents their strategic roles as they appear in the literature. Part 3 presents the ‘coordination’ and the ‘incentive/defensive’ functions of IPRs in the networked enterprise, which are

gaining ground in a context of collaborative innovation. Part four presents the ‘offensive role’ of IPRs which largely contributes to define the place of the networked enterprise (as a leader or a follower) within the networks of firms to which it usually belongs. Finally part 5 concludes the paper by stressing the fact that the new forms of organization of enterprises largely explain the recent evolution of IPRs legislation.

2-The Organization of the Networked enterprise: Origin and Definition

2-1- A dual vision of the Firm: Knowledge and transactions

Among the theories of the firm, we cannot detect a theory specially dedicated to the networked enterprise. The traditional theories of the firm mostly focused on the objectives of the firm (conflict between profit maximisation in the neoclassical approach of the firm and the existence of multiple objectives reflecting the complexity of the organization in the behavioural and managerial approaches). The question of the boundaries of the firm, first posed with the Ronald Coase’s contribution in 1937, who opposed market and hierarchy, became more topical from the 1970s, a period which coincided in the economic reality with the organizational difficulties faced by the hierarchical mode of organization of enterprises. The existence of transaction costs, but also of bureaucratic costs thus began to explain the size of enterprises and the related “make or buy” choice (Williamson 1975, 1985). The agency theory (Jensen and Meckling 1976) and the theory of property rights (Alchian and Demsetz 1972) have adopted a radical individualist approach of the firm viewed as a ‘nexus of contracts’ and thus being a ‘legal fiction’. In this approach, the networked enterprise do not exist. There only exist contracts linking individuals owning various production means. The competence based approach of the firm¹ relying on the vision of the firm as a complex organization, a ‘processor of knowledge’ helps to understand how the objective of knowledge creation and diffusion is achieved, associating the internal organization of the firm and the access to external resources (Cohendet and Llerena 2005). Following these authors, we consider that the transaction approach of the firm (where it is viewed as a ‘processor of information’ (Fransman 1994) and thus focuses on the allocation of resources according the level of transaction costs) and the competence based approach of the firm can be complements and not substitutes, what they call a ‘dual’ vision of the firm. The firm, considered as an organizational device, simultaneously allocates and creates resources. In this vision, the characteristic of the economic context, and the attention given to the activities (core competences, non core competences, peripheral activities) will determine the importance given to knowledge creation (associated with core competence and a challenging economic context) and to transaction costs (mostly important for peripheral activities and a stable economic context). This is this dual vision of the firm that we retain to study the origin and the organization of the networked enterprise. Such an approach necessitates coming back to the economic context that largely contributes to explain the evolution of the organizational structures of the enterprise.

¹ Including the evolutionist approach, the resource based theory, the strategic competence based approach and the social-anthropology of learning approach (see Cohendet and Llerena, 2005)

2-2 From the hierarchical to the networked enterprise

The study of economic history allows to put forward the evolution of the firm's organization from the integrated company (at the beginning of the twentieth century) to the multidivisional company (from the 1960s on, see Chandler 1977, 1990), where the units that could be located abroad were functioning as 'quasi firms'. The reasons for the evolution of the firm's organization lies in a mix of economic, social and technological factors (see on this point, Kapàs 2008). The main explanations of the emergence of a new form of enterprise, the networked enterprise² are also related to a set of economic, social and technological factors, which are a) the crisis of the Fordist model of production, b) the deregulation of markets and c) the diffusion of information technologies.

The crisis of the Fordist model of production begins at the end of the 1960s and is characterized by the saturation of markets for undifferentiated goods. In a more open environment, big integrated firms bear increasing "bureaucratic costs" and have difficulties to adapt. The necessity to adapt to a changing and diversified demand grows and shows the main change in the competition grounds, from the price in the Fordist model of production to innovation in the flexible model of production. Innovation, that is new combinations in the terms of Schumpeter (1911,1942), has become a fundamental objective of the firm, imposed by competition. This idea is commonly shared by business theories (Porter 1990; Tidd et al. 2005; Uzunidis 2004) and the competence based theories of the firm (see above), defining the firm as a 'processor of knowledge', make the link between the creation and knowledge and the diffusion of innovation.

The opening and liberalisation of markets that have begun at the end of the 1970s, have aimed at fighting against the economic crisis characterized by the conjunction of inflation and unemployment. These policies have been developed and disseminated through international organizations (WTO, IMF and World Bank) (Michie 2003, Milward 2003). The liberalisation of markets (goods and services, labour, finance) has opened new markets for firms but also has made easier the organization of the production process on an international scale, not only through the creation or purchase of new subsidiaries (internal and external growth) in different countries but also through the signature of contracts with suppliers and subcontractors located in different parts of the world.

