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**THE ROLES OF INTELLECTUAL PROPERTY RIGHTS IN THE NETWORKED  
ENTERPRISE: THE GROWING IMPORTANCE OF COORDINATION IN  
INNOVATION NETWORKS**

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# THE ROLES OF INTELLECTUAL PROPERTY RIGHTS IN THE NETWORKED ENTERPRISE: THE GROWING IMPORTANCE OF COORDINATION IN INNOVATION NETWORKS

Blandine LAPERCHE<sup>1</sup>

**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 production and organisational costs. In this paper, we study the functions of intellectual property rights in these productive and organisational objectives of the networked enterprise. Intellectual property rights are usually studied in relation to their incentive/defensive and offensive roles. But do they play a role in the organisation and notably in the coordination of activities within 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 position 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

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## 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)

Despite the diversity of organisational models that can be found in the economic reality, there is no doubt that the organisation and management of activities through networks have gained ground (Berger, 2005, Lung, 2008). In particular, big hierarchical firms seem to be part of past history, being replaced by the ‘networked enterprise’. Today, most companies are increasingly 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). Also, 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 organisation has been well studied in sociology (Castells 1996; Mariotti 2004) and in economics and management of innovation and of organisations, certainly because it seems to be particularly adapted to the economic context characterised 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). At the same time, in the field of economics and management of innovation, intellectual property rights (IPRs) have obtained the status of “assets” (see the quotation at the start of 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). Whereas the networked enterprise on the one hand and intellectual property rights on the other hand are well studied subjects in economics and management of innovation and organisations, the research on the roles of intellectual property rights in the organisation and the strategy of the networked enterprise still needs to be developed.

In this paper, based on a review of academic literature, we aim to contribute to the research on this topic and to improve the understanding of the functions of intellectual property rights (IPRs) in the particular case of the networked enterprise building innovation networks. We distinguish three main linked functions of IPRs: 1) the well-known incentive/defensive role which is aimed at protecting and thus giving incentives to the constitution of the firm’s innovation resources. 2) The offensive role, aimed at defining the place of the firm in competition. 3) We put forward a third function of IPRs: their role in the coordination of activities, which is rarely studied. The notion of coordination means the ordering of the parts of a whole according to a logical plan and with a definite aim. We develop the idea according to which the ownership of IPRs facilitates the efficient allocation of the networked enterprise’s resources. In other words, they may make easier the relationships between all the fragmented parts of the networked enterprise. This role is explained by the analysis of their impacts on transaction costs. We also consider that this coordination role is gaining ground in the context of collaborative innovation. This paper thus offers a new point of view on the strategic but also on the organisational functions of IPRs, in the particular case of the networked enterprise.

Section 2 comes back to the origin of the networked enterprise and defines its main characteristics. Section 3 defines IPRs and presents their strategic roles as they appear in the literature. It also puts forward this coordination role of IPRs that appears to be fundamental in the networked enterprise. Section 4 links the coordination role to the more traditional

‘defensive/incentive’ role of IPRs in the particular case of the networked enterprise. Section 5 presents the ‘offensive’ role which largely contributes to define the position of the networked enterprise (as a leader or a follower) within the networks of firms to which it usually belongs. Finally section 6 concludes the paper by stressing the fact that the new forms of organisation of enterprises can largely be linked to the recent evolution of IPRs legislation.

## **1. THE ORGANISATION OF THE NETWORKED ENTERPRISE: ORIGIN AND DEFINITION**

### **1.1. A dual vision of the Firm: knowledge and transactions**

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 organisation in the behavioural and managerial approaches). The question of the boundaries of the firm<sup>2</sup>, became more topical from the 1970s. This was a period that coincided - in the economic reality - with the organisational difficulties faced by the hierarchical mode of organisation of enterprises (increasing bureaucratic costs, difficulty to adapt to a changing environment). 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 to the firm, with it being viewed as a ‘nexus of contracts’. With this approach, the networked enterprise, as an organisation, does not exist. As a matter of fact, the firm (and thus the networked enterprise) is a “legal fiction”. There are only exist contracts linking individuals owning various production means.

