The patentability of Computer Implemented Inventions: finding the right balance for European competitiveness

WHITE PAPER

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FOREWORD

For a number of years now, Europe has been assessing the heated debate over software patentability. The questions raised are complex and have become impassioned due to the uncertainties at the crux of each and every industrial revolution. This debate gives us the chance to understand the importance of software in our post-industrial society and daily lives. Software often has a discrete role, but over time has become more and more fundamental, be it to our computers, mobile phones, cars or planes.

As we are economists, ***Microsoft Europe*** *has asked us to review the stakes for the patentability of Computer Implemented Inventions. This report sheds light on the various issues at stake, be they microeconomic or geopolitical. Instead of providing yet another technical report, our objective is to assess these questions by taking a step back to understand the stake levels.*

Although this report was drafted before the project directive was rejected on July 6 2005, we, nonetheless, believe that the economic debate still prevails. As such, the main elements of our analysis remain relevant, regardless of the ensuing form of the political debate.

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REPORT OUTLINE

1 THE COMPOSITE NEEDS OF IP PROTECTION IN THE FIELD OF SOFTWARE

Europe's current debate on Computer Implemented Inventions (CII) is both passionate and complex. As such, it does not deserve to be relegated to two opposite sides pitted against one another (although this is the reality) — whereby each side could lose part of its fundamental stakes. More, this debate is taking place at a time of major industrial change: software is now omnipresent, be it in business segments or technical objects, far beyond the realm of yesterday's computing world.

The complex world of software…

In the 1960's, software was a product adjunct to hardware systems. Over time, software has become independent and now plays a key role in a computer's added value. More discrete, software innovation has also become a competitive factor in areas spanning consumer electronics, automotive, telecommunications, aeronautics, medical imagery, computer-aided music or design and, in the future maybe even literature. Software has, also, become more influential and pervaded the services sector with firms whose business scope is restricted to software services.

Since we are talking about immaterial goods, the Internet, quite logically, sped up mutation in the conception and circulation of software (as well as piracy…). New development processes have seen the day, with open source code and adaptable software. With the Internet serving as the threshold for decentralised coordination, open source software has spread rapidly and broadly. This context has also created multiple hybrid software which borrows from open source, as well as the traditional features of proprietary software. Today's software world is thus giving birth to new innovation processes and new organisations that cannot be confined to a « binary » landscape: neither open versus proprietary software, nor private versus open science[1], …

1) The distinction between private and open science is proposed by Dasgupta P., David, P. (1994), Towards a new economics of science, Research Policy, 23.

To fully grasp the scope and depth of the debate on intellectual property, we need to bear in mind software's highly composite features:

- From a micro-economic view, given the vast range of the fields and types of applications, defining software isn't easy. Europe's choice to put forth a directive on Computer Implemented Inventions, include the intricate interpretations of a software product's technical details and underline that semantics is not trivial.
- There are many different types of players in the field. The first ring includes a number of large specialised firms (software) and diversified companies (hardware + software), as well as SMEs and software publishing start-ups, IT services and open source developers. Moving beyond the IT sector, small and big companies develop software to embed in their own products — and while these companies may be less visible, they are, nonetheless, key players too.
- Today's software geo-politics reaches beyond the OECD. India and China, for example, can no longer be defined simply as "software buyers", but now wield their own strategy (attractive sites to delocalise programming or services, developing standards, etc.).

…points to different interests in terms of software intellectual property

It is, therefore, hardly surprising that no single rule on intellectual property related to software has won unanimity. The current situation recalls the major debate which kindled spirits across Europe in the middle of the XIXth century and led England to consider repealing their patent systems, and the Netherlands to repeal their own. In many respects, today's debates mirror yesterday's: the scope of an industrial revolution underway, the impact of international trade and consequently the regulations to be implemented. Even if economic theory does not give us the means to say that there may not have been other solutions, the XXth century's economic development has moved forward with patent systems stemming from stable long-term compromises. The definition of stable systems in the XXIth century is once again complex process, and not only in the field of software. For example, we know that, since sounds and images can be exchanged over the Internet using peer-to-peer protocols, the efficiency of copyright mechanisms is increasingly questioned.

A few specific problems point to the intellectual property of software. Put briefly, this specificity is supposed to lie in the granularity[2] and incremental nature of innovation. In such a perspective, Software which generates real innovation, may be based on previous breakthroughs which may be protected[3].

Yet a patent provides broader protection than copyright (which merely protects the expression and not the invention) and the debate cannot reasonably be closed by a narrow restriction to the scope of CII patentability, since patent protection meets the needs of a wide range of economic players :

- The software patent is primarily the business of industries at large, and not just software publishers[4]. For example, in USA, the percentage of patents filed by pure players (software publishers) accounted for 21% in 1990 and 28% in 1994, and has hovered around 22%-23% since 1998[5].
- An industry's propensity to file for patents, based on the number of patents files per R&D budget, is lower in the software industry than in other industries[6].
- More, patentability has not yielded a higher number of patents filed in software publishing. Some segments even point to growth, albeit modest, in both the United States and Europe[7].

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2) Kahin B. (2004), Through the lens of intangibles : what software and services reveal about the system, in « Patents, innovations and economic performance », OECD Conference Proceedings.

3) Shapiro C. (2001), Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard-Setting, University of California at Berkeley.

4) Hunt R., Bessen J. (2004), The Software Patent Experiment, Business Review. "We found that software patents are not closely related to the creation of computer programs— the vast majority of software patents are obtained by firms outside the software industry." "Firms outside the manufacturing sector employed 90 percent of computer programmers, but together they accounted for only 25 percent of software patents. It would appear that the distribution of software patents across industries reflects something other than the creation of software" (p.26).

5) Hahn R.W. (2005), Intellectual Property Rights in Frontier Industries, Software and Technology.

6) Hahn R.W. (2005) again and Chabchoub N., Niosi J. (2005), Explaining the propensity to patent computer software, Technovation, 25 : « Conversely, the propensity to patent (13% for publicly quoted companies) in the software industry is not particularly high when compared to other high-technology industries, such as the pharmaceutical, chemical or the ICT sector » (p.977).

7) Mc Queen D. (2005), Growth of software related patents in different countries, Technovation 25.

In short, as software is not exclusively an issue for software publishers, business sectors see the patent as a means to protect their own industrial needs. These needs, however, are not satisfied with the same efficiency by copyright or trade secret.

Although, the software patent meets the needs of certain players, the answer does not necessarily lie in unconditional patentability. It would obviously be hard to overlook the following:

- SMEs, both in the United States and in Europe, do not use commonly use software patents. This is due to both the cost and the procedural red tape (be it real or perceived), or lack of awareness of the benefits. As a result, these companies often limit their recourse to copyright.
- The importance of the open source movement as a means to push software forward is a recognised phenomenon. The software patent must be compatible with the ecosystems where open code, proprietary, and hybrid software must co-exist.
- America's experience illustrates the risk of a progressive shift from the software to business method[8] patents. Referring to the distinction made by the Economic Nobel Prize winner Ronald Coase, we could say that it is fundamental that the patent be a tool to protect the "market for goods" and not invade the "market for ideas"[9].

What Intellectual Property (IP) systems may promote competition of and by software in Europe?

The outline for the specifications of intellectual property system meeting the collective interests of Europe are laid out below:

- Protecting intellectual property can, for some players and predominantly industrial players who are not in the software industry, mean filing a patent. Their competitiveness both within and outside of

8) Even IBM argued that: «with the advent of business method patenting it is possible to obtain exclusive rights over a general business model, which can include all solutions to a business problem, simply by articulating the problem ». IBM response to 19 march 2001 USPTO request for comments on the international effort to harmonise the substantive requirements of patent law. www.uspto.gov/web/offices

9) Coase R. (1974), The Market for Goods and the Market for Ideas, The American Economic Review, 64.

Europe partly depends on the patent. Be these companies, Nokia or Alcatel for example – either active in the debate or taking sides—both claim their need for a patent and cannot be overlooked for Europe's collective interest.

- These software patents cannot be continuously developed in Europe's cloudy regulatory framework. The new system will have to be "neutral" to ensure access by all firms, regardless of size (or by lowering current thresholds) and should not overlook the open source movement since its development has reinforced technology and competition dynamics for both large and small software developers.

An OECD experiment running through the end of the 1990s and the first decade of this century showed that software's progress hypothesises that both large and small companies exist within the ecosystem, regardless of their specialisation or not in the IT sector, and give free rein to innovations stemming from open source. Public policy on patents should not, therefore, favour companies in terms of their size (large over small) or software in terms of ownership or organisation (proprietary over open source).

Europe has set a target for 2010, seeking to be the leading knowledge-based economy with 3% of GDP dedicated to R&D, as stated by the Lisbon objective. For the time being, Europe is far, very far, from this objective, with an average 2% in R&D investment. If constraints weighing the public budget make the Lisbon targets unattainable and forbid voluntarism, it is key to set up an efficient regulatory system, which can be monitored and adapted. The current protection system, including software, must bear this target in mind.

This report must use this rationale to prove or point to the need to build a software IP system in Europe. This IP system must preserve the ecosystem described above, and keep efficient watch-dogs on the look-out, to ensure that over the long term only inventions can be patented.