Thanks to the progress and the diffusion of information technology, the global management of production - in real time - becomes possible. In fact, information technology binds the scattered units of the enterprise. The use of modern information technology reduces the cost of data transfer and facilitates the location of units abroad, as well as national and international partnerships. Information and communication technologies are also fundamental in the mobilisation and the integration of fragmented and diversified forms of localised knowledge and competences (Cohendet et al. 1999).

² Many names are given to this new form of organization of activities as project based company, modular enterprise, hollow corporation, etc. Several processes named vertical disintegration, outsourcing/offshoring etc. also define these new forms of organization etc. This diversity of names also reflects the many differences that exist between the organizations of firms, more or less close to the multidivisional enterprise. As a matter of fact, the networked enterprise is more a complement than a substitute to the multidivisional firm (Berger 2005).

A large modern corporation can be sketched as a network of units linked together in the aim of producing goods and services (final or intermediary production). Some of the units are owned by a central firm (usually a holding company) and the other kinds of activities are linked by contract (partnerships, subcontracting, licensing, franchising).

In the networked enterprise, the central firm focuses on its 'core' activities (usually the ones that will reinforce its innovation capacity and more globally the ones which are at the basis of the definition of firm's strategy). These core activities are wholly owned by the central firm (which is coherent with the vision of the firm as a processor of knowledge). The achievement of the other activities (for example the production of parts of the final products, the commercialisation of final goods) is mainly managed through contracts with other more or less independent entities (subcontractors, licences, franchises etc.). The fully outsourced activities mainly concern the ones that deal with the implementation of the firm's strategy (here, the transaction costs are the main governance criteria). As a consequence, the value of firms increasingly relies on intangible assets (IPRs, and other components of the knowledge capital, see below) / compared with tangible ones (Serfati 2008). Thus, the central firm can be considered as a designer or an architect of global network. The expression "network architect" is for example used by the Renault Group to describe its main activity.

Networked enterprises have gained greater flexibility, thus enabling them to adjust to the evolution of the demand. The networked enterprise associates internal and external flexibility. Internal flexibility deals with the management of work within the company: the enterprise focuses on a stable core of managers in R&D, financial and administrative departments. It uses more diverse forms of work and contracts of employment (in terms of working time, salaries, place of work, job content) to manage the other employees. To this greater internal flexibility are associated increased options in the ways firms manage their assets at the international level (external flexibility). The globalization of corporate strategies refers to their liberty or flexibility in the management of human, financial, scientific and technical assets at international level. Networked enterprises are organized at a global level, according to the competitive advantages of potential host territories. Holding companies are located in areas with low or even non existing taxation. Research and development laboratories are set up in areas where financial, scientific and technical resources are abundant. Production plants select attractive countries in terms of specialization and labour costs as well as transport infrastructures. Goods are marketed in all financially solvent areas worldwide. The pertinence of the dual vision of the firm can be seen in the productive strategy developed by the networked enterprise, which simultaneously tries to develop its innovative capacity (which implies new investments) and to reduce its production costs (through the rationalization of its production process and of its structure) (Uzunidis et al. 1997)

The strategy of rationalization is all the more important that finance has gained a major role in the management of firms (Plihon 2002; Aglietta and Rébérioux, 2004, Gaffard 2003; Michalet 2007). The different steps of financial market deregulation and liberalisation have produced an interconnected global market. New types of investors (pension funds, insurance companies, investments funds) are investing in big enterprises worldwide. Due to their main activity (e.g. managing employee's pension

funds), they feel less concerned by the development of such companies (eg. their technological performance or the size of their staff) than by the amount of the dividends to be received. Their fluctuating behaviour, dependent on the level of the price earning ratio, has important implications in the management of such corporations. In particular, the objective of profit maximization, linked to the increase of the shareholder's value, becomes one the most important (Laperche 2006). The "Profitability imperative" is the result of this new context. It means that in order to keep the precious new institutional investors, managers of big globalized corporations have to boost shareholder value. The increase of the shareholder value will moreover be profitable to them, as they have often become, thanks to the stock options plans, shareholders of the companies they manage. This profitability imperative is a powerful reason of the erratic boundaries of networked enterprise, which are transformed by processes of mergers/acquisitions and outsourcing/offshoring.

