The networked enterprise and the role of Intellectual property rights

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1. Introduction

The big hierarchical firm seems to be part of past history. In 1949, the Ford Motors Company was described in the *Encyclopedia Britannica* as a huge company, owning mines, railroads, hevea plantations, ships, electric plant, foundry, cement works, hospitals, professional schools… etc (see Berger, 2005). Michelin or Renault in France, and many other companies in various sectors and countries had also the same profile of big integrated companies.

Nowadays, the terms of "hollow corporations", "fragmented companies", "Network firm", "Fabless" and "modularity" express a new reality. First of all, 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. However, these big changes do not mean that only one organizational model –the networked firm- survive. In the MIT vast enquiry "how we compete?", some cases of integrated companies have been found in various sectors, as for example Zara in the clothing sector which remains very integrated, or Samsung and Sony in the electronic sector (see Berger, 2005).

In spite of the diversity of organizational models that can be found in the economic reality, there is no doubt that the organization and the management of activities as a network have gained ground. The organization and the strategy of the networked firm have already been

well study in sociology, economics and management (see notably Castells, 1996; Chenais, 1994; Uzunidis, Boutillier, Laperche, 1997; Gaffard, 2003; Baudry, 2004; Berger, 2005). In this paper, we rather want to focus on the role of intellectual property rights (IPRs) in the networked enterprise. IPR are often studied in relation to the innovation dynamics and strategy. Here, we want to better understand their role not only in the strategy but also in the organization of the networked enterprise.

We show that IPRs have several roles in the networked enterprise. The first one can be called a "coordination role", making easier the relationships between all the fragmented parts of the networked enterprise. The second role is the incentive/defensive role, aiming at protecting and thus giving incentives to the constitution of the networked firm's "knowledge capital" (Laperche, 2007). The third role is an "offensive one" which largely contributes to define the place of the networked enterprise within the networks of firms to which it usually belongs. Thus, this paper not only shows the role of IPRs in the organization of the networked enterprise but it also demonstrates that the organization of the firm –as a network- is an important factor that explains the strengthening of IPRs at the global level. The rest of the paper is organized as follows. Part 2 comes back to the origin of the networked enterprise and defines its main characteristics. Part 3 presents the "coordination role" and the "incentive/ defensive role" of IPRs in the networked enterprise, which is gaining ground in a context where more and more institutions are taking part in the constitution of a firm's knowledge-capital. Part 4 presents the "offensive role" of IPRs, which is determining in the definition of the status of the enterprise (as a leader or a follower) inside the networks of firms. 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

The main explanations to the change from the integrated and hierarchical company to the networked enterprise are related to the crisis of the Fordist model of production, the deregulation of markets and the diffusion of information technologies.

The crisis of the Fordist model of production began 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, Bessant and Pavitt, 2005; Uzunidis, 2004).

The deregulation of markets that begins at the end of the 1970s, aimed at fighting against the economic crisis characterized by the conjunction of inflation and unemployment. These policies have been developed and diffused through international organizations (WTO, IMF and World Bank) (Michie, 2003, Milward, 2003). The deregulation of markets (goods and services, labour, finance) opened new markets for firms but also 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 networked enterprise.

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 firms strategies). These core activities are wholly owned by the central firm. 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. 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.

