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How do firms protect their "Knowledge capital"? Socialization versus appropriation

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1- INTRODUCTION

The deregulation and privatization policies which have introduced and extended markets in ever more areas in industrialized – as well as developing – countries since the beginning of the 1980's have generated greater freedom for firms and corporations (Chesnais; 1994; Andreff, 2003; Milward, 2003). Wider competition, together with the questioning of the "fordist" model of production (based on mass production and the consumption of undifferentiated products) resulted in innovation, and especially technological innovation, becoming the basis of competing corporate strategies (Porter, 1998; Tidd, Bessant, Pavitt, 2001; Uzunidis, 2004).

In order to innovate, i.e. to develop new "combinations" (Schumpeter, 1912, 1942) in the technological field, the enterprise must be able to produce, have access to, use and protect scientific and technological knowledge. This cognitive activity is not new to economics, even though the subject of technical change became a special field of economics mainly after the Second World War (see notably the papers collected by N. Lazaric and E. Lorenz, 2003). Hence, it is possible to identify strategies for making up a knowledge and information base within enterprises as far back as the beginning of industrial capitalism (scientific and technical intelligence; recruitment of researchers; creation of laboratories; patenting, cf. Laperche 1998).

In a context of global competition based on technological innovation, the formation and protection of the knowledge base is of major importance to firms. The purpose of this paper is to study the strategies implemented by firms to protect their knowledge base. Intellectual property rights – and notably patents - are the first tools that come to mind. Their rationale, since their origin, has been to give inventors some incentives and at the same time to facilitate a large diffusion of knowledge, so that the cumulative process of innovation may take place (Scotchmer, 2004). However, due to this restriction, and also for reasons of cost, other tools than patents have been used by enterprises, notably secrecy and technical standards. In fact, one of the contributions of the paper is to show that firms use a whole set of tools to protect their knowledge capital. This will be the idea developed in the first part of the paper.

However, to assess properly the protection strategies of the firm's knowledge capital implies to take account of today's characteristics of elaboration of the knowledge capital by firms. In the second part of the paper, we will see that external means of formation of a knowledge capital are now of growing importance (through cooperative agreements with other firms – small or big ones – or with universities). However, in-house strategies are still essential, especially to integrate the new scientific and technical information into the enterprise knowledge. This growing importance of external means of formation of the knowledge capital can be explained by the profitability imperative and its related necessity to reduce the risk for, the cost and the length of technical progress.

How do such strategies impact the way firms protect their knowledge capital? We will present the idea according to which the recent trend to extend patenting possibilities to new fields (information technology, genetics) and closer to the scientific border is driven by the same profitability imperative. As firms are more and more open to their environment, they need to have a wider and stronger protection of their own knowledge base in which patents have a major part to play, even though they have important restrictions. What are the consequences of this growing contradiction between, on the one hand, the socialization of the knowledge capital and, on the other hand, its growing oligopolistic appropriation?