1-3 Definition and Role of IPRs in the literature

IPRs include industrial property rights, that is to say, patents, trademarks, industrial models, and the protection of trade secrets. They also include copyright protection. The patent is a temporary monopoly (which lasts 20 years) given to an inventor, as an acknowledgement of the invention, whether a product or a process in all field of technology, provided that it is new, involves an inventive step and is capable of industrial application. A trademark protects words, names, symbols, sounds, or colours that distinguish goods and services from those manufactured or sold by others and it indicates the source of goods. Trademarks, unlike patents, can be renewed forever as long as they are being used in commerce. A design patent may be granted to anyone who invents a new, original, and ornamental design for an article of manufacture. Trade secret laws protect individuals and businesses against the misappropriation of trade secrets by improper means. Copyrights protect works of authorship, such as writings, music, and works of art that have been tangibly expressed.

The many works dealing with the functions of intellectual property rights in enterprises give us the possibility to draw up a list of the main aims that encourage firms to use them (see for synthesis Gallini 2002; Scotchmer 2004; Hanel 2006)

Table: The reasons of the resort to intellectual property rights (in particular to patents)

| |
|---|
| Protection against imitation (copy dissuasion and/or lawsuits in case of counterfeiting) |
| Incentive to invest in R&D by making investments profitable (production and commercialisation of protected products and/or signature of licence agreements) |
| Negotiation means (in partnerships and/or with financing institutions) |
| Image / reputation of the enterprise |
| Assessment of internal performance / Valuation of the enterprise |
| Blocking competitors / reinforcement of entry barriers |

These aims are well studied in the literature and we they will be explained in more details in the rest of the paper, applied to the particular case of the networked enterprise. What is important to mention here is that the hierarchy of the objective is not unchanging. It varies, according many factors as the size of the enterprise, the sector, the type of protected creation, the character more or less innovative of the enterprise, the market structure and the intensity of competition (Hanel 2006).

In the dual networked firm, focused on the reduction of organizational and production costs and on the creation of new knowledge, we can make the hypothesis that the roles of coordination and of incentives will be strong.

3- The coordination role and the incitative / defensive roles of IPRs in the networked enterprise

3-1 The coordination role of IPRS

The contemporary economic theory stresses the role of property rights in the coordination of activities and in the allocation of resources. The Coase theorem (Coase 1960; Stigler 1966) means that negotiation leads to an effective allocation of resources when property rights are clearly defined and when there is no other obstacle to the transaction. The transaction cost theory (Williamson 1975,1985) and the theory of uncompleted contracts (Hart and Moore 1990) stipulate that vertical integration lead to the efficiency of transactions and of organizational forms.

However, the networked enterprise means the reintroduction of market in the functioning of the enterprise / compared to integrated firms, where hierarchy (based on the ownership of physical assets) is considered as an alternative to market. This reintroduction of market reveals transaction costs, which are caused by the imperfection of markets: information search, finding the suppliers, negotiation of contracts and execution of contracts.

According to this reasoning, and taking account of the growing importance of the ownership of intangible assets compared to the ownership of physical asset in the networked enterprise (Serfati 2008), we can consider the hypothesis that IPRs, just as certification and logistics integration (see Baudry 2004), would play an important role in the coordination of activities, clarifying the relationship and thus reducing the transaction costs between the central firm and the different units that compose the networked enterprise.

As a matter of fact, the ownership of trademarks for example - but also of course of patented inventions or design- plays like a signal for the central firm or for potential suppliers that shows the quality of the enterprise's products and services. In other words, trademarks may increase the reputation of the central firm and of potential suppliers that would be chosen thanks to the IPRs they own. In the case of subcontracting and in franchising contracts, licences³ allow the different units to use the patented invention, or the protected trademark or design usually owned by the central firm. Licences are usually considered as producing productive efficiency (to produce proprietary products efficiently; to let others

³ A Licence is an agreement whereby the owner of intellectual property authorizes another party to use it.

use the intellectual property as inputs to innovation (research tools); to resolve blocking situation and to enable the development of complementary inventions) (Sctochmer 2004, p.162). IPRs thus allow the diffusion of technology within the enterprise and gives incentives to the production of specific assets. In the case of R&D partnerships where specific assets are built jointly (co-contracting or contracts between the central firm and a research lab for example), shared patents reduce the possibility of opportunist behaviours (hold-up situations) between the co-contractors.

In other words, the definition of IPRs may facilitate exchanges by reducing transaction costs, as in the Coase theorem. However, it does not mean that the allocation of resources will be in every case efficient as the transaction costs do not completely disappear, a situation that would only occur in a context of pure and perfect competition. That is to say that the choice to outsource activities or not will depend on the comparison between the transaction costs and the gains of exchange, where IPRs play an important role.