Report overview

Chapter 2 to this end explains the current debate from a historical viewpoint. Yesterday's debates on intellectual property on software have an interesting past. Since the invention of the patent in the 16th century in Venice, tensions have recurred, seeking to ensure the right level of retribution for efforts undertaken by inventors on the one hand, and on the other hand, to help vehicle progress acquired via the new inventions.

This debate crystallised in the middle of the XIXth century in Europe, taking a turn which confirms its kinship with today's debates: « *The patent controversy, as most seesaw battles, attracted at the time the widest public interest; frequent reports appeared in the daily press and in weekly magazines* »[10]. The debate on the reform of the patent system appeared in the British Parliament in 1827, and lasted for close to fifty years. The Netherlands abolished their patent system (1869), while the Swiss, via a referendum in 1882, refused to launch a patent system, and the various States of the emerging Germany (1870s') could not find common grounds.

Nevertheless, each of these economies walked into the XXth century with a patent system[11]. Even if the XIXth century showcased the diversity of idiosyncratic national industrialisation strategies, no patent-less system over the long term was observed.

In terms of software, the current debate quite naturally finds root in the continuity of copyright history. This tool - namely since the 1886 Bern convention ensures transnational recognition— and has proven its efficiency to protect literary, musical artistic creations. This commercial regulatory system, initially designed for the printing industries (newspapers, books, scores, etc..) was then successively enlarged to include photographs, phonographs, movies, jingles, broadcasting, photocopying, as these technologies and creations became widespread, and even software creation. The sector's scope widened mainly for simplicity reasons. To protect the crystallisation of an idea, it is easier to protect the final product, rather than some of the methods. For the same reasons, this form of protection facilitated bilateral and multilateral recognition and from this point, was extended to the circulation of works or concerned objects.

Experience points out that software needed more breathing space, than in the copyright area, in both the United States and Europe. In the United States, software patents practically saw the day in the Supreme Court, leading the

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10) Machulp F., Penrose E. (1950), The patent controversy in the Nineteenth Century, The Journal of Economic History, Vol. 10, page 1. Guellec D., Martinez C. (2004), Overview of recent changes and comparison of patent regimes in the United States, Japan and Europe, Patent innovation and Economic performance, OECD conference proceedings.

11) It was already quite clear that the problem was not purely binary (patent or no patent), but that the resulting systems stemmed from national compromises and international harmonisation efforts (as of the 1886 Bern Convention). To convince ourselves that systems which became stable at the end of the XIXth century were not maximalists, we shall remember that some of patent advocates rallied at that time for permanent and unalienable monopolies.

Patent Office to review its stance. In Europe, software patents were created around the interpretation of two words ("as such") of an article (n°52) of the European Patent Convention[12]. The game, however, has changed and Europe has to define a clearer set of rules.

In the same chapter the specificities of intellectual protection will be laid out to see a number of intrinsic features of the sector's innovation processes, progressively pulling hardware and software protection apart, the cumulative nature of technical progress, the rise of standards, and the pervasive spreading of software. We will then review the advantages and disadvantages of the available options for IP from software secret to patent and include copyright. The issues traditionally put forth because of patent thicket or for the strategic use of patents have not been blocked out.

This set of questions if reviewed with the objective of understanding software IP's new requirements in a context characterised by new phenomena like open source, hybrid products or packages, off-shore programming or service. More, competition in this host of industries lies in each and everyone's capacity to differentiate their firm via embedded software and where software's global geopolitics is more complex than in the 1980s:

- All of these elements lead to the following next steps: the economic and industrial systems making their way into software are not the same as yesterday's.
- Consequently, it is difficult to uphold the viewpoint that patent protection is not required simply because the software industry initially grew without widespread use of patents. Similarly, in an evolving industry, it is difficult to maintain that copyright can cover the entire scope of IP needs (« one size fits all »).

12) Guellec D., Martinez C. (2004), Overview of recent changes and comparison of patent regimes in the United States, Japan and Europe, Patent innovation and Economic performance, OECD conference proceedings.

Chapter 3 focuses on the specific stakes linked to Europe's software patentability. The first challenge lies in embedded software which is highly strategic, if not the most strategic sector of European industry. It is at the heart of all the great European success stories like Airbus, Ariane, nuclear plants, and is also at the basis of all the modern weapon and defence systems. While some of this software is not aimed at being open to competition through patents (military or security critical applications), most need a strong legal framework to be produced and exported without threatening the companies that produce it. The debate seems to have reached a consensus, and at least for embedded software, patents might provide the appropriate protection. It allows for a wide diffusion of technology and for the inventors, a fair return on investments via licenses. In this context, considering the threats faced by the European industry, it seems highly unreasonable not to adopt a legal framework covering what already exists. In short, a top quality patent for embedded software.

Another point to focus on is the case of SMEs which deserve be reconsidered. For this purpose, we will focus on studies considering the SMEs-patents in CII. SMEs take advantage of proactive patenting strategies and, contrary to the conventional view, the EPO granted a significant part of the CII patents to SMEs. SMEs account for more than 20% of all CII patents granted since 1998, and every year this number continues to grow. In terms of stock, 3.700 CII patents were granted to more than 2,000 SME's and individual inventors in Europe. This means that the generally admitted idea that SMEs were excluded from CII patenting must be reconsidered and that — even in the present regulatory context rather confused — this tool responds to some needs. Also regarding SMEs, Venture capitalists seem to be particularly sensitive to patents to secure their investments. A survey about companies benefiting from European venture Capital Association (EVCA) reported that 60 % of the companies supported have as patent[13] dependent business model. And software is no exception to this preference. Representing 900 members, the EVCA expressed the necessity of a patent for CII. Their rationale is that when undertaking their due-diligence, venture capitalists consider dependence of the product on a specific patent, competing patents and the strength of the protection.

Other stakes are also underlined and encompass international asymmetries of Intellectual Property in software. Between Europe and the rest of the world, we

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13) EVCA Barometer issue October 2003.

will show the risk of concentrating R&D in areas of the world with the strongest protection systems. And the international dimension of the problem is not restricted to OECD countries. China and India are taking active positions in software and, as they emerge as industrial powers in an ever-growing range of sectors, they too are concerned by the capacity to embed software. Strong coherency is also needed across the different European Union countries: IP policy suffers from heterogeneities. Indeed, the EPO policy is not the same as national patent offices. It seems impossible to develop a strong industry where software plays an ever increasing role (as embedded software) in a system where many legal frameworks coexist and where no true protection is offered against violation of intellectual property.

Globally, the present situation induces an unconstructive ambiguity for European firms, with hidden costs. While some ambiguity may be constructive economically speaking (e.g. in terms of monetary policy), this is currently not the case. As CII patentability mostly implies firms which have embedded software in their products or industrial processes, the ambiguity focuses on a wide range of European champions, from various sectors. Even if some 20% of the patents have been filed by SMEs, it is hard to imagine this figure going up much further without being clearer.

In **Chapter 4**, the objective is to analyse the terms of Europe's ongoing debate in relation to the versions of the CII directive. This is to determine whether the project conforms to the specifications defined above. This analysis takes place in three phases. First, we review the problems of the American software patent system, from strategic use of the patent to the so-called "patent thicket" and the patenting of pure ideas. The goal is to gauge, the risk of evolving in Europe to a system which patents ideas. It appears that the proposed CII directive is not a novelty, as it aims to legalise current European Union jurisprudence to create visibility and provide a safer framework for the business community. The European directive does not discard the fundamental basis in which EPO jurisprudence is built and merely prolongs the effect of technical criterion, whereas the American system relies on the "utility" criterion. In the final phase, we must review the threat of the CII patent to the Open Source movement. Anti-patent advocates sustain that developing free software experiences the same hurdles as other software since developers are likely to use existing functionalities which are protected by a patent. The patentability of proprietary innovations may thus lead to an asymmetric framework where while de facto proprietary innovators can directly access functionalities developed by free software, the reverse relationship is not an easy one. This thesis is assessed in the European context, also accounting for the complex evolution towards hybrid products or strategies, and the bargaining power of Open Source. The general idea is that an ecosystem can host Open Source or Free software and include a "reasonable" framework for CII patents, with a non extensive definition of "technical effects". Nevertheless, the evidence that CII patents are weapons against Open Source is not obvious. Even with its inflationary character, the US case does not mean that Open Source disappear. Moreover, the conventionally less permissive rules on this side of the Atlantic will not delineate a specific battlefield in Europe.

In **Conclusion**, quite obviously, the discussions on this Directive have, above all, underlined the stakes for Europe. More, these discussions highlight unanswered questions on software, and especially, on embedded software. In July 2005, the European Parliament will have to decide on the project version it adopts. This decision will be of a strategic importance for many European firms, whatever their size, and, especially, for firms competing on the inventiveness of their embedded software. Considering the evolution of IP software protection in US and Japan, the evolution of industrial strategies regarding software in China and India, there is no necessity to demonstrate once again the degree of importance of the Directive. The 1973 Munich Convention is no longer the appropriate framework, leaving confusion as to sectors well outside of the IT realm. Tomorrow's rules will have to ensure better quality. This need for efficiency raises the following points:

- ✓ To ensure the system's efficiency, with shorter time delays to meet technological rhythms: delivery windows, timeframe to react, arbitrage timeframe,… This means that the European Patent Office will be endowed with the appropriate means and tools, and that the national counterparts will also have the powers once the national laws are adopted.
- ✓ In the same mindframe, the timespan for patents and their longevity must be shorter to limit strategic use, and once again to account for technological innovation and to provide a quicker diffusion.
- ✓ The patent must vehicle value-rich information. Disclosure rules must point to technical progress. Creating a European database, for example, may help research in previous findings and improve accessibility to patent offices for firms and scientists.