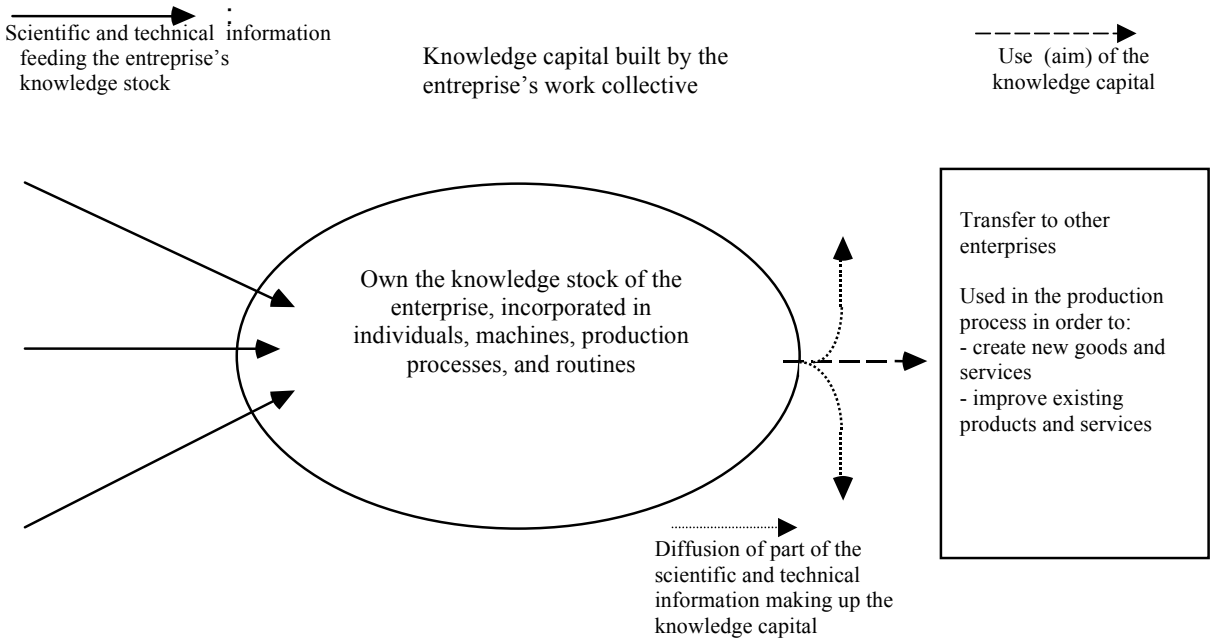
2- DEFINITION AND PROTECTION OF THE FIRM'S KNOWLEDGE CAPITAL: A PORTFOLIO OF PROTECTION TOOLS

2-1 The knowledge capital: definition and formation

2-1-1 Definition and roles

We can define the "knowledge capital" as the set of scientific and technical knowledge and information produced, acquired, combined and systematized by a firm for productive purposes. "Knowledge capital" refers to the accumulated knowledge of the firm (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 the firm and is 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" (see fig. 1).

Figure 1 : The Knowledge capital



Source: Laperche 1998, 2006 forthcoming.

A firm may use its knowledge capital in a value creation process by:
- 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;
- using this knowledge capital in its own production process. In this case, the knowledge capital can be considered as a means to produce goods and services and as a tool for reducing its production process completion time.

2-1-2 Formation

The formation of a firm's "knowledge capital" has old roots (Laperche, 1998) in an economic system characterized by change (see Schumpeter, 1947).

At the beginning of industrial capitalism, states were the main investors in the production and protection of knowledge, with a view to strengthening their political and economic power. Throughout the twentieth century, when the national systems of innovation (Freeman, 1987 Lundvall, 1992) were better structured, the states were the first investor in R&D, conducted by public or private institutions.

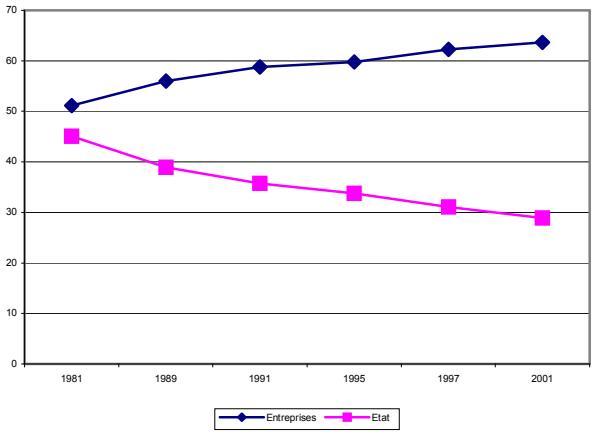
The role of the State is not only to inject money in order to favour scientific and technical development, but also to promote an attractive and incentive economic context. For example, it is during the 18th and 19th centuries that states faced with industrial revolutions created coherent systems to protect intellectual property (Hilaire Perez, 2000, Laperche, 2001a), thus giving entrepreneurs and enterprises incentives to invest in the production of knowledge. The first industrial research laboratories were created at the end of the 19th century[1], and firms

[1] For example, in 1890 Bayer created its own research laboratory in Germany, General Electric created its research laboratory in 1901, etc.

began to employ researchers, thus achieving the great alliance between science and technology (see Gille, 1978).

Nowadays, in all industrialized countries, corporate investment in GERD largely exceeds public investment.