The coordination function of IPRs is all the more important as, in recent years, innovation has become a collaborative process, linking together several firms and institutions. The building of the networked enterprise's innovation capabilities, its 'knowledge capital' is achieved through innovation networks.

In the dual networked enterprise, the coordination function of IPRs (reduction of transactions costs) and their role of incentives (for the creation of new knowledge) appear to be linked.

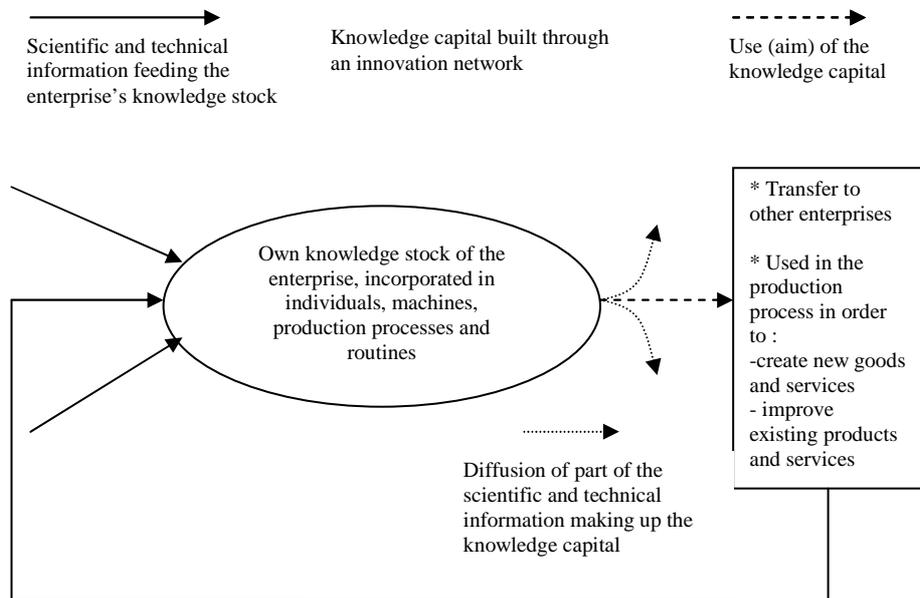
3-2 From coordination to incitation in the context of collaborative innovation

Collaborative innovation means that the process of knowledge creation is today the result of partnerships between the units (more or less independent for the central firm) of a same firm but also between several networked enterprises and several kinds of institutions (see Hamdouch et al. 2008). Collaborative innovation mainly results from the economic context based on a global competition where innovation performances and profitability imperatives are associated.

To better understand this collaborative innovation process within the networked enterprise, we define the "knowledge capital" as the set of scientific and technical knowledge and information produced, acquired, combined and systematized by one or several firms for productive purposes⁴. "Knowledge capital" (see fig 1) refers to the accumulated knowledge of one or several linked firms (embedded in the individuals – know-how, competences – machines, technologies and routines of the enterprise) which is continuously enriched by information flows and which is used in the production process or more globally in the value creation process. Thus, it is a dynamic concept – a process – that defines the knowledge accumulated by one or several firms and continuously enriched and combined in different ways, and eventually used or commercialized. This productive aim – the creation of value – is the main characteristic which turns knowledge into 'capital'.

⁴ Theoretically, the notion of "knowledge capital" is based on the definitions and/or on the economic developments of three key concepts/notions: knowledge, firm and capital (see Laperche 2007)

Figure 2 The ‘knowledge capital’ (Laperche 2007)



A firm may use its “knowledge capital” in a value creation process by i) simply selling this knowledge base to another enterprise (e.g. the selling of a computer program). Thus, the “knowledge capital” (embodied in the software) is transferred to another enterprise which can use it in its production process; ii) using this “knowledge capital” in its own production process. In this case, the ‘knowledge capital’ can be considered as a means to produce or to improve goods and services and as a tool for reducing its production process completion time.

The formation of this knowledge capital is today achieved on a global scale. This can be assessed by the growing importance of international R&D partnerships between firms (Archibigu and Iammarino 2002; Hagedoorn 2002), patents and technology flows (OECD 2003), and globalisation of R&D (UNCTAD 2005; OECD 2008).

Moreover, networked firms are more and more developing their knowledge base thanks to the innovation network into which they are involved. The issue of networks is now considered as a challenge in the economics of innovation, which starts “from the recognition that innovation and industry are highly affected by the interaction of heterogeneous actors with different knowledge, competencies and specialization, with relationship that may range from competitive to cooperative, from formal to informal, from market to non market” (Malerba 2006, p.15).