The competence-based approach of the firm<sup>3</sup>, which relies 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 organisation of the firm and the access to external resources (Cohendet and Llerena 2005). Following the logic of these authors, we see that the transaction approach of the firm (where it is viewed as a ‘processor of information’ (Fransman 1994) focusing on the allocation of resources according to the level of transaction costs) and the competence-based approach of the firm can be complementary and not a substitute - what is called a ‘dual’ vision of the firm. The firm, considered as an organisational 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 the allocation of resources and thus 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 organisation of the networked enterprise. Such an approach necessitates coming back to the economic context that largely contributes to explaining the evolution of the organisational structures of the enterprise.

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<sup>2</sup> First posed with the Ronald Coase’s contribution (Coase, 1937), who opposed market and hierarchy.

<sup>3</sup> 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).

## 1.2. From the hierarchical to the networked enterprise

The study of economic history allows to highlight the evolution of the firm's organisation from the integrated company (at the beginning of the 20<sup>th</sup> 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 organisation lie in a mix of (endogenous and exogenous) economic, social and technological factors (Kapàs 2008). The main explanations of the emergence of a new form of enterprise, the networked enterprise<sup>4</sup>, 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. It is characterised 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 (Milgrom, Roberts, 1988). Innovation has become a fundamental objective of the firm, imposed by competition. Innovations, according to Schumpeter (1911, 1942) means new combinations of production factors and may take the form of the introduction of a new product, the introduction of a new method of production, the opening of a new market, the conquest of a new source of raw material or half manufactured good, the carrying out of a new organization. This idea of the current importance of innovation 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'. They make the link between the creation of knowledge and the diffusion of innovation.

The opening up and liberalisation of markets, which began at the end of the 1970s, were aimed at fighting against the economic crisis characterised by the conjunction of inflation and unemployment. These policies have been developed and disseminated through international organisations (World Trade Organization, International Monetary Fund and World Bank) (Michie 2003, Milward 2003). The liberalisation of markets (goods and services, labour, finance) has opened new markets up to firms but also has made the organisation of the production process on an international scale easier, 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 spread 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 technology is also fundamental in

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<sup>4</sup> Many names are given to this new form of organisation of activities as project-based company, modular enterprise, hollow corporation, etc. Several processes like vertical disintegration, outsourcing/offshoring etc., also define these new forms of organisation. This diversity of names also reflects the many differences that exist between the organisations of firms, more or less close to the multidivisional enterprise. As the multidivisional firm may still be found in the economic reality, the networked enterprise is more a complement than a substitute to it (Berger 2005).

the mobilisation and the integration of fragmented and diversified forms of localised knowledge and competences (Cohendet et al. 1999).

A large modern corporation can be described as a network of units linked together with 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, which will reinforce its innovation capacity and more globally which are at the basis of the definition of the firm's strategy. 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. 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) compared with tangible ones (Serfati 2008). Therefore, the central firm can be considered as a designer or an architect of a 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 (Uzunidis et al. 1997). 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 diverse forms of work and contracts of employment (in terms of working time, salaries, place of work, job content) to manage the other employees. Associated with this greater internal flexibility are increased options in the ways firms manage their assets at the international level (external flexibility). The globalisation of corporate strategies refers to their liberty or flexibility in the management of human, financial, scientific and technical assets on an international level. Networked enterprises are organised at a global level, according to the competitive advantages of potential host territories. Holding companies are located in areas with low or even zero 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 specialisation 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 for the purpose of knowledge creation) and to reduce its production costs (through the rationalisation of its production process and of its structure) (Uzunidis et al. 1997).

The strategy of rationalisation is all the more important because 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 maximisation, linked to the increase of the shareholder’s value, becomes fundamental. The “profitability imperative” (Laperche 2006) is the result of this new context. It means that in order to keep the precious new institutional investors, managers of big globalised corporations have to boost shareholder value. The increase of the shareholder value will moreover be profitable to them, as they have often become, due 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.