Graph 1 : Evolution of the shares of GERD supported by states and by enterprises in OECD countries (percent)



Source : OECD, 2001, 2003.

The formation of the enterprise's knowledge capital implies to gather 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, of R&D and of tangible and intangible resources), and for the other part external means (contractualization with firms and other institutions). (see table 1)

Table 1: In-house and external means of formation of the firm's knowledge capital

In-house means	**External Means**
- Investment in Human Resources	- Contracts with other firms
- Investment in and management of R&D and means of production (tangible and intangible)	- Contracts with institutions

As already mentioned, innovation is the basis of corporate competition strategies. This accounts for the importance of the formation of the enterprise's own knowledge capital. It also accounts for the necessity to protect it from competition. What strategies do firms implement to protect their knowledge base?

2-2 Patents, secrecy and technical standards: a portfolio of protection tools

2-2-1 Patents

Intellectual property rights are the first tools that come to mind when dealing with the protection of an enterprise's knowledge capital. As a matter of fact, the knowledge capital of an enterprise is composed of information and knowledge - embedded in individual minds but

also in its machines, products, industrial processes, software programs - produced, acquired and managed by the enterprise itself.

Regarding technical invention, industrial property rights, and notably patents are the most important tools of protection[2] (see Levêque, Menière, 2003, Laperche, 2004a). As they grant a 20-year temporary monopoly (under the TRIPs agreement[3]), patents represent for firms an incentive to invest in the design and production of inventions. Thanks to patents, inventors can secure and increase their return on investment (by working their inventions, or giving this possibility to other firms through licence agreements). They have also the possibility to protect themselves from possible patent infringement. Moreover, thanks to their patents, inventors can find partners or financial resources more easily.

However, patents are not always positively judged by enterprises:

- they are regarded as expensive, a fact which explains that big enterprises are the main patent holders. As a matter of fact, the cost of a patent does not only refer to the cost to obtain it but also includes the cost of possible lawsuits.
- Not everything can be patented. Patents only protect technical inventions, thus excluding substantial portions of the knowledge capital of the enterprise (however, the concept of technical invention is today ambiguous, considering the extended capacity to patent in new fields; a subject we will detail in the third part of this paper).
- Patents diffuse too much information. As a counterpart of the temporary monopoly given to the inventor, patent laws include the obligation to disclose the scientific and technical information included in the invention. The aim is to ensure the cumulative nature of technical progress (Scotchmer, 1991).

Because of such restrictions, enterprises use other tools than patents to protect their knowledge capital: secrecy and technical standards.

2-2-2 Secrecy and technical standards

Patents are not always perfect tools to protect inventions, and many recent studies have shown that the part of secrecy and lead time has increased during the 90's as a protection mechanism for both product and process innovation (See Levin et al. 1987 ; Harabi, 1997, Cohen et al., 2000,). For example, in Cohen, Nelson and Walsh's study, only 23% of all respondents consider patents as an effective appropriability mechanism for process innovation, compared with 50% of respondents for secrecy and 38% for lead time. For product innovation, patents are considered relatively more effective - 41%, but less than secrecy (51%) or lead time (50%). Two questions arise from these results: is it preferable to protect invention through patents or secrecy? How can a firm build a "lead time" over its competitors?

Secrecy is another tool used by enterprises to protect their knowledge capital, perhaps the oldest one. In their rules, guilds laid down the necessity to keep their production methods secret. A. Smith explained in the *Wealth of nations* (1776) that trade secrets were at the origin of extraordinary profits in capital (ed.1976, p.87). K. Marx also exposed in *Capital* (1867)