As a matter of fact, the formation of the enterprise’s “knowledge capital” implies the gathering of different types of inputs, i.e. human resources (researchers, engineers), tangible resources (machines, tools) and intangible ones (patents, software, information). The enterprise has to produce and appropriate scientific and technical knowledge in order to expand the knowledge base it has already

accumulated. Different means are used by the enterprise, which we can call for one part in-house means (investment and management of human resources, R&D and tangible and intangible resources), and for the other part external means. External means can be divided in two categories: equity relations (for example joint venture) and non equity relations (contracts with firms and other institutions and more informal contacts). (see table 1)

Table 1: Means of formation of the firm's "knowledge capital"

| In-house means (<i>Rosenberg 1990; Cohen and Levinthal 1990</i>) | External Means (<i>Jaffe 2000; Mowery et al. 2001; Tidd et al. 2005; Antonelli 2005;</i>) |
|--|---|
| <ul style="list-style-type: none"> - Investment in Human Resources - Investment in and management of R&D and means of production (tangible and intangible) | <p><i>Equity relations :</i></p> <ul style="list-style-type: none"> - joint venture - purchase of innovative enterprise <p><i>Non equity relations :</i></p> <ul style="list-style-type: none"> - Contracts with other firms (including licensing) - Contracts with institutions: e.g. university research labs (including licensing and hiring of short term researchers) () - More informal contacts |

This strategy of collective constitution of the knowledge capital can be seen in high tech sectors as in apparently more traditional ones. The case of the Lafarge Group can illustrate this: its research centre is located at L'Isle d'Asbeau, next to Lyon, and is in 2000, the first world research centre, in terms of employees and budget in the field of building material. It also cooperates with other enterprises (Bouygues and Rhone Poulenc, and then Rodhia since 1994) and with research Labs (Polytechniques, INSA Lyon and Toulouse, Universities of Berkeley, Princeton, Massachusetts institute of Boston US, of Laval and Sherbrooke Canada and Polytechnique of Lausanne) (Barjot 2007). The evolution of IBM from a hardware manufacturing company to a global service provider has depended on a strong evolution of its collaborative network that has taken part to the adaptation of its knowledge capital. In the case of IBM, the network - and the characteristics of the relationships within the network - has been used to facilitate to the strategic positioning of the firm (Dittrich et al. 2007). It is also through the constitution of a network of partnerships, linking small and big companies, universities and research centres that Monsanto achieved in the 1970s-1980s its strategic shift from chemistry to vegetal biotechnology.

The purpose of all these strategies is to reduce the cost, risk and length of technical progress and hence increase the short term return on investment in the scientific and technical fields. This purpose is all the more important that the complexity of technological development increases, which implies a collective process to be able to innovate quicker and with less risks. Due to the profitability imperative, the big enterprise develops external means of formation of the knowledge base, which are both less risky and less costly. This does not mean, however, that the firm does not make in-house investment any more, as this kind of investment is crucial to understanding and absorbing the scientific and technical

development achieved by other institutions on their own base. This trend shows that the formation of the “knowledge capital” is built collectively, i.e. several institutions (big or small enterprises, research laboratories...) take part in its formation.

The collective constitution of the knowledge capital thus implies tools to ensure the coordination within the networked enterprise and between the central firm and its partners (networks of firms). We can put forward that IPRs take a greater part in this coordination process. The sharp increase of licence agreements in the past decade supports this idea: in a recent survey of firms in OECD countries, approximately 60% of respondents indicated that they had experienced an increase in both inward and outward patent licensing over the past decade and more than 70% expected inward licensing to increase further in the next 5 years (Sheehan et al. 2004)⁵. Whereas some empirical studies show the importance of property rights protection over transaction cost considerations in the decision to outsource (see Gooroochurn and Hanley 2007), according to us, IPRs also have also a role in the reduction of transaction costs in collaborative strategies (including outsourcing). As a matter of fact, IPRs clarify the relationships between the co-contractors (coordination), and thus, by reducing transaction costs, give incentives to the collective building of knowledge capital, by protecting the tangible and intangible elements that constitute it. In the networked enterprise, the coordination role of IPRs is linked to their more traditional defensive/incitative roles. The temporary monopoly conferred by industrial property rights gives the possibility to go to courts in case of infringement. IPRs thus secure merchant relations and give an incentive to joint investment efforts and to the internal transfer of technology. Within the networked enterprise, IPRs are a tool used by firms to replace the control based on the ownership of tangible assets by a control based on the ownership of intangible assets.