- ✓ Special support for SMEs may be created to inform, facilitate their patent strategies, share legal expertise and mutualise litigation risks.

Europe needs to endow itself with a quality-level CII patent system— and non-inflationary. Patent systems must not only accompany technical change, they must adapt to change. Since the very beginning, the aim of the Directive is to clarify and harmonise the conditions of patentability of CII and not to open the door to a free patentability of software.

2 SPECIFICITIES AND DYNAMICS OF SOFTWARE'S INTELLECTUAL PROPERTY

The current debate on the patentability of CII is a milestone in the third industrial revolution. This current issue in economic history is characteristic of the adaptation period that the IP system needs to encompass technologies it was not initially designed for. And these adjustment periods foster noise, since yesterday's past does not shed enough light on tomorrow.

Fortunately, we can rely on milestones and guidelines to move forward. Given this backdrop this chapter provides a set of initial outlines.

- First, we will review the European debate regarding the 19th century patent system. This reference is noteworthy for several reasons, especially given the socio-economic impacts of today's technology (§2.1).
- We will then assess how software patents (including CII) progressively appeared in the OECD. We will also define some specificities in the innovation process for software and list the available tools or methods to protect IP (§2.2).
- Finally, we will raise questions regarding the efficiency of IP systems, by events, such as the extended development of open source, the emergence of hybrid products (or strategies) between proprietary software and open source or off-shore externalisation of parts of the software value chain (§2.3).

2.1 Highlights on yesterday's European patent debates

2.1.1 Key dates and issues

2.1.1.1 From Venice to the Paris Convention

The word 'patent' comes from the Latin 'litterae patentes', which means an 'open letter'. Such letters were used by medieval monarchs to grant rights. With a royal seal, these letters served as evidence of these rights, for all to see.

While the first system for patenting inventions cannot be attributed historically to any specific country, it is acknowledged that the first informal system was developed in Italy during the Renaissance. Venetian glass-blowers then spread this system across Europe to protect their craftsmanship skills and know-how from local workers.

The first recorded patent of invention was granted to John Utynam who, in 1449, was awarded, a monopoly for a glass-making process previously unknown in England. In return, Utynam was required to teach his process to native Englishmen. Interestingly enough, the function of passing on information is nowadays fulfilled by the publication of a patent specification. In North America the colonies adopted a similar system of limited monopolies.

Patent law first saw the day in the United States based on Article I of the American Constitution (1787). This article lists the powers specifically attributed to Congress and therefore, includes the power to ensure the development of Sciences and the Arts by granting authors and inventors exclusive protection of their writings and discoveries for a limited time period.

At the end of the 18th century, three of the most important countries already had statutory patent systems (France, Great-Britain and United States). Patent laws were also rapidly enacted in the Austro-Hungarian Empire in 1810, Russia in 1812, Belgium in 1817, Spain in 1820, Sweden in 1834 and Portugal in 1837. This expansion process was simultaneous with technical progress and growing exchanges due to the spreading of the industrial revolution in Europe and North America.

Thus, by 1880, patent systems had been introduced in most European countries, with the notable exceptions of the Netherlands and Switzerland, which we will examine further on.

The first attempts to pave the way for greater harmonisation can be seen in the 1883 Paris Convention for the Protection of Industrial Property — cornerstone of the modern international patent system.

2.1.1.2 The debate was already heated as of the XIXth century

It is fundamental to note that the fight between anti- and pro-patents is neither new nor linked to a specific industrial field, despite the current debate about Computer Implemented Inventions (CII) patents. In a seminal paper, Machulp and Penrose (1950) illustrated the violent confrontation of proponents and opponents of patents in Europe in the middle of the XIXth century. Indeed between 1850 and 1875, several countries questioned the utility of patents[14].

The Netherlands abolished all patents on its territory between 1869 and 1912. Switzerland was opposed to patents until 1887 and the emerging "Germany" faced the heterogeneity of its diverse internal patent systems.

Inspired by the anti-patent movement across Europe in 1869, the Netherlands abolished the patent law it introduced in 1817, because the patent was mainly seen as form of monopoly. The anti-patent movement had close ties with the free trade movement, particularly strong in the Netherlands. Another interesting point is that key criticism regarding patents focussed on the "workability" of the 1817 patent law and on the difficulty in reforming it.

Despite international pressure, the Netherlands refused to re-introduce a patent law until 1912. On the whole, during this extreme laissez-faire period, Netherlands's economy remained rather sluggish, and its industrialisation relatively shallow. According to estimates made by Maddison (1995)[15], using the value of 1990 US dollars, in 1820 the Netherlands was the second richest country in the world, behind Great-Britain (per capita). A century later, however, it was overtaken by no less than 6 countries – Australia, New Zealand, United States, Canada, Switzerland and Belgium – and almost nearly by Germany. Germany's per capita income was only about 60% that of the Netherlands in 1820, but hardly below it in 1913.

A referendum held in Switzerland in 1882 to amend the constitution, and adopt patent legislation was rejected. No patent law was adopted until 1907. This anti-patent policy contributed to the development of a number of industries helping some industries legally "steal" knowledge and know-how from neighbouring

14) Machulp F., Penrose E. (1950), The patent controversy in the Nineteenth Century, The Journal of Economic History, Vol. 10, page 1. Guellec D., Martinez C. (2004), Overview of recent changes and comparison of patent regimes in the United States, Japan and Europe, Patent innovation and Economic performance, OECD conference proceedings.

15) Maddison A. (1995), Monitoring the World Economy, 1980-1992, OECD.

countries. Chemical and pharmaceutical industries did well during the period and are said to have actively "imported" technologies from German States. In the food industry, there is a claim that the absence of patents actually encourages foreign direct investment.

In Germany, a strong movement against the patent invention began as a reaction not only to demands made by patent advocates to strengthen patent protection, but also for demands to adopt uniform patent legislation for all local States of the German Customs authority (Zollverein). Free-trade arguments were often cited to criticise patent protectionism. Trade associations and chambers of commerce submitted reports recommending reforms or abolition of the patent laws. After several years of public debate, the Prussian government opposed the adoption of a patent law by the North German federation, and in December 1868, the Chancellor Bismarck himself announced his objections to patent protection. Finally in 1877, a uniform patent law for the entire Reich was adopted.

2.1.2 Economic lessons of the historical heritage

2.1.2.1 Finding the right balance between the creation and spreading of new knowledge

The defendants of a patent system put forth the following arguments during the XIXth century. To foster the thesis that patent laws had a "*beneficial influence on the nation at large*", proponents argued that a man has natural property rights in his own ideas and that their appropriation by other persons must be regarded as stealing. Consequently, Society is morally obliged to recognise and offer a protection to these rights. Since inventors contribute positively to society, justice requires that a person be rewarded for his/her services in proportion to their usefulness.

As inventions and their use were recognised as necessary for industrial progress, this progress was assessed to be socially desirable. The most effective method to foster inventors' and capitalists' projects was to grant exclusive patents rights. More, a patent might be an appropriate incentive to disclose secret information and counterbalance the consequences of the granted monopoly.

For patent opponents the system was deemed to be negative for economic development. Opponents focussed the debate principally on the economic function of the patent system. They wanted to abolish each country's patent system, arguing that the exchanges of technical ideas were key to economic development. To limit the detrimental consequences they requested stricter patent application conditions.

From the beginning, the issue lay in finding the right balance between instilling the creation of new knowledge and their diffusion. This dividing line is still present in today's debates.

2.1.2.2 The need for international harmonisation

History shows examples of issues linked to the international heterogeneity of patent systems.

The intense debate that swept through German States concerned the issue of retaining a regional legislation which generated much heterogeneity in Intellectual Property rights. A national law was finally preferred. Another historical example of the required homogenisation of patent law within a federal country is given by the centralised tradition of patents in USA. In the United States, there was no historical difference among the States. Property rights were at heart of Constitution. Patent granting was a federal prerogative and no State had discretionary competence to grant patents.

Even in non-federal areas, a strong appeal for homogenisation developed rapidly. Though some countries could have industrialised without a patent system, in Europe's early XIXth century, a strong harmonisation current concerning intellectual property rights was underway, and clearly affirmed by 1886 with the framework of the Bern convention. Progressively, all reluctant countries admitted the need for patent law.

North (1981) explains that the convergence process can be found in works on industrialisation: "*in the absence of property rights over innovation, the pace of technological change was most fundamentally influenced by the size of the markets*" (p. 165)[16]. Large and growing markets would increase the private return to innovation *ceteris paribus* and would allow for specialisation and creativity. Small industrialised countries could then seek out foreign markets. If these markets had a patent system, the small countries would sooner or later

16) *North D.C. (1981), Structure and Change in Economic History, 1981.*

be more likely to adopt a legal patent framework themselves, as seen by the Netherlands and Switzerland.