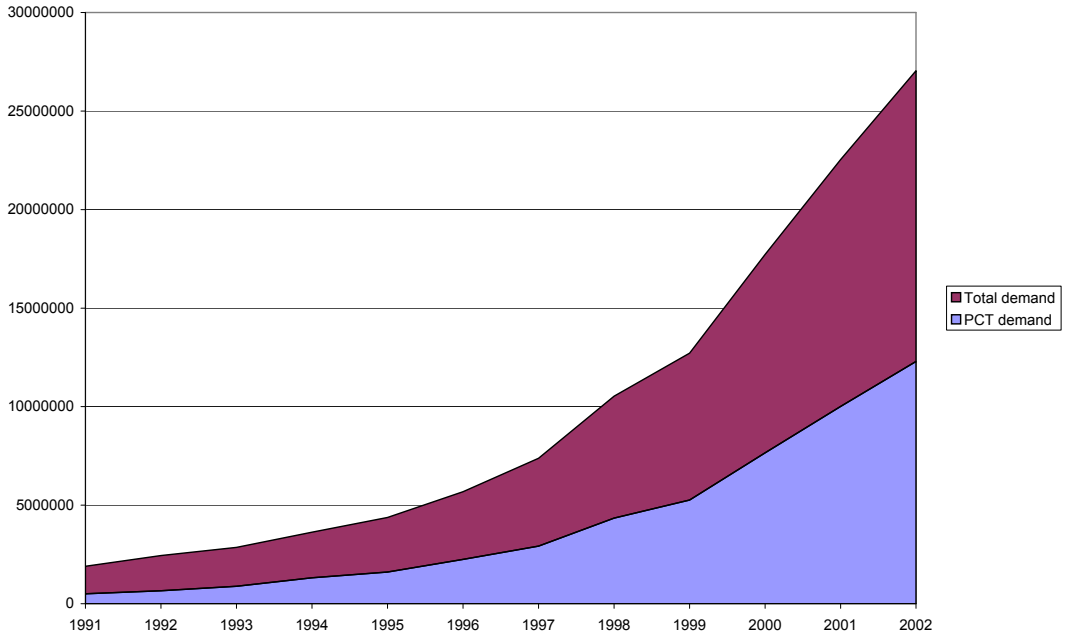
[2] However, in fact, firms often use different titles of industrial property rights for one invention: brand for the name of their products, and registered design for the form of their products. Firms can also resort to copyright.

[3] Agreement on Trade related Aspects of Intellectual Property Rights, which is annex 1C of the Marrakesh Agreement establishing the WTO, was signed in Marrakesh, Marocco on 15 April 1994.

that the first manufactures employed “some almost idiot workers” for operations containing trade secrets, (ed. 1982, L.I, p.350), etc.

However, it would be exaggerated to say that it is a better protection tool than a patent. A first reason is that the number of patents filed has not been reduced in the recent years, as can be seen in graph 1. If secrecy represented a better mechanism of protection, we could imagine that the demand for patents would, if not decrease, at least stagnate.

Graph 1 : Demand for patent rights worldwide (1991-2002)



Note : Demand for patent protection can count each supranational application only once. However here, demand for patent rights includes the number of designated countries in each supranational application.

Source : Trilateral Statistical Report, edition 2003 (for 1998 to 2002), 2000 (1995 to 1997) and 1996 (1991 to 1994). Available on http://www.uspto.gov

The second reason is that a secret is difficult to keep, all the more so in a context of global competition:

Secrecy cannot provide absolute protection, because some process characteristics can be identified through an analysis of the final product (reverse engineering).

Moreover, Schumpeter (1947) has shown that innovation is the result of the collective work of a bureaucracy, the “technostructure”, a term coined by Galbraith (1967), and thus indiscretions or the trading of trade secrets (Von Hippel, 1988) can reduce the interest of secrets, all the more so when turnover is high (Carnoy et al., 1997).etc.

And, finally, secrets have a cost. In the enterprises which traditionally use secrets to protect their products or processes, a very specific organization of work is implemented, characterized by a very developed division of all tasks so that very few of the highest managers know the entire production process (For example, it is the case for Michelin, in France).

In fact, industrial secrets and patents can be associated: secrecy is used for the protection of process innovation and patents for products. If the market is new and competition not too

harsh, if the research is not completed, if the financial resources of the enterprise are not sufficient, keeping the invention secret can be a first step, before filing a patent.

The best knowledge capital protection consists in continuously being ahead of one's competitors. In order to build this leadership over their competitors, firms try to erect entry barriers using formal or informal strategies.

Informal strategies include the accumulation of tacit knowledge (Polanyi, 1958), which needs time and learning and is difficult to evaluate and transfer, precisely because of the knowledge tacitness and stickiness. The accumulation of tacit knowledge thus enables the firm to build its own specific advantage (Nelson and Winter, 1982; Dosi, 1984).