The coordination function is also visible through the relationships with investors. IPRs give a value to R&D investments, in a context where profitability has become an imperative. Filing and holding patents transform potential inventions in valuable assets, which can give confidence to investors and shareholders concerning the profitability of the firm’s investments.

However, if we come back to the first role assigned to IPRs (protection of invention and creations), some limits have been put forward (see Gallini 2002). For instance, patents diffuse too much information and are costly (direct and indirect costs). Copyright protection implies the capacity to make the proof to be the first creator, etc. To reduce the limits of IPRs, enterprises use joint tools of protection; in other words, they built portfolio of protection tools, notably associating lead time to traditional IPRs protection tools (see Levin et al. 1987; Cohen et al. 2000). This leads us to the offensive

⁵ The types of IPRs agreement may depend on the type of commitment between the partners. Whereas licence agreements may be used in exploitation strategies which involve important exchange of information, exploration strategies may rely on lower commitment (as shown by Dittrich et al. 2007 in the case of IBM), notably at the beginning of the project (trade secrets could be used first – however, if from exploration strategies are generated new technologies, these ones would surely result in shared patents or cross licences).

role of IPRs within innovation networks. Here again, the coordination functions is associated to the offensive role of IPRs.

4- The offensive Role of IPRs: coordination and leadership within innovation networks

4-1 Patent pools as a solution to patent thicket

The innovation strategies of networked firms lead to a blurred distinction between the networked enterprise and the innovation network to which it belongs. As a matter of fact the constitution of the knowledge capital implies contractual relations between the central firm and units and partners. The partners may be small and medium enterprises specialized in technological fields but they may also be big enterprises and competitors of the networked firm as a whole. These kinds of alliances are meant to share the cost of development of new products and processes and to reduce the conception needed time. These alliances often lead to an important number of patents that can be owned separately by the different partners or be shared. Whatever the solution chosen, the development of a new technique lead to an important number of patent, a “patent thicket” in the words of C. Shapiro (2001) that can block the use or even the final production by a subcontractor that would have to sign too many and costly licences. The number of infringement and litigation thus also increases. These situations have been become much more common with the growing number of very restricted patents delivered notably by the USPTO since the 1980s (Gallini 2002). A good example of the blocking impact of a patent thicket in the biotechnology sector is the case of the Golden Rice, this variety of rice produced through genetic engineering to biosynthesize beta-carotene, a precursor of pro-vitamin A in the edible parts of rice. While created at the university of Zurich, the golden rice uses technological means protected by patents. Its exploitation needed to negotiate licences with more than 70 patent owners (Joly and Hervieu, 2003). Some legal solutions are proposed to conciliate the incentives to innovate and the dissemination of knowledge, such as compulsory licensing, non exclusive licences, modifying the duration and the breadth of patents (O'Donoghue et al. 1998; Scotchmer 2004). But another type of solution to these restrictions has been found in the way firms manage their industrial property rights. Some studies have shown that building patent pools that are current in the definition of collective standards, could be a solution to the blocking of knowledge or could prevent litigation (Clark et al. 2000; Shapiro 2001; Choi 2003, Scotchmer 2004). According to C. Shapiro, ‘Virtually, every patent licence [and by extension cross licences and patent pools, bl] can be viewed as a settlement of a patent dispute’ (2003, p. 392). This was for example the solution chosen to solve the problem of the exploitation of the Golden Rice, case to which we referred above (Bonneuil et al. 2006).

A patent pool can be defined as ‘an agreement between two or more patent owners to license one or more of their patents to another or third party’, or more precisely as ‘the aggregation of intellectual property rights which are the subject of cross-licensing, whether they are transferred directly by patentee to licensee or through some medium, such as a joint venture, set up specifically to administer the patent pool’ (Clark et al. 2000, p.4). Patent pooling is not new, as shown by the cases of the Manufacturer’s

Association formed in 1914 and the radio broadcast pool undertaken by RCA in 1920 (see Scotchmer 2004, pp.174-176). This practice was often regarded as a threat for competition (notably in the US under antitrust laws), but in the two cases mentioned above, the US navy supported the patent pools for defence purposes.

In fact, two cases may be distinguished: when patent pools, or cross licences concern technology substitutes, they are considered as part of a strategy of cartelization (C. Shapiro 2001, p.139 gives the example of the laser eye surgery attempted by summit technology Inc and VisX Inc). In these cases, patent pooling can encourage the development of monopolistic behaviours (such as high prices, imposition of “invalid” technologies, technology malthusianism). When patent pools concern complementary pieces, they may be considered positively, as a solution to resolve blocking situations (the famous cases of MPEG 2 video compression technology, DVD standard and DVD video are often cited in the literature). The strong link between cartelization and patent agreements justifies according to C. Shapiro the development of antitrust limits to patent settlements, based on the consumer benefit of such agreements (Shapiro 2003).