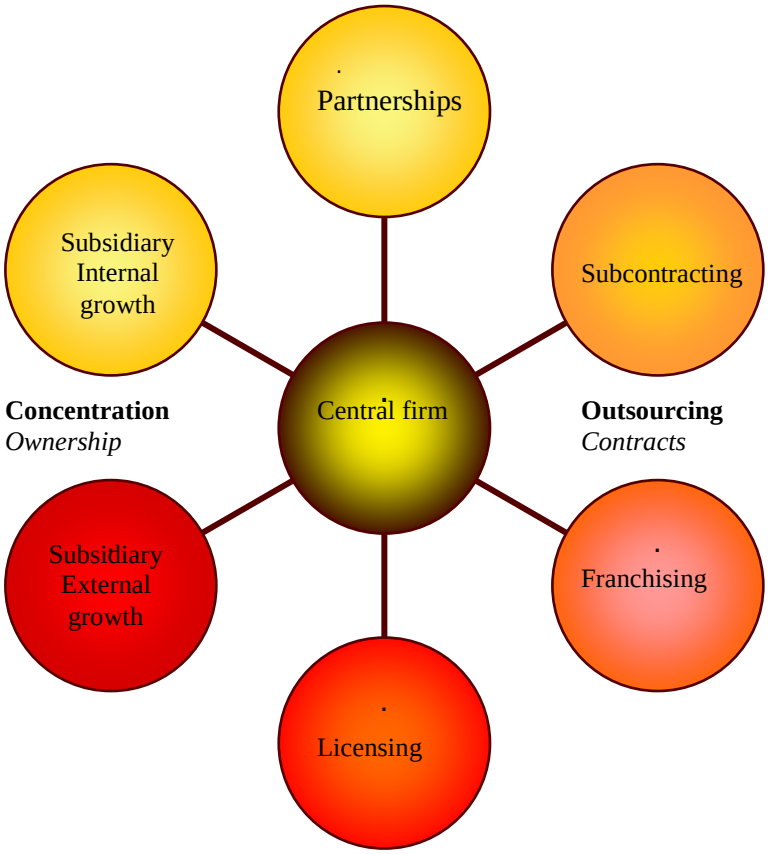
Networked firms have gained greater flexibility, thus enabling them to adjust to the evolution of the demand. The networked enterprises associate internal and external flexibility. Internal flexibility deals with the management of work within the company: the firm focuses on a stable core of managers 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 firms are organized at a global level, taking advantage of 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.

Internal and external flexibility have important impact on the functioning of the working groups and then on the system of motivation: the worldwide dispersion of the members of the technostructure makes it more difficult for them to identify with the specific objectives of the organization (as for example innovation, growth of sales, of size, etc.). The organic solidarity (in Durkheim's words, see Durkheim, 1930, ed.1996) that ties the members of working teams is closely related to physical vicinity, which information technologies reproduce only very imperfectly. Financial motivation would thus come back as the main motivation in the big global firm compared to the motivations of the workers of the technostructures of the end of the 1960s (Galbraith, 1967). If identification and the wish to adapt are present, the pecuniary motivation however represents the universal objective of the members of global working teams, all the more as the evolutive character of networks makes employees more vulnerable to the possible strategic changes decided by big multinational firms (naturally, the employees who are far from the decision making centres are hit first, but executives are also more

frequently hit by reorganizations) under the pressure of institutional stockholders. The increase of opportunist behaviours at the end of the 1990s and the beginning of the 2000s can thus be understood as the result of this undermined cohesion within the large corporation (Stiglitz, 2003; Dietrich and Sharma, 2006 ; Laperche, 2006).

The increasing role of finance in economics (Plihon, 2002 ; Aglietta, Rébérioux, 2004) can be observed in the management of companies (Gaffard, 2004 ; Michalet, 2007). The different steps of financial market deregulation and liberalization 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 than by the amount of the dividends to be received. Their fluctuating behaviour (they "vote with their feet"), 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, comes back has one the most important. 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/relocations.

Figure 1



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

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, involve 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 to indicate the source of the 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 networked enterprise means the reintroduction of market in the functioning of the enterprise / compared to integrated firms, where hierarchy is considered as an alternative to market (Coase, 1937). This reintroduction of market reveals transaction costs, which are caused by the imperfection of markets: information search, finding the suppliers, negotiation of contracts, execution of contracts (Coase, 1937; Williamson, 1975). In this context, IPRs, just as certification and logistics integration (see Baudry, 2004), 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. 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 enterprises 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 subcontracting and in franchising contracts, licences[1] allows the different units to use the patented invention, or protected trademark or design usually owned by the central firm. Licence are usually considered as producing productive efficiency (to produce proprietary products efficiently, to let others use the intellectual property as inputs to innovation (research tools); to resolve blocking right to enable development of complementary invention (this third reason being most of all important in the case of horizontal alliances, studied below) (Sctochmer, 2004, p.162). IPRs thus allow the diffusion of technology within the enterprise and gives incitation to the production of specific assets. In the case of R&D partnerships within the networked enterprise 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 property may facilitate exchanges by reducing transaction costs, as in the Coase theorem (Coase, 1960; Stigler, 1966).[2] 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

[1] A Licence is an agreement whereby the owner of intellectual property authorizes another party to us it.
[2] The Coase theorem means that negotiation lead to an effective allocation of resources when property rights are clearly defined and when there is no other obstacle to the transaction.