Formal strategies implemented to build a lead time rely on a mix of patents and standards, held by several players linked by strategic partnerships. Strategic RD partnerships aim at sharing the costs and the risk of the development of new technology and, concurrently, at constructing entry barriers. According to ISO, standards are normally built by consensus, taking account of the interests of all stakeholders, but in the sectors where technological progress is fast, standards are defined collectively by major firms, anticipating the consensus and the birth of the relevant innovations (Foray,1990). The technologies are imposed to the standardization office, and to all the other firms in the sector. Thanks to the patents they hold on the standardized techniques, and their licensing strategies (patent pooling), major firms accumulate technological rents that can be reinvested in new technological development and thus build the lead time over their competitors (Laperche, 2001b). The examples of these standard wars are very common in information technology sectors (see Shapiro and Varian, 1998).

To summarize, firms use a set of tools, arbitrating between the advantages and restrictions of different kinds of protection mechanisms and continuously trying to increase their leadership over their competitors.

However, in order to assess properly the protection strategies of the firm's knowledge capital, we have to take account of today's characteristics of elaboration of the knowledge capital by firms. In our opinion, external means of formation of the knowledge capital now have a growing importance - due to what we can call the profitability imperative and its related necessity to reduce the risk, the cost and the length of technical progress - even though in-house strategies are still essential, especially to integrate new scientific and technical information into the enterprise knowledge stock. How do such strategies impact the way firms protect their knowledge capital? These issues are studied in the next part of the paper.

3- THE PROFITABILITY IMPERATIVE AND THE CONTRADICTION BETWEEN THE SOCIALIZATION AND APPROPRIATION OF THE KNOWLEDGE CAPITAL

3-1- Socialization of the formation of the knowledge capital

Since the beginning of the 80's and the shift of the production norm from mass production of standardized goods to product flexibility and diversification, several evolutions have occurred in firms' management and organization. Such evolutions have had important consequences on the way firms make up their knowledge capital.

3-1-1 The strategic evolution of enterprises: Globalized networks and finance

Since the beginning of the 80's, three main changes have modified the strategy and the organization:

- As already mentioned, innovation has become the main differentiation strategy over competition. From an organizational perspective, this evolution has lead to a transformation of the firm from a hierarchical to a network organization. A large modern corporation can be sketched as a network of units owned by a central firm (usually a holding company) and other kinds of activities linked by contract (partnerships, subcontracting, licensing) (see Gaffard, 1990, Chesnais, 1994, Uzunidis, Boutillier, Laperche 1997, Andreff, 2003). Networked firms have gained greater flexibility, thus enabling them to adjust to the evolution of the demand. To this greater internal flexibility is associated a growing liberty in the way firms manage their assets at international level.

- The globalization of corporate strategies refers to their liberty in the management of human, financial, scientific and technical assets at international level. Networked firms are organized at global level, taking advantage of the comparative advantages of potential host territories. This globalization of firms' strategies has been made possible by the liberal policies of market (goods and services, labour, financial) integration, developed and diffused through international organizations (WTO, IMF and World Bank) (Michie, 2003, Milward, 2003).

- The third change is the increasing role of finance in the management of companies (Chesnais, 1996; Plihon, 2002; Stiglitz, 2003). The different steps of financial market deregulation and liberalization have produced an interconnected global market. New kinds of investors (pension funds, hedge funds) have invested in big enterprises worldwide and their fluctuating behaviour (they "vote with their feet") has had important implications in the management of such corporations, even if they have not reduced the power of managers (on this point see, Laperche, Galbraith, Uzunidis, forthcoming). These changes can be summarized in the expression "the profitability imperative", which means that in order to keep these precious investors, managers have to boost shareholder value. This change has an important impact on the ways firms make up their knowledge capital

3-1-2 The predominance of external means of formation of the knowledge capital

Echoing these strategic and organizational changes, three main trends can be presented in the same period:

- Given the strong competitive context based on technological performance, enterprises try to develop their knowledge base, thus generating multi technological profiles. (Von Tunzelmann, 1996; Patel and Pavitt, 1997); 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 (see Kline, Rosenberg, 1986).