In the same time, since the beginning of the 1980s, discussions have gained ground on the positive impacts of patent pooling, and led to the *Antitrust guidelines for the licensing of intellectual property* in 1995 (issued by the US Department of Justice and the Federal Trade Commission) which recognises that ‘patent pools can have significant pro-competitive effects’ (Clark et al. 2000, p.6). According to this guideline, an intellectual property policy is pro-competitive when it integrates complementary technologies, reduces transaction costs, clears blocking positions, avoids costly infringement litigation and promotes the dissemination of knowledge; thus when one focuses on its coordination function.

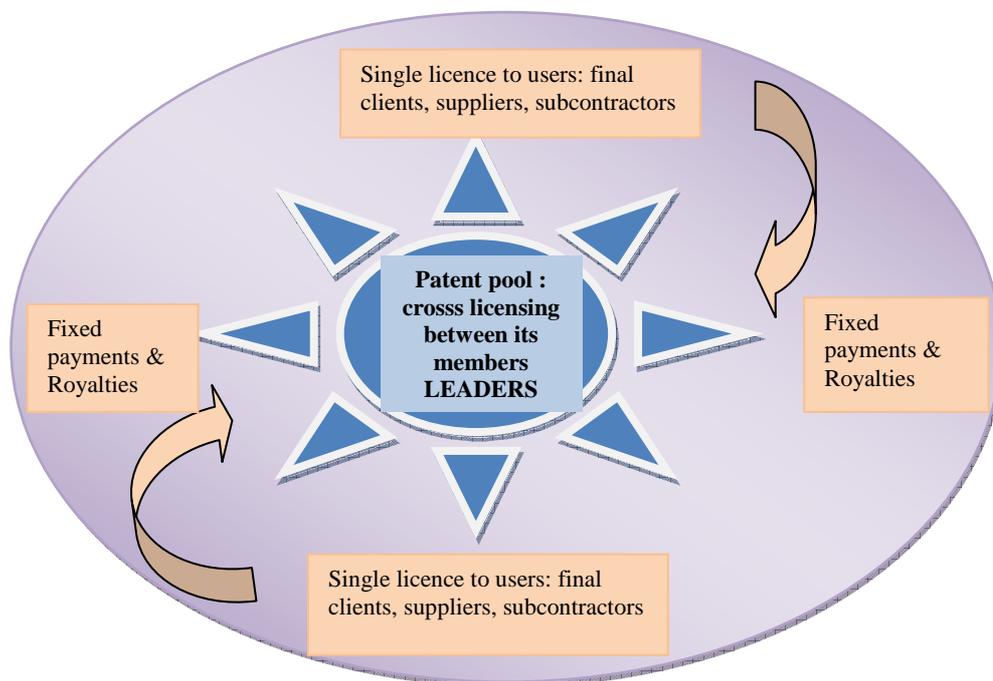
The same report states that the benefits of such a strategy are the elimination of problems caused by blocking patents, the increase in the disclosure of information between patent pool members, the reduction of licensing transaction costs and the distribution of risk: ‘Like an insurance policy, a patent pool can provide incentive to further innovation by enabling its members to share the risks associated with research and development. The pooling of patents can increase the likelihood that a company will recover some, if not all, of its costs of research and development efforts’ (Clark et al. 2000, p.9). The latter argument also shows that the patent pooling strategy, which is gaining ground in new technology sectors (like biotechnology and ICT, in the latter case see Shapiro and Varian 1998) is driven by the same profitability imperative which also explained the development of external means of formation of the ‘knowledge capital’.

4-2 Patent pools and the construction of a hierarchy within an innovation network

Patent pooling is often studied in relation to its pro-competitive effects (cf. coordination function within the network of firms) but we would like to put forward that it also plays an important role in the definition of the place of the firm within its network. As a matter of fact, patent pooling, even in the case when complementary technologies are involved, supports the idea of a growing private and oligopolistic appropriation of the ‘knowledge capital’. Even if the formation of “knowledge capital” depends on