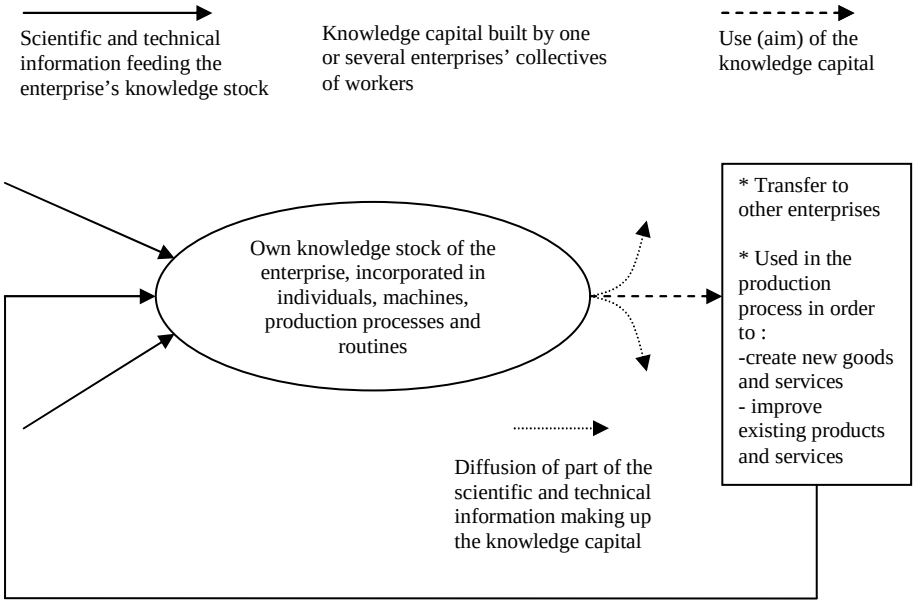
comparison between the transaction costs and the gain of exchanges, where IPRs play an important role.

The coordination role of IPRs is all the more important as, in recent years, the network constituted by the firm not only affects final production or distribution of product, but also and more and more the heart of the enterprise, that means the activities that will be at the origin of new products and processes: R&D, design. The coordination role is thus linked to the role of giving incentives and protecting the constitution of what we call the firm's Knowledge capital.

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 purposes [3]. "Knowledge capital" (see fig 2) refers to the accumulated knowledge of one or several linked firms (embedded in the individuals – know-how – 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'.

Figure 2: The 'knowledge capital' (Laperche, 2007)

[3] 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)



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 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 catogories: equity relations (for example joint venture) and non equity relations (contractualization 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	**External Means**
- Investment in Human Resources - Investment in and management of R&D and means of production (tangible and intangible)	*Equity relations*: - joint venture - purchase of innovative enterprise *Non equity relations*: - 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

Currently, the constitution of knowledge capital, shows distinctive characteristics. A first characteristic is the growing interest of firms for the various steps of R&D, notably the most basic ones. Given the strong competitive context based on technological performance and "permanent innovation" (Foray, 2004), enterprises always try to develop and increase their knowledge base; they focus on their core activities and try to develop their competencies within these activities. Moreover, they are more and more interested not only in applied research but in basic research as well, which is one of the explanations of the interactive character of the innovation process (Kline and Rosenberg, 1986).

The second characteristics of R&D activities and thus of the constitution of Knowledge capital is globalization. If R&D has long been regarded as a case of non globalization (Patel and Pavitt, 1991), the studies conducted in the 1990s show that the globalization of RD is gaining ground, whatever the focus of specific studies: in terms of foreign-based laboratories (Bartlett, Doz and Hendlung, 1990; Florida, 1997; Madeuf et al. 1997, 2002), in terms of patents and technological flows (OECD, 2003), and in terms of R&D partnerships (Archibigu and Iammarino, 2002; Hagedoorn, 2002). The 2005 issue of the *World Invest Report* also reports a sharp increase in R&D globalization, which however mostly concerns the most applied parts of the R&D process (UNCTAD, 2005).