These historical lessons bring forth several remarks:

- First it is interesting to tie the German experience to the heterogeneous debate of national law in today's European Union.
- Moreover, if, as North believes, history repeats itself, then a global economy favours less diversity in software patent rules: exporting countries or areas cannot be insulated from the IP environment abroad or over the long term keep "idiosyncratic" systems.
- Another key lesson from history is that IP has always been linked with the race for power and influence between nations.

Patent and leadership may have led to technical or cultural domination of one nation (UK during the first industrial revolution). Indeed, patents were copied, duplicated and finally dissolved for the benefit of other countries. Deciding to promote infant industry strategies or to attract FDI, a number of countries have established an anti-patent institutional environment. Looking forward, economic progress as represented by industrialisation, shows that most countries, including Japan, industrialised with a patent system. If however, Germany, the Netherlands and Switzerland did not use a patent system there is no evidence that the equilibrium attained would have been sustainable.

Even if it would be impossible to end the XIXth century dispute in a conceptual manner, this review shows that current software patent issues are not new historically. Most of the current debate finds its roots in this not so ancient past. At the heart of information revolution, we see that history is cyclical and the stakes (international leadership of nations, international division of labour, protection of IP) are close and magnified in a more open and global world economy.

2.2 Conditions of emergence of software patents within the OECD

2.2.1 Tools to protect the IP of software

2.2.1.1 Main specificities of innovation processes in software

In the 1960s, hardware manufacturers mainly financed software production. Margins on expensive proprietary hardware were high enough so that custom software was often considered as an "implicit" add-on product. Nowadays, the rare segments of the hardware market which still reap comfortable margins cannot finance software development for the entire market, especially for software developed for commodity hardware[17].

To understand the specific issues of software IP, characteristics of innovation processes in the field must be defined:

- Innovation is often incremental and continuous, the exact timing as to when projects become a real innovation is difficult to define. Computer programs are usually built on pre-existing ideas and prior code as well[18].
- As software is information, the production process involves high fixed costs and negligible marginal costs. The entire cost of a computer program is concentrated in the first copy, and reproduction costs are extremely low. Software can consequently be copied. The propensity to piracy and reverse engineering is a well-known phenomenon in software industry.
- Computer program life cycles are generally short. The lead-time to market in the software industry tends to be brief and shorter than in other industries.
- As in other hardware and device industries, the standardisation issue is key to the software industry, where applications need to

17) Evans D.S., Layne-Farrar A. (2004), Software Patents and Open Source: The Battle Over Intellectual Property Rights, summer, Virginia Journal Of Law & Technology Vol. 9, No. 10, University of Virginia.

18) Burk D.L., Lemley M.A. (2005), Designing Optimal Software Patents, in Intellectual Property Rights in frontier Industries, Edited by Robert W. HAHN, AEI-Brooking Joint Center for regulatory Studies, Washington D.C.

interface with an operating system and often with each other as well.

- Software is increasingly incorporated in appliances or devices (washing-machine, dryer, car,…). Embedded software has become omnipresent. For many firms producing consumer or industrial goods competition via software is a conventional model.

2.2.1.2 Virtues and limitations of trade secret and copyright

The first and natural way to protect software is by keeping it a secret. All businesses have information that could harm their competitive position if it became public knowledge. The most famous example of a trade secret is the Coca-Cola formula. If a business relies on keeping knowledge a secret, its protection lasts as long as the information meets the criteria of a trade secret. There is no time limitation regarding protection.

Employees are often the best source regarding a company's trade secrets. Legal reasons aside, employees cannot be expected to keep secrets if they are not specifically coached or incited to do so (non-disclosure clause). Moreover, de facto trade secrets do not protect against reverse engineering. As a secret is not the best way to share knowledge, this practise has severe consequences for the diffusion of the invention and knowledge which could be extremely damageable for activities where innovation is cumulative, such as the software industry.

Copyright grants legal rights to authors, composers, playwrights, publishers or distributors providing exclusive publication, production, sale, or distribution of a literary, musical, dramatic, or artistic work. Source code, object code, and screen displays are literary works eligible for copyright protection.

Copyright protection is both extremely easy to obtain and affordable. In France for instance, copyright protection costs about a few dozen euros to receive a copyright protection for software. In the United States registration fees cost 530 US dollars (plus legal expenses)[19]. In the software industry, a business just provides its source code, and the notice is the copyright providing immediate

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19) Seidenberg S. (2005), Software Copyrights Take A Backseat To Patents, Corporate Legal Times, march.

protection. Companies do not have to wait one year or more (like for a patent) to be granted protection. More, copyright protection provides important whistles and bells, especially in terms of protecting the firm's later-stage products from piracy.

However, as the software industry is developing rapidly, new questions arise regarding the software aspects to be protected by copyright law[20]:

- The fundamental problem is that copyright actually provides a very weak protection against reverse engineering. In particular for software, copyright can be circumvented by re-implementing code, because it does not place restrictions on underlying ideas[21]. Infringement requires substantial similarity of protectable expression, not just an overall similarity of the works.
- Copyright protection is designed to protect expression and not functionality. Copyright protection does not cover a competitor who designs a mimetic product in terms of functionalities, as long as the competitor does not use the "expression" from the first product[22]. Since the competitor's customers are for the most part interested in functionality, and not expression, this is not constraining[23].
- A direct potential side-effect is to dissuade private funding[24]. Copyright law does not play a substantial role in providing the sustainable differentiation that investors (in particular venture investors) seek to decide whether to invest in early-stage software firms[25].

The issue is to know whether a legal framework established at a time when the printing industry was in its youth may cover all the needs of IP protection in the digital revolution.

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20) Mazeh Y. (2002), Present and Future Priorities in Copyright Law, A Scoping Study, February, Wolfson College, Oxford.

21) Mann R.J. (1999), Secured Credit and Software Licensing, 85, Cornell Law Review, 134.

22) Mann R.J.(2004), The myth of the software patent thicket: an empirical investigation of the relationship between intellectual property and innovation in software firms, American Law & Economics Association Annual Meetings.

23) In 1983 IBM was one of the last business to stop disclosing source code. The reason was that it made it too easy to reverse engineer them and create computing products quite legally.

24) http://www.atip.org/public/atip.reports.92/patent.92.html

25) Mann R.J.(2004), idem.

2.2.1.3 Advantages and costs linked to the software patent

Although, there is no legal widespread definition of the software patent some definitions have appeared[26]. Amongst academic definitions, one of the most widely accepted is the definition offered by Bessen and Hunt (2004). According to them, a software patent can be defined as including the words "*software*," "*computer*" and "*program*," in the specifications. Patents that meet these criteria, and also contain the words "*semiconductor*," "*chip*," "*circuit*," "*circuitry*" or "*bus*" in the title are excluded, as they are believed to refer to the technology used to execute software rather than pertain to the software itself.

The Free On-line Dictionary of Computing[27] provides a general definition of what a software patent should be: "*a patent intended to prevent others from using a programming technique*". It is worth noting that the European Patent Office (EPO) prefers to define a Computer Implemented Invention rather than provide a strict definition of a software patent. EPO provides a general definition of a CII:

> "*A computer-implemented invention is an invention whose implementation involves the use of a computer, computer network or other programmable apparatus, the invention having one or more features which are realised wholly or partly by means of a computer program*".[28]

A patent is usually thought of as the strongest form of intellectual property protection. The owner of a patent is granted the right to exclude others from making, selling, importing, or using the invention for a period of time. Up to now, the copyright and patent regimes have co-existed without frontal conflict as their purposes are different. Copyright deals with the protection of individual works of authors, while patents protect inventors of innovative processes implemented within (non-unique) apparatuses designed to solve a given problem.

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26) Campbell-Kelly M. (2003), Software Patents, Milken Institute Review, 5, 4.

27) FOLDOC is an on-line, searchable encyclopedic dictionary of computing subjects. It was founded in 1985 by Denis Howe and is hosted by Imperial College, London.

28) European Patent Office, Computer-implemented inventions and Patents, Law and Practice at the European Patent Office.

As a patent allows an inventor to protect his/her research, it fosters ex ante innovations for businesses to invest in R&D. A company investing in R&D, can be ensured that the fruit of its expensive research will not be easily appropriated and that the company has legal protection as well.

Moreover, the main benefit of the patent system is that it is opposed to the trade secret system. The patent system stimulates the rate of diffusion and technology transfer through disclosure (which is usually the counterpart of the legal monopoly granted), marketing and licensing. When a patent is granted, a company is granted a legal monopoly during the 20-year patent term to exclude others from making, using, selling or importing the invention. The patent holder also has obligations and must meet demand for its invention and helps the company negotiate a revenue stream by licensing the invention to be used by others or provide services to others.

Since patents protect software functionalities, patents have the theoretical potential of providing a sustainable differentiation that investors are looking for. For a business, a patent is a means to be recognised[29] by demonstrating its technical competence to third parties, converting tacit knowledge into a verifiable and transferable format, and in making the business attractive to potential acquirers. These reasons mean that patents send positive signals to the industrial and financial communities.

Patents, however, are perceived as inducing costs due to current design as much as to the principle of the patent itself (re: developments linked to US case). One category of complaints can best be described as procedural. Software patents are often not properly awarded, meaning they can be misused, and should thus be altogether eliminated. The anti-patent movement argues that patents are inefficient and can be extremely expensive: between 10,000 and 20,000 US dollars for an American patent[30], bureaucracy, legal personnel and lawyers, making the patent system very costly and unattractive. These costs add to the welfare lost due to the monopoly granted by the patent system (limiting the static efficiency of price competition).