- The second new trend is the globalization of R&D. If R&D has long been regarded as a case of non globalization (Patel, Pavitt, 1991), the studies conducted in the 1990's show that this trend is gaining ground, whatever the focus of specific studies : in terms

of foreign-based laboratories (Bartlettt, Doz, Hedlund, 1990 ; Madeuf, Lefebvre, Savoy, 1997; Madeuf, Lefebvre, 2002, Florida, 1997, Research Policy, 1999), in terms of patents and technological flows (OCDE, 2003), and in terms of intercompany R&D partnerships (See Hagedoorn, 2002).

- Finally, big firms rely more and more on external means of formation of the knowledge capital. Intercompany partnerships are a first illustration of that trend. Another support of this idea is the role played by innovative start-ups and their links whith bigger enterprises. When they are not taken over by bigger firms, start-ups are often linked by contract with bigger enterprises which usually took 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 1990's by big American firms to enrich their knowledge base (See Sessi, 2003). Outsourcing is another way to reduce the cost of technological development (and hence a strategy to increase profitability), and is very often used in the software industry (software design outsourced to Bangalore – India, for example). A last example is the closer relationship between universities and enterprises. This type of relationship has been allowed by law in the US since the early 1980's (notably the Bayh Dole Act) – and was further adopted by many countries like France, in 1999 (loi sur la recherche et l'innovation) - thus facilitating the signature of contracts as well as technology tansfers between enterprises and universities (See Jaffe, 2000 ; Mowery and al. 2001, Laperche, 2002). 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 (see Laperche, 2006, forthcoming).

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 integrating the scientific and technical development achieved by other institutions on their own bases (Rosenberg, 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. However, in this context, how do firms cope with the question of the protection of the knowledge capital? Does this trend toward socialization mean that the need and the willingness for appropriation are on the wane?

3-2 The oligopolistic appropriation of the knowledge capital

The strategies implemented by firms to protect their knowledge capital have also changed. Two main elements can be presented: the first one is the extension of patentability to new scientific and technical fields, which can be considered as an answer to the greater interest of firms in innovation and research (both applied and basic); the second element is the emergence of new possibilities in terms of collective protection of the knowledge capital. These two elements show the growing contradiction between, on the one hand, the socialization of the knowledge capital and, on the other hand, the tendency toward its oligopolistic appropriation.

3-2-1 The extension of patentability

As firms are more and more open to their environment, they need 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) (see Gallini, 2002; Revue d'économie industrielle, 2002; Laperche, 2004b).

Back in the 1980's, 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 of information and communication technologies, i.e. the core 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 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[4], 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, the 1998 directive marked out the patentability of genes and of partial gene sequences.

Moreover, the scope of industrial property rights was widened at the end of the 90's, with the Trade related industrial property rights (TRIPs) multilateral agreement which saw the light in 1994, at the end of the Uruguay Round. This agreement allows patentability in all technological fields and harmonizes 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 of patented technology.

All of these institutional changes evidence a greater need for protection, requested by firms themselves. This greater appropriation need is driven by what we have called the profitability imperative. Every investment in the development process of knowledge and innovation must be profitable in the short run. That is why corporate lobbying is a major explanatory element of that legal evolution, as reported by J. Rifkin in the case of the TRIPs agreement (see Rifkin, 1998).

[4] The first important decision is the Chakrabarty decision of the Supreme Court of the US: when a General Electric employee (A. Chakrabarty) filed a patent for a genetically modified micro-organism able to absorb the oil of black tides, the United States Patent and Trademark Office (USPTO) rejected it on the grounds that a micro-organism, as a product of nature, could not be eligible for a patent. After many appeals, the Supreme Court of the US accepted the patent explaining that this micro-organism was not a pure product of nature but that human hands had been used to create it.

The strong increase in the number of patents (filed and granted), notably in the US system, has given rise to debates in the US but also in Europe, where the US model is traditionally regarded as a source of inspiration. The extension of patentability has been seen as a source of concern for the main following reasons (see Gallini, 2002).