Finally, the third characteristic is that firms more and more develop their knowledge base thanks to the network(s) 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). The link between innovation and networks which has been made theoretically and empirically (Pyka and Küppers, 2002), shows that after relying on states' investments and on their own competencies, big firms rely more and more on external means of formation of the knowledge capital.

The increase in R&D partnerships and alliances is a first illustration of that trend. Alliances and partnerships may be used whether in exploitation strategies (refinement and extension of existing technologies) or in exploration strategies (exploration of a new technological field) (March, 1991).

Innovative start-ups also play an important role in networked enterprise. When they are not taken over by bigger firms, start-ups are often linked by contract with them which usually take part in their funding (through corporate ventures) (Laperche, Bellais, 2001). In this strategy, the large corporation does not bear alone the risk inherent in the development of new technology, and shares it with its partner (here, the start-up). This strategy has been largely used during the 1990s by big American firms to enrich their knowledge base (Tidd, Bessant and Pavitt 2005, pp. 425-463).

National or international outsourcing is another way to reduce the cost of technological development (and hence a strategy to increase profitability) and also results in the expansion of networks. It is very often used in the software industry (software design outsourced to Bangalore – India, for example). Innovation activities can be fully outsourced to another institution, being and enterprise or a research lab for example. The relationship between firms and universities and public research labs have been allowed by law in the US since the early 1980s (notably the Bayh Dole Act) – and was further adopted by many countries – thus facilitating the signature of contracts as well as technology transfers between enterprises and universities and more informal contacts between enterprises staff and scholars (Jaffe, 2000; Mowery et al., 2001; Laperche, 2002).

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 localised 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, Massachussets 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 firms (Dittrich et al., 2007). But the purpose of all these strategies is also 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 (Rosenberg, 1990; Cohen and Levinthal, 1990). This trend shows that the formation of the "knowledge capital" is socialized, i.e. several institutions (big or small enterprises, research laboratories…) take part in the formation of one's firm "knowledge capital".

The socialization of the knowledge capital thus implies that the role of IPRs in the coordination of the firm increases. Some empirical studies for example show the importance of property rights protection over transaction cost considerations in the decision to outsource (see Gooroochurn & Hanley, 2007).

However, according to us, IPRs also have a role in the reduction of transaction costs in collaborative strategies (including outsourcing). IPRs clarify the relationships between the co-contractors (coordination), and thus, by reducing transaction costs, give incentives to the constitution of knowledge capital, by protecting the tangible and intangible elements that constitute it.

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).

Moreover, 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 firm, 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.

Finally, 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, IPRs are not always considered as efficient tools of protection. 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 Cohen et al., 2000). This leads us to the offensive role of IPRs within networks.

4- The offensive Role of IPRs: Domination of networks and Oligopolistic appropriation of Knowledge Capital

The innovation strategies of networked firms lead to a blurred distinction between vertical relationships (networked enterprise) and horizontal relationships (networks of firms). 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 big enterprises and competitors of the networked firm as a whole. This kind 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 (example) 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 increase. 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) .

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, Scotchmer and Thisse, 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 and al., 2000; Shapiro, 2001; Choi, 2003, Scotchmer, 2004).

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, and thus 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 theses 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).