The other category of complaint refers to the very nature of innovation processes in software. For example, if a company obtained a patent, the

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29) Granstrand O. (2003), Innovation and Intellectual Property, DRUID Summer Conference on creating, sharing and transferring knowledge, Copenhagen June 12-14.

30) Seidenberg S. (2005), Software Copyrights Take A Backseat To Patents, Corporate Legal Times, March.

property right could expire in 20 years and its secrets would be published as part of the patent process. The term may be extended or shortened in special circumstances. While this time period may be shorter in certain industries (pharmaceutical industries for example), it can be too long in other industries. Indeed a frequently voiced objection to software patents is that the 20-year time span is too long in a rapidly evolving technological environment such as the software industry[31].

2.2.2 Context and path of emergence of software patents

2.2.2.1 United States : from software to business methods

The first software patent ever granted was filed in 1962 by British Petroleum Company and was a patent for a "*computer having slow and quick storage access, when programmed to solve a linear programming problem by an iterative algorithm, the iterative algorithm being such that (...)*".[32]

At the start of the computer boom in the 1960's, software was thought to have no value. Only computers were sold, and the accompanying software was free. When people started talking about software in the 1970's, IBM, the biggest software manufacturer at the time, and opposed to granting patents. The solution, involved using the copyright to protect the software, as if it were a work of art.

In the 1970's, the USPTO was also reluctant to grant patents on inventions relating to computer software and avoided granting any patent if the invention used a calculation made by a computer. The USPTO's rationale was that patents could only be granted to processes, machines, articles of manufacture, and compositions of matter, but could not be granted to either scientific truths or mathematical expressions. The USPTO reviewed neither processes nor machines, focussing instead on computer programs and inventions containing or relating to computer programs as mathematical algorithms. As such, software related inventions were considered non-statutory. The opinion is blatant in several key cases (1972 - Gottschalk v. Benson ; 1978 – Parker v. Flook ; 1978 – In re Freeman).

31) Campbell-Kelly M. (2003), Software Patents, Milken Institute Review, 5, 4.

32) http://www.cippm.org.uk/pdfs/JILT%20kretschmer%2011_03.pdf

Figure 1: Major changes in the US patent system

Year	Event or case	Result
1980	Diamond v Chakrabarty	Patentability of artificially engineered genetic organisms
1980	Bayh-Dole legislation	Increase in University patenting
1981	Diamond v Diehr	Patentability of software
1982	Legislation	Creation of CAFC; patent validity more likely to be upheld
1984	Hatch-Waxman Act	Increased importance of patents for drug firms vis-a-vis generic producers
1985/6	TI sues Japanses semiconductor firms	Wins suits; sues U.S. semiconductor firms, funding R&D from licensing royalties
1986	Kodak-Polaroid	Decision on instant camera patent; final injunction against Kodak leading to $1Bn judgment
1995	TRIPS agreement	Harmonization drive begins
1998	State Street and ATT vs. Excel	Patentability of business methods

Source: Hall 2004

Thus, until the end of the 1970's, software technologies could not be patented since patents would pre-empt mathematical algorithms.

Instead of strengthening manufacturing, the Reagan administration further strengthened and protected intellectual property rights, as a means to offset America's declining production capacity. Consequently American businesses significantly shifted their patent strategies from hardware to software[33].

In 1981, the Supreme Court forced the USPTO to change its position. The Diamond v. Diehr case provided the first instance in which the U.S. Supreme Court ordered the USPTO to grant a patent on an invention even though computer software was used. The invention was a method determining how rubber should be heated to be "cured." The invention used a computer to calculate and control rubber heating times. The invention however (as defined by the claims) not only included the computer program, but also included steps

33) Kahaner D.K. (1992), Software patents in Japan, US Office of Naval Research Asia. www.atip.org/public/atip.reports.92/patent.92.html relating to heating rubber, and removing rubber from the heat. The Supreme Court stated that the invention was not just a mathematical algorithm, and as such was also a process to mould rubber, and should be, therefore, patentable. This was true even though the only "novel" feature of this invention was the timing process controlled by the computer.

After 1981, the USPTO and inventors were left trying to determine when an invention was merely a mathematical algorithm, and when it was in fact a patentable invention which simply contained a mathematical algorithm. Although lower courts attempted to make this distinction clearly, the resulting opinions showed confusion. Clearly, the patentability of a software-related invention depended heavily on the claims put forth by the patent attorney.

At the end of the 1980's jurisprudence issued by several cases (1980 – In re Walter ; 1981 – Diamond v. Diehr ; 1982 – In re Abele ; 1989 – In re Iwahashi) affirms that software is patentable as a process, if it does not pre-empt a mathematical algorithm.

In the early 1990s, the Federal Circuit[34] tried to clarify when a software-related invention was patentable. The court stated that the invention as a whole should be examined. Is the invention only a mathematical algorithm, such as a computer program designed to convert binary-coded decimal numbers into binary numbers? If so, then the invention cannot be patented. If, however, the invention uses the computer to manipulate numbers representing concrete, real "world values", then the invention can be patented.

Until 1994, software was only patentable if disguised as hardware, when a court decision removed this restriction[35]. And in 1995, the USPTO decided to develop guidelines for patent examiners reflecting recent legal decisions. After releasing draft versions of the guidelines for comment, the USPTO adopted guidelines for USPTO examiners to determine when a software-related invention is statutory and therefore patentable. The more recent jurisprudence (1998 – State Street Bank v. Signature Financial Group ; 1999 – AT&T vs. Excel) aims at asserting that software is patentable provided it produces a "useful, concrete, tangible result".

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34) The highest court for patent matters other than the Supreme Court.

35) In re Alappat, 33 F.3d 1526 (Fed. Cir. 1994).

On a practical level, in the United States, this means that restrictions on patenting business methods (apart from the requirements of novelty and inventive step) hardly exist.

2.2.2.2 Japan : a widening process under control

Japanese doctrine states that the invention has to be a "highly advanced creation of technical ideas by which a law of nature is utilised":

- A computer program that simply performs a mathematical algorithm is not patentable
- If software is used as a means to materialise a law of nature and is linked to appropriate hardware elements, it may be patented.

In 1985, the Japanese Copyright Act was amended and defined computer programs. The Japanese Parliament passed a bill in April 2002 to strengthen software patent protection. The new Law, designed to help clear up the ambiguity surrounding computer software patentability, has been effective since September 2002.

Up to 2002, Japanese software was legally protected by patents if its computer program was stored on physical media such as a CD-ROM or floppy disk. However, under the terms of the new Law, it is no longer necessary to store computer programs on this type of physical support to ensure patentability (which means that downloadable products may be protected by patents).

Thus, the new bill provides greater protection of computer programs. Software associated with computer programs are treated as a tangible "thing" and can therefore be considered as a patentable item. So the law protects computer programs not stored on media such as CD-ROM, thereby allowing intangible computer programs stored on a network to be protected as well.

But this move towards the US framework is monitored. The Ministry of Economy, Trade and Industry (METI) intends to elaborate guidelines to discourage corporate abuse of software patents (for spring 2006). The goal is to limit the problems of patent hegemony when a patent involves basic technologies (like movie compression). One possibility is to call on the holders of basic software patents to make their code available to all companies at reasonable prices. In the Japanese economic system, such public coordination, leads private firms to modify their behaviours within the limits of regulation is a rather classical (and efficient) way to proceed.

2.2.2.3 Europe : CII within the scope of software

Even though the European Patent Convention and its Article 52 excludes the patentability of programs for computers "as such", this does not mean that all inventions including software can not be *de jure* patentable. Patents which qualify as software patents based on American standard definitions have been granted by the EPO since the 1980s. The EPO that first promulgated the most widely followed doctrine governing the scope of patent protection for software related inventions is the "technical effects". A technical contribution means a further technical effect that goes beyond the normal physical interaction between the program and the computer.[36]

The European Patent Convention (EPC), Article 52, paragraph 2 excludes the following from being patented:

- Discoveries, scientific theories and mathematical methods.
- Aesthetic creations.
- Schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers.
- Presentations of information.

However paragraph 3 then explains that:

- The provisions of paragraph 2 shall exclude patentability of the subject-matter or activities referred to in that provision only to the extent to which a European patent application or European patent relates to such subject-matter or activities as such.

Many believe that, for decades, this "*as such*" has been interpreted as meaning "*as long as an idea in the program (and anything in paragraph 2) is claimed*", but this interpretation has not been followed by the Boards of Appeal of the

36) According to the jurisprudence of the Boards of Appeal of the EPO, a technical effect provided by a computer program can be, for instance, a reduced memory access time, a better control of a robotic arm or an improved reception and/or decoding of a radio signal. It does not have to be external to the computer on which the program is run.

EPO. Like the other parts of paragraph 2, computer programs are open to patenting to the extent that they provide technical contribution to the prior art.

Though many argue that there is an inconsistency on how the EPO now applies Article 52, the practice of EPO is at least consistent regarding the treatment of different elements of Article 52(2). A mathematical method cannot be patented, but an electrical filter designed according to this method would not be excluded from patentability by Article 52(2) and (3).