- the extension of patentability to new subject matters and closer to the scientific border may block the exploitation of knowledge (this is explained by large patents or by the increase in the number of limited but linked patents).
- this evolution is at the origin of litigation costs

As a result, even if short term return may grow, the increase in transaction costs may hinder innovation in the long run and thus may be counterproductive and contradictory to the interests of industry in the long run (reduction of the stock of "free" knowledge from which the firm may draw; in other words, reduction of externalities stemming from investment in research and development).

A solution to these restrictions has been found in the way firms manage their industrial property rights[5]. Some studies have shown that building patent pools could be a solution to the blocking of knowledge or could prevent litigation (see Clarke, 2000; Shapiro, 2001, Choi, 2003).

3-2-2 Patent Pools and Oligopolistic appropriation

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 subject of cross licensing, whether they are transferred directly by patentee to licensee or through some medium, such as joint venture, set up specifically to administer the patent pool" (Clarke, 2000, p.4).

Patent pooling is not new but during most of the 20th century in the US, this practice was regarded as illegal under Antitrust laws. However, since the beginning of the 80's, discussions have gained ground on the positive impacts of patent pooling, and led to the *Antitrust guidelines fro the licensing of Intellectual property* in 1995 (issued by the US Department of Justice and the Federal Trade Commission) which recognizes that "patent pools can have significant pro-competitive effects" (id, 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
- 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

[5] Some other legal solutions are proposed, such as compulsory licensing, non exclusive licences, granting narrower patents, and so on.

can increase the likelihood that a company will recover some, if not all, of its costs of research and development efforts" (Clarke 2000, p.9).

The latter argument 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.

It also supports the idea of a growing private and oligopolistic appropriation of the knowledge capital which is quite contradictory with the socialization of its formation. In other words, even if the formation of knowledge capital depends on interdependent relations between increasing numbers of institutions (big firms, small concerns, research labs…), only a few firms are able to appropriate the return of their investment. Moreover, patent pooling can encourage the development of monopolistic behaviours (such as high prices, imposition of "invalid" technologies, and so on).

4- Conclusion

What are the implications of this growing contradiction between, on the one hand, the socialization of knowledge capital formation and, on the other hand, of its growing oligopolistic appropriation. We can put forward too main issues arising from this contradiction, which we regard as crucial.

The first implication which is a much studied subject is the danger hanging over the scientific commons. This evolution is not new. K. Marx, notably in *Grundrisse*, explained that within capitalism, when industry is well developed, invention becomes "a branch of business" and thus science becomes a productive factor of capital (See Uzunidis, 2003). However, during a long period it did not catch the economists' eye. Today, many of them put forward the idea according to which the closer relations between firms and universities or public labs and the new capacity to patent nearer the scientific border results in the reduction of autonomous science, which is nevertheless crucial for the development of science, technology and economic progress in general "While the privatization of the scientific commons has been relatively limited so far, there are real dangers that, unless halted, soon important portions of future knowledge will be private property and fall outside the public domain, and that could be bad for both the future progress of science, and for technical progress" (Nelson, 2004, p. 455).

Another issue is the one of the social role of knowledge development and thus, the place of universities in modern societies. There are not many things in common between the university aiming at developing knowledge without practical goals and today's "entrepreneurial universities" (Etzkowitz, 2003). Universities seem to become the providers of a "ready-to-use" or "ready-to-think" service. If universities are regarded as competitors for innovative enterprises, the question of the blocking of future research comes back. This is suggested by a recent decision of the Federal Circuit explaining that, as conducting research work, basic or applied, is part of the core business of a university, it is quite reasonable under the law for a patent holder to require that the university take out a licence before using patented material in research. "After this ruling, Nelson explains, it is highly likely that patent holders will act more aggressively when they believe that university researchers may be infringing on their patents" (Nelson, 2004, p. 466). If there is no blocking in the case the university can afford the cost of the licence, we can imagine that it would generate or accentuate hierarchy between

universities, between the ones which can conduct research work, and thus will attract the best academics and the best students… and the others. This greater privatization raises the issue of the right balance between public and private activities, already raised for example by John Kenneth Galbraith in the *Affluent Society* (1958) in which he explained that the desequilibrium between the two kinds of activities led to "private opulence and public squalor". This means that all non competitive activities in the short run could be neglected by private enterprises, which could have negative impacts on the future of our societies.

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