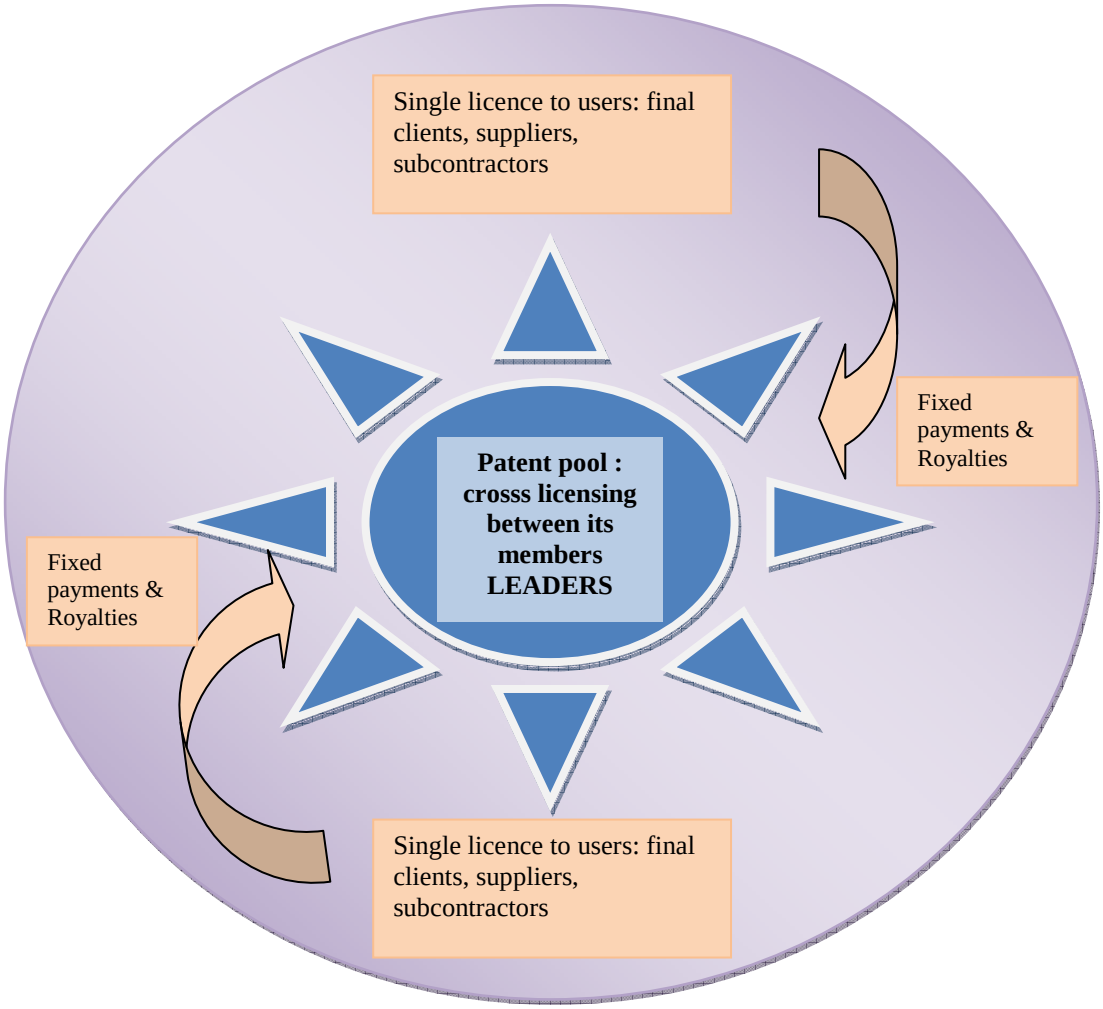
Since the beginning of the 1980s, discussions have gained ground on the positive impacts of patent pooling, and led to the *Antitrust guidelines for the licensing of intellectual property* in 1995 (issued by the US Department of Justice and the Federal Trade Commission) which recognises that "patent 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.

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 ICT and biotechnology) is driven by the same profitability imperative which also explained the development of external means of formation of the "knowledge capital".

Patent pooling is often studied in relation to its pro-competitive effects (cf. coordination role 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 networked value chain (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 3). 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 2001b). This strategy clearly shows the offensive role of Intellectual Property Rights within networks.

Figure 3: Patent pool and hierarchy within a network



5- Final Remarks: The Networked Value Chain as an explanation of the recent evolution of IPRs

To sum up, we can say that IPRs' role in economics is clearly linked with the networked organization of the value chain, involving both the networked firm (vertical organization of the value chain) and networks of firms (horizontal organization of the value chain). The whole value chain is thus networked, vertically and horizontally. The roles played by IPRs in this networked value chain are summed up in table 2

Table 2 - Role of IPRs in the networked value chain

Role	**Explanation**
Coordination role	*Reduction of transaction costs within the networked enterprise and within the networks of firms (patent pools) *Image of the firm within the networked enterprise and within the network (trademark)
Defensive/ incentive role	*Protection of the socialized Knowledge capital *Incentives to the diffusion of technology and to the investment in the constitution of the socialised "Knowledge capital" *IPRs give a value to R&D investment (secure the shareholders)
Offensive role	*Definition of the place of the networked enterprise within the network *Oligopolistic appropriation by the leaders of the knowledge Capital and construction of barriers to competitors *Lead time