In practice, even if the move towards the United States scheme is undeniable, the EPO does not grant patents for computer programs or computer-implemented business methods that make no technical contribution. In this respect the EPO's patent granting practice significantly differs from the USPTO.

2.3 Equilibrium of IP is questioned by new phenomena in the field of software

To appreciate IP-related stakes, it is key to underline that software is a field where innovation is an ongoing process. Conventional development stems from an era when software was a product linked to hardware. But times have changed, the Internet has revolutionised the value chain's organisation models. Free software, open source, hybrid, off-shore development or services are phenomena which question the traditional forms of IP software.

2.3.1 From Free or Open Source software…

Since the middle of the 1980's, new forms of software development have appeared: Open Source software today used as well by individuals as by big companies like Boeing, Amazon, Google, and E-Trade. Open Source development is undertaken or supported by large enterprises like IBM, Novell and HP, as well as by SMEs. The Open Source operating system, Linux, Apache (used for hosting websites) and Sendmail (used for routing e-mail) are thus widely diffused[37].

37) Apache powers 2/3 of the Web. Bonaccorsi A., Rossi C., Giannangel S. (2003), Adaptive entry strategies under dominant standards. Hybrid business models in the Open Source software industry

The roots of the phenomenon date back to the 1970s, when protests arose because of the excessive copyright protection for software. To face the so-called higher obstacles to cooperation imposed on the computing community by the owners of proprietary software, the GNU[38] project was founded in 1984 by Richard Stallman. The GNU project mission was to build a non-proprietary Unix look-alike[39].

Unlike proprietary software, where source code is not available to users, open source software is characterised by its availability for users. Each user, consequently, has the possibility to modify (and sometimes the technical ability…), adapt and improve the source code, paving the way to cooperative development modes.

The expressions « free software » and « open source » are often used as perfectly interchangeable synonyms, but the two concepts differ, even though in both cases third-parties, users and developers, can share the information related to the code source. According to GNU, the expression « free software » refers to the freedom for users to execute, copy, distribute, study, change and improve the software. While Open Source means that users, developers and third parties can access the source code, these rights may be associated with restrictions and, even, may be associated with commercial processes. That means that free software is an open-source software that is freely available and free of charge.

The development of these families of software benefits from volunteer programming, as well as the participation of private company employees who have been dedicated to a specific task by their employer[40], or by funds provided to help promote the development of open source software, be it in the scope of an economic model buoyed by enterprises, respecting market demands: profitability, keeping costs to a minimum and protecting intellectual property. Open source advocates feel that the available source incites users to play a key role in debugging software, based on an interactive and cooperative mode.

The software's intellectual property rights are governed by a license system. There are host of license systems, which are more or less restrictive; the most well-known being General Public Licence (GPL) developed by Free Software

38) Acronym "GNU's Not Unix".

39) Lerner J., Tirole J. (2002), Some simple economics of the Open Source, The Journal of Industrial Economics, 2.

40) For example, the 200 programmers of IBM in « IBM Linux Lab ».

Foundation, which has the specificity of being extended to all recent versions of a code under GPL licenses. There is also the BSD license, which is less “open” since BSD limits the diffusion of source code.

2.3.2 … to varieties of hybrids products and packages

Quite obviously, open source and proprietary systems are not leak-proof, and a wide range of intermediate hybrid products (or packages combining software and services) exists. For example:

- Linux is distributed via free downloadable programs which differ from off-the-shelf products: products sold include modules which integrate proprietary installation, CODEC for video, and various applications (Shockwave Flash, Acrobat Reader, etc).
- Other popular Open Source programs such as MySQL generates revenues via commercial licenses, in view of integrating commercial products
- Another technique, used by Sendmail.com develops proprietary software using basic sendmail functionalities which still belong to Open Source.

Key products developed in open source often become the subject of a commercial proprietary product, and is envisioned as of the project’s beginning. Users often have the choice between the software’s open source version, which is under constant development, and several proprietary versions, which provide complementary functions to serve special needs depending on the targeted population’s specific needs. The additional source code of these versions is not necessarily made public.

Moreover, the sale of IT products linked to the software (advice, support) is for the time-being, the main revenue stream associated with Open Source software. Apache’s success illustrates this point: the software is free or inexpensive and the salesperson’s added value is for the most part generated by the sales of services (specifications and implementation of the Web server, hosting, IT maintenance).

Supplying integrated solutions to provide equipment, software and support services (helpdesk) are also a part of this trend. This is the case when HP provides a suite of open software products (open source software stack) including Linux, JBoss the application server, Apache, the Web server and

MySQL. The interest is twofold: to render hardware products which have associated software profitable and to sell rather sophisticated support services.

Even IBM seems to perceive the new horizons which include promoting new standards, as a means to position the company's proprietary products. This is the case when one opens the environment to develop code under Eclipse as a means to better integrate its Rational product line (modelisation tool). Using the same rationale, IBM donated 85 million dollars' worth of code, representing half a million lines of code in August 2004 to the Linux developer community.

2.3.3 <u>The value chain's off-shore features</u>

The externalisation of a number of programming or service tasks has cast a new light on IP software. As organisations delocalise and send work abroad, the value chain has become international, meaning organisations are potentially less secure and often have new requirements in terms of IP protection.

The software and IT services industry is labour-intensive, and the productivity gains linked to technical progress are currently insufficient to offset the gains reaped by using cheaper and, thus, delocalised personnel. Given the better value for money ratio, companies have started to delocalise their payroll costs. For the time being this phenomenon has impacted the American market, but Europe is also beginning to feel this trend.

Forrester Research currently estimates that for the United States alone, the number of positions which have been delocalised in the services sector alone (which encompasses IT at large) will jump from 400 000 positions in 2003 to 3.3 million in 2015, or approximately 2% of the working population. This means that the United States will lose approximately 450 000 positions, representing 8% of the sector's workforce. According to Gartner Dataquest, more than 80% of America's corporate decision makers question the virtues of delocalising specific IT tasks.

Western IT service providers delocalise their business, attracted by the low costs as well as the high quality of available human resources in the sector and outside of the OECD. As such, India will soon be the world's leading country in terms of the number of companies which are SEI-CMM and ISO 9000 certified. Each year, more than 75 000 IT engineers are created and the country has no less than 320 universities, 132 engineering schools and 700 private institutions for IT training

American companies appreciate India's offshore opportunities; as such key players have built development centers, be they IBM, AT&T, Novell, Texas Instruments or Hewlett Packard. Moreover, a number of companies, from aeronautic transportation to banks and including insurance companies, hotels and department stores use Indian IT services on a regular basis.

India has accompanied its IT development with a specific industrial strategy. The sector's development has been strong due to the creation of a special environment: lower import duties for equipment, flexible intellectual property laws, high level training programs, and the development of high speed and very high data rate subscriber line (VDSL) telecommunication networks (deregulation, public investments and grants, and so on).

Companies working in the sector and which have industrialised production already use (or will soon use) offshore production. For Business Objects' Hervé Couturier, vice-president for Business Development, his company already sub contracts some R&D work to Apar, « *tasks requiring little added value and which are repetitive are allocated to zones with lower payroll costs. For example, we delocalise the maintenance for products nearing the end of their life cycle* » [41].

2.4 <u>A complex specification for modern intellectual property systems</u>

The current debate on software patents echoes questions raised in the XIXth century, in the heat of the industrial revolution. And even in the XIXth century, the date ranged from micro (incentive for economic agents) to global (impact of patent systems on exchange flows and international investments). Philosophical points regarding the monopolistic (even temporary) appropriation of knowledge were raised. Reality principle, however, won over and the XXth century saw the progressive build-up of protection systems largely revolving around patents (or at least a system which included patents). We do not know if other development paths, not centred on patent, would have seen the day.

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41) Burger C., Discazeaux O. (2003), SSII : la délocalisation d'activités en passe d'être industrialisée en France, 01 Informatique.

But History did not go down such a route, namely due to international interdependence. If we were to carry over the lessons learned, the question we would most likely ask today would be: *« what scope for a software patent?* » rather than « *do we need a software patent?*» This is the path Europe chose in 2002 with its Directive. By choosing CII and by emphasising the technical effects, the Directive's destination cannot, *ex abrupto*, be considered as searching for software patentability. Of course the refined definition of the Directive's key elements, starting with the technical nature of the invention is hardly trivial and deserves the full attention it is currently receiving. But stating that this is only a first step towards the patentability of business methods or, moreover, ideas sounds strange, as if the American system were being judged on European territory.

We have seen that Europe differs greatly from the US and even Japan. In the United States, legal jurisdiction has opened the door very wide regarding patentability. And this point should not be overlooked. But patenting ideas and business methods is neither Europe's motivation nor in its collective interest. The European process to build its rules leaves little leeway to extend the definition as the US has done.

Defining an efficient system to protect IP is not simple. A number of subject-rich events such as the explosion of Open Source (and its positive impact on technical progress and competition), hybridation or off-shore, must be assessed. This direction will, undoubtedly, lead us to look farther than yesterday's viewpoint, and go beyond the secret or the copyright, to satisfy the diverse and complex needs to protect IP.

3 STAKES LINKED TO THE EU'S INDUSTRIAL COMPETITIVENESS

Although the terms of the debate are not simple, we must convince ourselves that a *status quo* or highly restrictive patent conditions (especially given the technical nature of CII) has both a price tag and/or hidden costs for Europe's industries.