**2. INTELLECTUAL PROPERTY RIGHTS AND COORDINATION IN THE NETWORKED ENTERPRISE**

**2.1. Definition and Role of IPRs in the literature**

IPRs include industrial property rights: 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 fields 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 (Table 1)

**Table 1.** 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

**Source:** Brousseau and Foray 1997; Gallini 2002; Scotchmer 2004; Tidd et al. 2005; Hanel 2006

These aims are well studied in the literature and 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 objectives is not unchanging. It varies, according to many factors as the size of the enterprise, the sector, the type of protected creation, the

more or less innovative character of the enterprise, the market structure and the intensity of competition (Hanel 2006).

## **2.2. The coordination role of IPRs**

In the dual networked firm, focused on the reduction of organisational and production costs and on the creation of new knowledge, we can make the hypothesis that the roles of coordination and of incentives of IPRs will be strong. In the case of the networked enterprise, coordination means the ordering of the fragmented parts (or units) and thus the allocation of resources according to its aims (creation of knowledge, rationalisation of production). Due to its impact on transaction costs, the ownership of IPRs (just as property rights in the Coase theorem, see below) may contribute to the coordination of all of its fragmented parts, in other words in the efficient allocation of the networked enterprise's resources.

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 incomplete contracts (Hart and Moore 1990) stipulate that, in presence of specific assets and incomplete contracts, vertical integration leads to more efficient transactions and 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 inside the firm, which are caused by the imperfect competition: information searches, finding suppliers, negotiation 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 assets in the networked enterprise (Serfati 2008), we can consider the hypothesis that IPRs - like certification and logistics integration (see Baudry 2004) - would play an important role in the coordination of activities (see also Penin 2005, who focuses on the role of patents). They may clarify the relationship and thus reduce 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 (and this also goes for patented inventions or designs) – acts as a signal of the quality of the central firm or potential suppliers' 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, licences<sup>5</sup> 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 to be responsible for productive efficiency: they facilitate the efficient diffusion of proprietary products; they let others use the intellectual property rights as inputs to innovation (research tools); they resolve blocking situation and enable the development of complementary inventions (Scotchmer 2004, p.162). IPRs allow the diffusion of technology within the enterprise and gives incentives for the production of specific assets. In the case of R&D partnerships, where specific assets are jointly built (co-contracting or contracts between the central firm and a research lab for example), shared patents reduce the possibility of opportunist behaviour (“hold-up” situations) between the co-contractors.

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<sup>5</sup> A licence is an agreement whereby the owner of intellectual property authorises for a fee another party to use it.

In other words, the possession 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 efficient in every case as the transaction costs do not completely disappear. This situation would only occur in a context of pure and perfect competition. That is to say that the choice of whether or not 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.

This coordination role is linked to the incentive role of IPRs. Conferring a temporary monopoly, IPRs guarantee or reinforce the profitability of investments and thus gives the firms incentives to invest more. In the networked enterprise, the assessment of the profitability of future investments will take account of the possibility to obtain a temporary monopoly but also of the costs of production. And transaction costs may represent a large part of them since the networked firm is made of multiple contractual arrangements linking the central firm with subcontractors and other cooperating firms. As a result, in the context of collaborative innovation where multiple actors take part in the innovation process, the two roles (coordination and incentives) are very linked as explained in more details in the next section.

### **3. FROM COORDINATION TO INCITATION IN THE CONTEXT OF COLLABORATIVE INNOVATION**

#### **3.1. Collaborative innovation and “knowledge capital”**

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. The incentives offered by IPRs are usually explained by the temporary monopoly associated to their possession, which increases the profitability (or its assessment) of investments. However, in the networked enterprise, the incentives associated to IPRs are also linked to their impact on the coordination of activities. The more efficient allocation of resources generated by IPRs may as a matter of fact increase the incentives to invest more in the production of knowledge. This aspect is gaining ground in the context of collaborative innovation.