We thus can put forward that the reasons of the evolution of IPRs laws at the international levels are closely linked to the need if IPRs by firms. As firms are more and more open to their environment, constituting global vertical and horizontal 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 (the global protection given by the TRIPs agreement also favours their appropriation strategies) (Gallini, 2002, *Revue d'économie industrielle*, 2002, Laperche,

2004). Back in the 1980s, in a context of decreasing competitiveness and serious challenge by Japanese enterprises, the US made substantial changes in the IPR, and notably in the fields of biotechnologies and information and communication technologies (ICT), i.e. the embryonic technologies of the time. Software programs were traditionally protected through copyright (this was explained by the fact that, as they are composed of mathematical algorithms, they were excluded from patentability, just like natural laws, scientific theories, natural phenomena, abstract ideas, formulae and methods). However in the US, a case law led to the patentability of computer programs (*Diamond v. Diehr*, 1981). Computer program patentability ensued from the explanation that a computer program represents an invention (in terms of process) and from the fact that it produces a useful, concrete and tangible result. The patentability of computer programs paved the way for the possibility to patent business models (*Street Bank v. Signature*, 1988). In Europe, even though the legal context is not clear, many software patents have been granted. The origin of the extension of patentability to living organisms can also be found in the US, and was based on the argument that a living being produced by a non-natural process (apart from human beings) is eligible for patent. Then patentability was extended to recombinant DNA (1980), to transgenic animals (the "onconmouse patent" in 1988) and to human gene and research tools (DNA sequences). In Europe, a 1998 directive specified the patentability of genes and of partial gene sequences.

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 allows patentability in all technological fields and harmonises the protection period covered by patents - 20 years. 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 networks of firms, 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 need 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") leads to the increase in the cost 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 that legal evolution, as reported by J. Rifkin or S.K. Sell in the case of the TRIPs agreement (Rifkin, 1998 ; Sell, 2003).

References:

M. Aglietta and A. Rébérioux, *Les dérives du capitalisme financier* (Paris : Albin Michel, 2004)

C. Antonelli, 'Models of Knowledge and Systems of Governance', *Journal of Institutional Economics*, 1 (2005), 51–73.

D. Archibugi and S. Iammarino, 'The Globalisation of Technological Innovation: Definition and Evidence', *Review of International Political Economy*, 9 (2002), 98–122.

D. Barjot, Lafarge (1993-2004) Comment on devient firme mondiale, *Revue économique* n°1 (2007), pp.79-112.

C. A. Bartlett, Y. Doz and G. Hedlund (ed.), *Managing the Global Firm* (London: Routledge, 1990).

B. Baudry, La question des frontières de la firme. Incitation et coordination dans la firme réseau, *Revue économique*, vol.55 (2004): 247-274.

S. Berger, *How we compete what companies around the world are doing to make it in today's global economy?*, (New York: Double day 2006).

S. Besen and J. Farrel, 'Choosing How to Compete: Strategies and Tactics in Standardization', *Journal of Economic Perspectives*, 8 (1994), 117–131.

M. Castells, *The Rise of the Network Society* (Oxford: Blackwell Publishers, 1996).

J. P. Choi, 'Patent Pools and Cross-Licensing in the Shadow of Patent Litigation' (Michigan State University, http://www.msu.edu, 2003).

J. Clark, J. Piccolo, B. Stanton and K. Tyson, *Patent Pools: a Solution to the Problem of Access in Biotech Patents?* (USPTO, http://www.uspto.gov, 2000).

R. H. Coase, The problem of the social cost, *Journal of Law and Economics*, 3 (1960): 1-44.

R.H. Coase, The Nature of the Firm" in *Economica*, Vol. 4, No. 16, (1937): 386-405

W. Cohen and D. Levinthal, Absorptive capacity: A new perspective on learning and innovation, *Administrative Science Quarterly* 35 (1990): 128-152.

W. M. Cohen, R. R. Nelson and J. P. Walsh *Protecting their Intellectual Assets: Appropriability Conditions and why US Manufacturing Firms Patent (or Not)?* (National Bureau of Economic Research Working Paper 7552, 2000).