The analysis which follows focuses on the pitfalls to avoid:

- Obviously, apart from SAP, European firms are not the crux of the current software industry (and will undoubtedly remain so in a foreseeable future), but CII patentability is above all about embedded software and, could potentially, impact many of Europe's industrial leaders (§3.1).
- More, considering that SMEs are, by nature, underutilising these tools, the resulting analysis is both partial and static. A number of facts underline the importance in providing companies with easy access to these tools, to find the right protection and to improve their credibility when applying for dedicated types of financing like venture capital. And, as current data confirms that SMEs have been granted CII patents by EPO, the thesis that SMEs are "excluded" from CII patents is not solidly grounded (§3.2).
- Finally, the CII patent debate is part of an overall international interdependence and stabilising patentability rules is key for economic relations with the rest of the OECD countries (primarily the United States) and with tomorrow's giants, India and China. Moreover, the Directive's first objective, seeking intra-European harmonisation, might not be regarded as a minor goal (§3.3).

3.1 Embedded software as assets for European firms

3.1.1 Defining embedded software

Differentiating between the inventions that were patentable and those which were not used to be very simple. With today's invasion of software, both embedded and hidden, this has become very difficult.

Although we have all used packaged software, we cannot extend this use to define embedded software as being software which is "not off the shelf". Especially since, a growing part of embedded software is comprised of packaged software which performs a special task within a device. The two following definitions provide complementary information to define the concept:

- *"[Embedded software is] software that is part of a larger system and performs some of the requirements of that system; e.g. software used in an aircraft or rapid transit system. Such software does not provide an interface with the user"*[42].

- *"[Embedded software] can be as simple as the microcode instruction set of a microprocessor or as complex as the security software inside a set-top cable modem box. Embedded software performs a specific function not under the control of the primary user and is often used in conjunction with a digital signal processor (DSP) and mixed-signal devices to form a DSP Solution"*[43].

According to the most widely accepted principles, a patent is granted to an invention having a technical effect. Both definitions insist on the fact that embedded software is precisely the part of software which has a technical effect: "*performs some of the requirements of that system*", "*performs a specific function*".

3.1.2 Strategic, even if not visible by national standards

Embedded software is a component housed in many manufactured products and across various fields: aeronautics, automotive or defence to name a few. Consequently, identifying embedded software is not easy, because at least ten industrial sectors, are concerned (according to the French accounting system).

Even though it is impossible to present an overall evaluation because of lacking data, we can reasonably say that the embedded software market represents dozens of billions of euros in Europe. For France, the UK and Germany alone, the 2003 figures account for spending of 20 billion €.

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42) www.validationstation.com/glossary/glossarye.htm

43) www.ti.com/corp/docs/investor/ar97/glossary.htm

Figure 2: Definition of the main industrial sectors that use embedded software

NAF code		Number of enterprises by number of employees <20	20-100	100-500	500-2000	>2000
29.4 29.5	Machine Tools Industrial Equipment	3 702	757	145	8	1
29.7	Electric Appliances	221	52	41	8	-
30	IT Office automation	594	75	39	11	1
31	Electrical Equipment	4 041	676	313	57	1
32	Electronic Appliances Telecom.	2 605	535	167	43	6
33	Medical Equipment	12 540	921	217	26	-
34.1	Automotive	1 983	431	227	67	15
35.1 35.2	Naval/Rail	2 383	140	56	14	8
35.3	Aerospace	341	83	56	35	9
40	Electricity/Gas	6 824	1 346	368	32	1

Figure 3: Embedded software spending in Europe in 2003

M€	France	UK	Germany
Total embedded software expenditure	6 400	5 500	8 100
Of which sales of standard software	150	120	500

Source : Pierre Audoin Consultants (2004)

Comparing these figures with the packaged software market, we see that in Europe, the entire IT Market totalled 260 billion €. In France alone the IT market represented 45 billion €, 25 % represented packaged software.

France ranks second in Europe, and fourth worldwide, behind the US, Japan and Germany. An overview of the French embedded software "market" in 2003 points to:

- Expenditures totalling 6 400 M€ and 47 900 jobs (18 % of a total 270.000 developers).
- This sector is clearly distinct from packaged software since standard software sales in embedded systems account for 2.5 % of the market: 150 M€
- About 3 000 companies (over 50 employees) develop embedded software.

Figure 4: IT market in Europe in 2003

	IT market in M€	Market share	GDP share
France	45,476	17%	2,9%
United Kingdom	58,335	22%	3,7%
Germany	57,147	22%	2,7%
Italy	22,013	8%	1,7%
Spain	10,213	4%	1,4%
Austria	6,021	2%	2,7%
Belgium / Lux	7,207	3%	2,7%
Denmark	5,82	2%	3,1%
Finland	3,414	1%	3,1%
Greece	1,667	1%	1,1%
Ireland	1,989	1%	1,5%
Netherlands	14,362	5%	3,2%
Norway	5,366	2%	2,8%
Portugal	2,246	1%	1,7%
Sweden	9,8	4%	3,7%
Switzerland	10,078	4%	3,5%
Western Europe	262,153	100%	2,7%

Source EITO 2004

These results can mainly be attributed to the strong position of the French defence/aerospace industries, as well as, to some growing markets such as automotive and electrical/electronics equipment. A number of French industries however, such as IT equipment, or consumer electronics/electrical appliances have faced delocalisation problems. This trend hurts the growing demand of "intelligence" embedded in products and may explain the relative weakness of demand for embedded software in these sectors.

As the market's number three, Germany represented in 2003:

- 8 100 M€ in spending and 63 500 software developers.
- 500 M€ in standard software sales in embedded systems.
- Around 3 900 companies (more than 20 employees) use and develop embedded software.

This result is due to the German automotive industry's strong position with a fast and growing demand for electronic components. More, the manufacturing industry is highly automated, consequently requiring a high level of embedded intelligence. Compared to France, the UK and the US, Germany's embedded software in the defence and aerospace sectors is relatively weak. As in France, globalisation has impacted the electronics sector with development activities shifting to other countries/regions, mostly in Asia.

Thus, embedded software is behind the innovations which have become key to the success of European and American industries. As it extends beyond the automotive, telecommunications and manufacturing sectors, embedded software is now a part of national security with jet fighters and tanks, military intelligence, strategy and battlefield tactics. Software innovations also run national infrastructures such as dams, bridges, electric power grids, transportation systems and water supplies.

3.1.3 The propensity to protect embedded software

Embedded software is probably the most 'patentable' part of software. It is designed to have a technical effect, so it is in the scope of the CII directive. Indeed, each version of the Directive project specifically aim to protect this type of software.

Indeed, most of the 30 000 CII-dedicated patents already granted by the EPO were for manufacturing sector firms. The situation is the same in the USA where between 1976-2002, 75% of all software patents issued, given to manufacturing firms[44].

McQueen and Olsson (2003) analysed this phenomenon using a bibliometric technique over 1993-1998. On a country-by-country basis, they measured software-related patent application assignments in relation to all patent applications. The figures below shows a comparison for 1996, indicating that software-related patent applications were especially common in Germany, Spain, Norway and Finland, and relatively rare in the United Kingdom, Italy and Switzerland. Germany deserves special attention since it accounts for 50% of all these European patent applications.

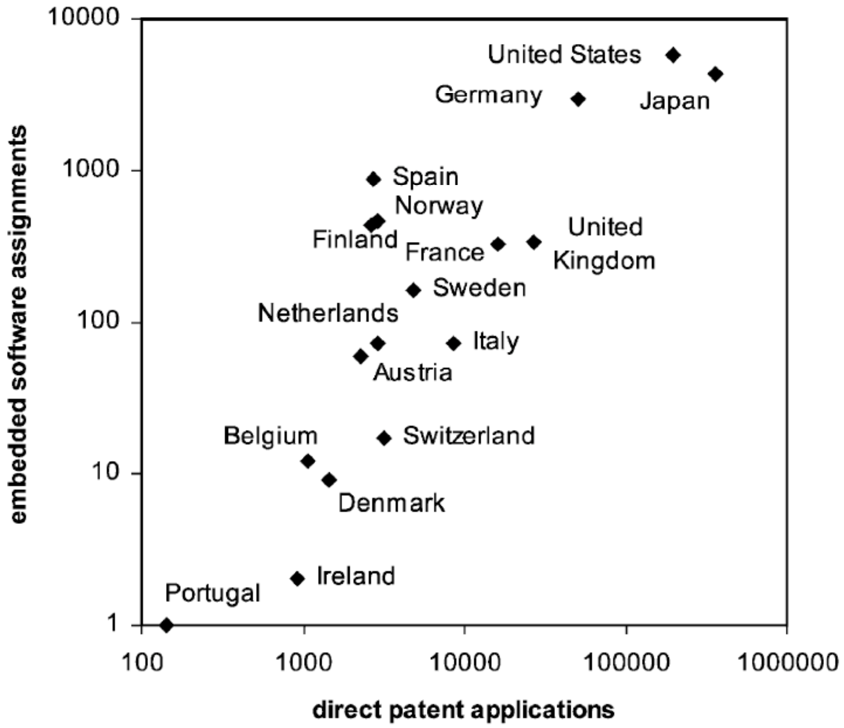
This work has been prolonged by McQueen (2005) according to whom:

> "*Three years later the very high numbers of software application assignments for Germany, Spain and Finland dropped significantly toward more "normal" levels while that for Norway remained high. With the exception of Ireland, for which the*

44) *Bessen J., Hunt R.M. (2003), An Empirical Look at Software Patents, MIT and the Federal Reserve Bank of Philadelphia, working paper.*

numbers are too small to be reliable, changes in the positions of the other countries between 1996 and 1999 were small."[45]

Figure 5: The national weight of embedded software patenting



Source: Mc Queen (2005) based on WIPO data

Embedded software is a highly strategic, if not the most strategic, sector of European industry. Indeed, embedded software crowns all of Europe's top success stories like Airbus, Ariane, nuclear plants, and is at the base of all the modern weapon and defence systems. Part of this software is not geared to being open to competition through patent (military or security critical application), but most software needs a strong legal framework. Considering the stakes, it would be inconsistent not to adopt a legal framework meaning a very high quality patent for embedded software.