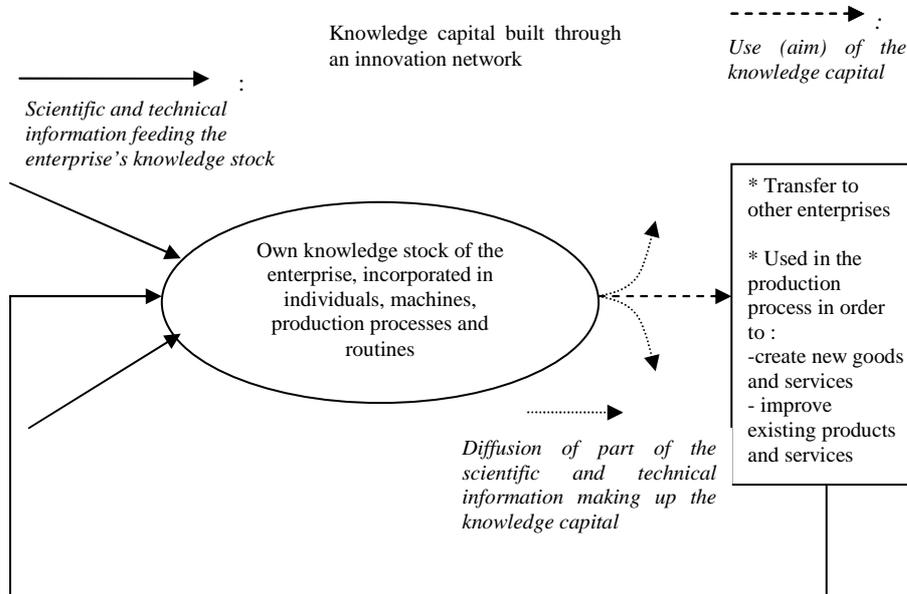
Collaborative innovation means that the process of knowledge creation is the result of partnerships between the units of a same firm (more or less independent of the central firm) but also between several networked enterprises and several kinds of institutions (see Hamdouch et al. 2008). Collaborative innovation mainly results from the economic context where innovation performance 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 purposes.<sup>6</sup> ‘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 used in the production process or, more globally, in the value creation process.

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<sup>6</sup> 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).

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 commercialised. This productive aim – the creation of value – is the main characteristic that turns knowledge into ‘capital’.

**Figure 1.** 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 programme). 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 increasingly developing their knowledge bases thanks to the innovation networks 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 - that are usually complementary in knowledge-based and innovative firms (Hagedoorn and Wang 2010) - are used by the enterprise: in-house means (investment and management of human resources, R&D and tangible and intangible resources) (Rosenberg 1990; Cohen and Levinthal 1990), and external means (Jaffe 2000; Mowery et al. 2001; Tidd et al. 2005; Antonelli 2005). 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 2)

**Table 2.** Means of formation of the firm's 'knowledge capital'

<b>In-house means</b>	<b>External Means</b>
<ul style="list-style-type: none"> <li>- Investment in Human Resources</li> <li>- Investment in and management of R&amp;D and means of production (tangible and intangible)</li> </ul>	<p><i>Equity relations</i> :</p> <ul style="list-style-type: none"> <li>- joint venture</li> <li>- purchase of innovative enterprise</li> </ul> <p><i>Non equity relations</i> :</p> <ul style="list-style-type: none"> <li>- Contracts with other firms (including licensing)</li> <li>- Contracts with institutions: e.g. university research labs (including licensing and hiring of short term researchers)</li> <li>- More informal contacts</li> </ul>

This strategy of having a collective constitution of 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) - see 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, which has taken part in 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.

### **3.2. Purposes of collaborative strategies and roles of IPRs**

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 since the complexity of technological development increases (Tidd et al., 2005). This implies a collective process of innovation that gives the possibility 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 investments 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 "knowledge capital" is built collectively: several institutions (big or small enterprises, research laboratories, etc) take part in its formation.