M. Dietrich, A. Sharma, 'The Corrupt Corporation: a Galbraith-inspired analysis', in Laperche, B., Galbraith J.K. and Uzunidis, D. (eds), *Innovation, Evolution and Economic Change. New ideas in the Tradition of Galbraith* (Cheltenham: Edward Elgar Publishing, 2006), 162–184.

K. Dittrich, G. Dusters, A.P. de Man, Strategic Repositioning by means of alliances networks: the case of IBM, *Research Policy* 36 (2007) 1496-1511.

E. Durkheim, *De la division du travail social* (1930) (Paris: PUF, 1996)

D. Foray, 'Exploitation des externalités de réseau versus évolution des normes', *Revue d'économie industrielle* N°51 (1990), 113–140.

D. Foray, *The Economics of Knowledge* (Cambridge Mass: The MIT press, 2004).

R. Florida, 'The Globalization of R&D: Result of a Survey of Foreign Affiliated Laboratories in the USA', *Research Policy*, 26 (1997), 85–103.

J.L. Gaffard, Coordination, marché et organisation. Essai sur l'efficacité et la stabilité des économies de marché, *Revue de l'OFCE* 85 (avril 2003), 235- 270.

J. K. Galbraith, *The New Industrial State* (Boston: Houghton Mifflin Company, 1967).

N. T. Gallini, 'The Economics of Patents: Lessons from Recent US Patent Reform', *Journal of Economic Perspectives*, 16 (2002), 131–154.

N. Gooroochurn, A. Hanley, A tale of two literatures: transaction costs and property rights in innovation outsourcing, *Research Policy* 36 (2007), 1483-1495.

J. Hagedoorn, 'Inter-Firm R&D Partnerships: An Overview of Major Trends and Patterns since 1960', *Research Policy*, 31 (2002), 477–492.

B. Jaffe, 'The US Patent System in Transition: Policy Innovation an the Innovation Process', *Research Policy*, 29 (2000), 531–537.

S. J. Kline, and N. Rosenberg, 'An Overview of Innovation, National Academy of Engineering', *The Positive Sum Strategy: Harnessing Technology for Economic Growth* (Washington DC: The National Academy Press, 1986).

B. Laperche, 'Brevets et normes techniques. De l'incitation à l'invention au contrôle de l'innovation', in B. Laperche (ed), *Propriété industrielle et innovation* (Paris, L'Harmattan, 2001b), 81–98.

B. Laperche and R. Bellais (2001), 'Entrepreneurs, capital-risque et croissance des grandes entreprises', *Problèmes économiques*, 2704-2705, 14–21.

B. Laperche, 'The Four Key Factors for Commercialising Research', *Higher Education and Management Policy*, OECD, 14 (2002), 149–175.

B. Laperche, 'Patentability : Questions about the Control of Strategic Technology', in C. A. Shoniregun, I. P. Chochliouros, B. Laperche, O. Logvynovskiy and A. Spiliopoulou-Chochliourou, *Questioning the Boundary Issues of Internet Security* (London: E. Centre for Economics, 2004), 117–140.

B. Laperche, 'Large corporations and technostructures in competition', in B. Laperche, J. Galbraith and D. Uzunidis (eds) (2006), *Innovation, Evolution and Economic Change: New Ideas in the Tradition of Galbraith* (Cheltenham: Edward Elgar Publishing, 2006), 142–161.

B. Laperche, 'Knowledge capital' and innovation in multinational corporations, *Int Journal of Technology and Globalisation* Vol. 3, No. 1 (2007), 24-41

F. Lévêque and Y. Menière, *Economie de la propriété industrielle* (Paris: La découverte, 2003).

R. Levin, R. Klevorick, R. Nelson and S. Winter, 'Appropriating the Returns from Industrial Research and Development: a Review of Evidence' (*Papers on Economic Activity*, 1987).

B. Madeuf, G. Lefebvre and A. Savoy, 'De l'internationalisation à la globalisation de la R&D industrielle : l'exemple de la France', *Innovations, Cahiers d'économie de l'innovation*, 5 (1997), 55–92.

B. Madeuf and G. Lefebvre 'Innovation mondiale et recherche localisée. Stratégies "technoglobales" des groupes. Le cas français', *Innovations, Cahiers d'économie de l'innovation*, 16 (2002), 9–27.