interdependent relations between increasing numbers of institutions (big firms, small concerns, research labs, etc.), only a few firms appropriate the return of their investment, thanks to the patents they own separately and/or collectively and that they licence to each other. The other members of the innovation network (the users: clients, suppliers, subcontractors, tec.) are not the owners of the technology, have to pay a licence fee to use the technology and/or to produce the products and services that derive from this technology. And this is true, even if they have participated, in more or less easily observable ways (competencies, consulting, informal exchanges of information...) in the constitution of the knowledge capital from which the licenced technology (or set of technology) emerges. What is important here is that the practice of patent pooling, notably resulting from ex-ante cooperation processes, contributes to define the place of firms (their hierarchy) within the networks (see figure 2). The members of the patents pool, that is the ones which own the separate or shared patents, are the leaders of the networks. Thanks to the power conferred by the ownership of intellectual property rights, they build entry barriers protecting the highest level of networks (the leaders). These protected leaders can also keep their advance over competitors, by reinvesting the rents they receive from the commercialisation of licences in R&D processes meant to develop the next generation of technology (Laperche 2001). This strategy clearly shows the offensive role of Intellectual Property Rights within innovation networks.

Figure 2: Patent pool and hierarchy within a network



5- Conclusion

In this paper we have developed the idea that in the networked enterprise, focused on its double aim of being more innovative and improving the efficiency of its organisation, IPRS not only play their traditional defensive /incentive/offensive roles but also have an increasing coordination function. The networked firm is more and more based (in its organization but also in the assessment of its value) on the ownership and intangible assets compared to physical ones. Logically, we can thus put forward that in the networked enterprise, intellectual property rights tend to replace physical property rights in the coordination function (traditionally put forward in the contemporary theories of the firm). This coordination role is associated with the more traditional incentive/defensive and offensive roles of IPRS (table 2). In this paper, some examples illustrate the developed idea. However, applying this analysis empirically to some particular networked enterprises will be the next step of this work.

Table 2 - Role of IPRs in the networked enterprise and in innovation networks

| Role | Explanation |
|---------------------------|---|
| Coordination role | <ul style="list-style-type: none"> *Reduction of transaction costs within the networked enterprise *Reduction of transaction costs within the networks of firms (patent pools) *Solution to patent disputes (licences, patent pools) *Reputation within innovation networks *IPRs give a value to R&D investment (secure the shareholders) |
| Defensive/ incentive role | <ul style="list-style-type: none"> *Protection of the collectively built 'Knowledge capital' *Incentives to the diffusion of technology and to the investment in the constitution of the 'Knowledge capital' |
| Offensive role | <ul style="list-style-type: none"> *Definition of the place of the enterprise within the innovation network *Oligopolistic appropriation of knowledge capital and construction of barriers to competitors *Lead time |

To conclude, and following this reasoning, we can put forward that the reasons for the evolution of IPRs laws at the international level appear to be closely linked to the need of IPRs by firms. As firms are more and more open to their environment, constituting global networks at each step of the value chain, they need tools to improve their coordination and provide their own knowledge base with wider and stronger protection. The recent trend towards extending patentability to new fields and closer to the scientific border can be regarded as an answer to this growing need for protection and coordination (the global protection given by the TRIPs agreement also favours their appropriation strategies) (Gallini 2002, Laperche 2004). Moreover, the scope of industrial property rights was widened at the end of the 1990s, with the Trade related industrial property rights (TRIPs). This agreement is managed by WIPO and WTO, and any infringement to this agreement can lead to commercial sanctions. Thus, it creates a

favourable context for the global diffusion –within the networked enterprise and/or within innovation networks, of patented technology (Maskus and Reichman 2004). All of these institutional changes evidence a greater need for protection, requested by firms themselves. This greater coordination and appropriation needs can be linked to what we have called the profitability imperative. Global corporations have to innovate in order to be competitive. The complexity, but also the rapid pace of technological progress (‘permanent innovation’) lead to the increase in the cost, in the complexity and hence in the risk of the innovation process, which has nonetheless to be reduced if firms want to keep their precious investors. To reduce the cost, the risk and the length of the innovation process, firms rely on their own capabilities but also on the resources offered by their networks. However, being more open to their environment, they become more vulnerable, all the more so when appropriability regimes are different in the countries they are active in. That is why corporate lobbying is a major explanatory element of the evolution of IPRs laws, as reported by J. Rifkin or S.K. Sell in the case of the TRIPs agreement (Rifkin 1998; Sell 2003). This extension (application in new technological fields, geographic extension) of intellectual property rights may however reveal to be dangerous for the firms, as the assessment of their value is more and more based on virtual than on physical results. Moreover, the multiplication of IPRs may increase the cost of the innovation process and thus sterilize their incentive effects on further investments. In this vein a recent paper links this recent large development of IPRs with the current financial and economic crisis (Pagano and Rossi 2009). Did the firms dig their own graves?

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