The collective constitution of the knowledge capital thus involves the use of tools to ensure the coordination within the networked enterprise and between the central firm and its partners (networks of firms). We can advance the argument 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).<sup>7</sup> 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 Jaffe, 2000; Gallini 2002). For instance, patents spread too much information and are costly (direct and indirect costs). Copyright protection implies the capacity to provide proof of being the first creator, etc. To reduce the limits of IPRs, enterprises use joint tools of protection; in other words, they built a portfolio of protection tools, notably associating lead time with traditional IPRs protection tools (see Levin et al. 1987; Cohen et al. 2000). This leads us to the offensive role of IPRs within innovation networks. Here again, as explained in the next section, the coordination function 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 'a 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

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<sup>7</sup> The types of IPRs agreement may depend on the type of commitment between the partners. Whereas licence agreements may be used in exploitation strategies that 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 technological inventions, these ones would surely result in shared patents or cross licences).

and units and partners. The partners may be small and medium enterprises specialised 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 time needed for their conception. These alliances often lead to an important number of patents that can be owned separately by the different partners or be shared.

Whatever the chosen solution, the development of a new technique leads to an important number of patents, a “patent thicket” in the words of Shapiro (2001), which 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 infringements and litigations also increases. These situations have 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 is 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, Golden Rice uses technological means protected by patents. For its exploitation, licences had to be negotiated 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 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 Shapiro, ‘Virtually, every patent licence [and by extension cross licences and patent pools] can be viewed as a settlement of a patent dispute’ [added by us] (2003, p. 392). This was for example the solution chosen to solve the problem of the exploitation of the Golden Rice (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 to 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: First, when patent pools, or cross licences, concern technology substitutes, they are considered as part of a strategy of ‘cartelisation’ (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). Second, when patent pools concern complementary pieces, they may be considered positively, as a solution to resolve blocking positions (the famous cases of MPEG 2 video compression technology, DVD standard and DVD video are often cited in the literature). The strong link between ‘cartelisation’ and patent agreements justifies the development of antitrust limits to patent settlements, based on the consumer benefit of such agreements (Shapiro 2003).

At 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. The pro-competitive effects of IPRS are thus clearly related to their 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 incentives 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 that also explained the development of external means of forming ‘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 position 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, etc.) 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. This is true, even if they have participated, in more or less easily observable ways (competencies, consulting, informal exchanges of information, etc.) in the constitution of the knowledge capital from which the licenced technology or set of technologies emerge.

What is important here is that the practice of patent pooling, notably resulting from ex-ante cooperation processes, contributes towards defining the position of firms (their hierarchy) within the networks. The members of the patent pool - the ones that 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, that is to say their role in the definition of the position of firms within the network(s) to which they belong.

## CONCLUSION

In this paper we have developed the idea that in the networked enterprise that is focused on its double aim of being more innovative and improving the efficiency of its organisation, IPRs not only play their traditional defensive/incentive and 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 of intangible assets compared to physical ones. 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 3). 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 research.

**Table 3.** Role of IPRs in the networked enterprise and in innovation networks

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

To conclude, we can say 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. As a matter of fact, the scope of industrial property rights was widened at the end of the 1990s, with the Trade Related Industrial Property Rights (TRIPs) agreement. This agreement is managed by WIPO (World Intellectual Property Right Organization) and WTO (World Trade Organization), and any infringement to this agreement can lead to commercial sanctions. The global protection given by the (TRIPs) agreement thus favours their appropriation strategies (Gallini 2002, Laperche 2004). It also 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 show a greater need for protection, as 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 and rapid pace of technological progress ('permanent innovation') lead to the increase in the cost, the complexity and hence in the risk of the innovation process, which nonetheless has 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 in which they are active in. That is why corporate lobbying is a major explanatory element of the evolution of laws on IPRs, as it was the case for the definition of the TRIPs agreement (Rifkin 1998; Sell 2003).

This extension of intellectual property rights (application in new technological fields, geographic extension) may however reveal to be dangerous for the firms, as the assessment of their value is increasingly based on virtual rather than physical results. Moreover, the multiplication of IPRs may increase the cost of the innovation process and thus sterilise their incentive effects in terms of 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). These aspects are stimulating issues for further research.

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