F. Malerba, 'Innovation and the Evolution of Industry', *Journal of Evolutionary Economics*, 16 (2006), 3–23.

J.G. March, Exploration and exploitation in organization learning, *Organization Science* 2 (1), (1991) 71-87.

K. E. Maskus and J. H. Reichman, 'The Globalization of Private Knowledge Goods and the Privatization of Global Public Goods', *Journal of International Economic Law* 7(2) (2004), 279–320.

C.A. Michalet, Dynamique des formes de délocalisation et gouvernance des firmes et des Etats, *Revue française de gestion*, n°177, 2007/8, pp.141-148.

J. Michie (ed.), *The Handbook of Globalisation* (Cheltenham: Edward Elgar Publishing, 2003).

B. Milward, *Globalization? Internationalization and Monopoly Capitalism* (Cheltenham: Edward Elgar Publishing, 2003).

D. C. Mowery, R. Nelson, B. N. Sampat, and A. Ziedonis, 'The growth of patenting and licensing by US universities: an assessment of the effects of the Bayh Dole Act of 1980', *Research Policy*, 30 (2001), 99–119.

OECD, *Science, technology and industry Scoreboard 2003* (Paris: OECD, 2003).

T. O'Donoghue, S. Scotchmer and J.-F. Thisse, 'Patent Breadth, Patent Life and the Pace of Technological Progress', *Journal of Economics and Management Strategy*, 2 (1) 1998, 1–32.

P. Patel and K. Pavitt (1991) 'Large Firms in the Production of the World's Technology: An Important Case of 'Non Globalisation', *Journal of International Business Studies*, First Quarter, 22 (1) (1991), 1–21

A. Pyka and G. Küppers, *Innovation Networks: Theory and Practice* (Cheltenham: Edward Elgar Publishing, 2002).

D. Plihon, *Le nouveau capitalisme* (Paris: Dominos, Flammarion, 2002).

M. E. Porter, *The Competitive Advantage of Nations* (London: Macmillan, 1990).

Research Policy 'The Internationalization of the Industrial R&D', Special Issue, 28 (2, 3), (1999).

Revue d'économie industrielle, 'Les droits de propriété intellectuelle, nouveaux domaines, nouveaux enjeux', Special Issue, 99, (2002).

J. Rifkin, *The biotech Century, Harnessing the Gene and Remaking the world* (New-York: Tarcher/Putman, 1998).

N. Rosenberg, 'Why Do Firms Do Basic Research (With Their Own Money)?, *Research Policy*, 19 (1990), 165–174.

S.K. Sell, *Private Power, Public Law. The Globalization of Intellectual Property Rights*, (Cambridge: Cambridge University Press, 2003).

J. A. Schumpeter, *Capitalism, Socialism and Democracy* (1942) (New-York: Harper and Row, 1950).

J. A. Schumpeter, *The Theory of Economic Development* (1911) (New Brunswick and London: Transaction Publishers, 1983).

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

Shapiro C. and H. Varian, *Information rules: a strategic guide to the network economy* (Boston Mass: Harvard Business School Press, 1998).

C. Shapiro, 'Navigating the Patent Thicket: Cross Licensing Patent Pools, and Standard Setting', *Innovation Policy and the Economy* (2001): 119-150.

G.J. Stigler, *The theory of the Price* (New York: Macmillan, 1966).

J. E. Stiglitz, *The Roaring Nineties* (New-York: W.W. Norton, 2003).

J. Tidd, J. Bessant and K. Pavitt, *Managing Innovation. Integrating Technological, Market and Organizational Change* (Chichester: J. Wiley and Sons Ltd, 2005).

UNCTAD, *World Investment Report "Transnational Corporations and the internationalization of R&D"* (New-York and Geneva: United Nations, 2005).

D. Uzunidis, S. Boutillier and B. Laperche, *Le travail bradé*, (Paris: Economie et Innovation, L'Harmattan, 1997).

D. Uzunidis, *L'innovation et l'économie contemporaine* (Bruxelles: De Boeck, 2004).

O.E.Williamson, Markets and hierarchies: Analysis and Antitrust Implications (Free Press, 1975).