45) *McQueen D.H. (2005), Growth of software related patents in different countries, Technovation, 25.*

3.2 A re-examination of the issue of patents for SMEs

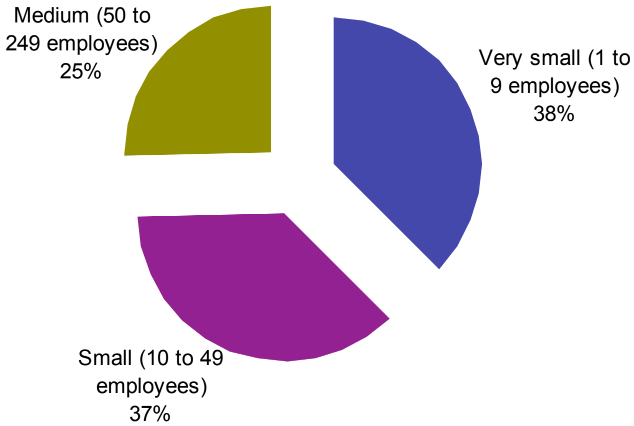
How SMEs effectively use and could use CII patents is another thorny question and the number of SMEs against patents cannot be overlooked. A number of points handled below, should help us review the question thoroughly. More, it is important (even if we do not fully develop the points here) to note, that in light of off shore contracts, smaller companies are also dependent on the capacity of their contract givers to protect embedded software.

3.2.1 The general benefits of the proactive use of patents for SMEs: a French case study

The first point to take into account is that innovative SMEs with a proactive strategy in terms of patents commonly benefit of it. In 2004, the French INPI (Institut National de la Propriété intellectuelle) carried out a general survey on the French SMEs which had filed for patent inventions in 1999. This survey assessed the overall role of patents as a tool to protect IP for SMEs. The survey did not focus on software. This study was of special interest since it stressed the performance of a complete set of SMEs over a significant period of five years.

Among the French firms that patented inventions in 1999, SMEs represented the largest category: 1.408 over a total of 2.735 (51 %), while big firms accounted for only 684 (25 %). Within the SME category, 38 % were very small firms with less than 10 employees.

Figure 6: Size of the SME firms filing for a patent in France



Source: INPI, 2004

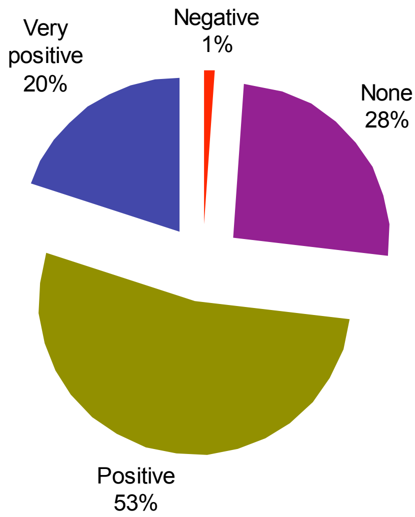
On average, SMEs patented only 1.3 inventions each (1.800 patents), while big firms patented an average 8.4 inventions (5, 721 patents). The SMEs filing for a patent were as follows: 17% were less than 3 years old and 18% were between 3 and 7 years old, which means that a third of them were young firms (only 3 % of the SMEs were granted a patent at creation of the firm). A majority of the firms belong to the industrial sector (62 %), with another 20 % in the services sector and 14 % in trade. Finally, the patent granted in 1999 was not the first for 63 % of these firms, and 25% of these companies filed at least one patent per year.

These firms filed for patents for conventional reasons:

- To protect their inventions against piracy: mainly the case of medium size firms selling standalone products and to defend themselves in case of legal battles.
- To reap revenues from their innovations by licensing their invention to very small firms which want to attract investors.

The study's key finding shows that SMEs which file for patents are healthy companies with on average major growth: +43 % number of employees, +33 % revenues, +200 % in R&D investments, ranging from 150.000 to 350.000 €/year. More relevant, these companies positively auto-evaluate the effects of their patent filing policy as clearly indicated in the next figure. The very low rate of negative answers shows that the fear of losing their corporate secret represented by the patent is clearly unfounded.

Figure 7: Impact on business development



Source: INPI, 2004

40 % of the SMEs, however, declared to have faced litigation during the period under review (attack or defence). Of these suits, 74 % are litigations with same-size firms while only 20 % occur with big firms and 6 % with both big and small. These court cases are more often than not, settled out of court.

3.2.2 The role of SMEs in software innovation processes: focusing on Finland

Finland is Europe's most techno-dynamic country and its R&D investment in relation to GDP is two times higher than the EU average. More, the number of high tech patents per capita ranks first. These figures alone prove that Finland has a consistent national system of innovation.

A study carried out between the 1980's and 1990's on a panel of 1600 Finnish innovations, of which 219 were software-related assessed the dynamics of software innovation. The following findings deserve special attention as they help key perceive the function of SMEs:

- This analysis reveals that software innovations were the driving factor behind the growth of innovation in Finland. More, innovation accelerated over the period studied.

- With this global backdrop, SMEs were responsible for half of these innovations, since most of these patents were filed by start-ups of no more than four years or by companies with less than 10 employee and with a profile start-up.
- The study also confirmed that software is not produced exclusively by software firms, so it seems logical that "*the software sector produces about a half of all commercialized software innovations, and the rest is produced in a variety of industrial and service sectors*" (p.32).
- Half of these innovations sold for at least two years after the initial idea, 70% broke even over a maximum period of two years and 60% were exported.

By the way, the Finnish case echoes the fact that the software industry is not a very concentrated industry. MANN (2004)[46] studied the structure of the American software industry and showed that the top ten firms in software industry account for only 32 % of industry total sales. When compared with other major industries, this percentage appears extremely low.

3.2.3 Patents as signal for venture capitalists

Generally speaking, start-ups finance their growth and innovation via investors, while 'standard' SMEs rely on their own financial resources. Pierre Haren, Ilog CEO, remembers :

> « *When we created Ilog, capital-risk hardly existed in France. Today, this is no longer true. In 1987, the French government via INRIA (French National Institute for Research for Software and Automation) invested 875 000 Francs [approximately 130 K€] in Ilog, requiring the signature of four ministers*»[47].

In two decades the setting has undergone a sea-change. Between 1999 and 2003, the European Equity and Venture Capital industry financed 6 400 companies developing software, representing a total invested of more than

46) MANN Ronald J. (2004), The myth of the software patent thicket: an empirical investigation of the relationship between intellectual property and innovation in software firms, American Law & Economics Association Annual Meetings.

47) Pierre Haren, Ilog CEO, "Samsung utilise nos produits pour tuer STMicro, c'est dramatique", in Le Monde, 12/05/2005.

10 billion €[48], averaging to 1.5 M€ per firm. This study suggests that in Europe venture capital, is crucial for software start-ups or for start-ups with software related innovations.

Venture capitalists seem to be particularly sensitive to patents to secure their investments. A survey about companies benefiting from European venture Capital Association (EVCA) reported that 60 % of the companies supported have as patent[49] dependent business model.

And software is no exception to this preference. Representing 900 members, the EVCA expressed the necessity of a patent for CII. Their rationale is that when undertaking their due-diligence, venture capitalists consider dependence of the product on a specific patent, competing patents and the strength of the protection.

In summary, patents both contribute to the reduction of risks and of asymmetrical information for financial investors during the first stages of SMEs:

- The patent signals the level of protection built by the firm to preserve the future revenues of its invention.
- But, in a more subtle way, it indicates the credible commitment of the team leading the project. If the managers accept to pay the patent-related costs (direct and hidden), it means that they anticipate a high value for their invention.
- Since venture capitalist cannot always directly assess this future value, the patenting strategy can be used as a tool to signal that value.

This idea is also put forward by Hall: "*for new entrants, especially in complex product industries like electronics where patents were previously unimportant, ownership of patents may have become an important signal of viability, especially because these firms have a median intangible to tangible asset ratio of above one half. That is, as the venture capitalists argue when considering funding these firms earlier in the life cycle process, patents are essential to provide a claim on the most important asset of the firm, its knowledge capital*." [50]

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48) « Money for growth », annual survey conducted by Thomson Venture Economis and PricewaterhouseCoopers

49) EVCA Barometer issue October 2003.

50) Hall H. (2004), Exploring the Patent Explosion, ESRC Centre for Business Research, University of Cambridge.

3.2.4 The place of SMEs in European CII patents granted

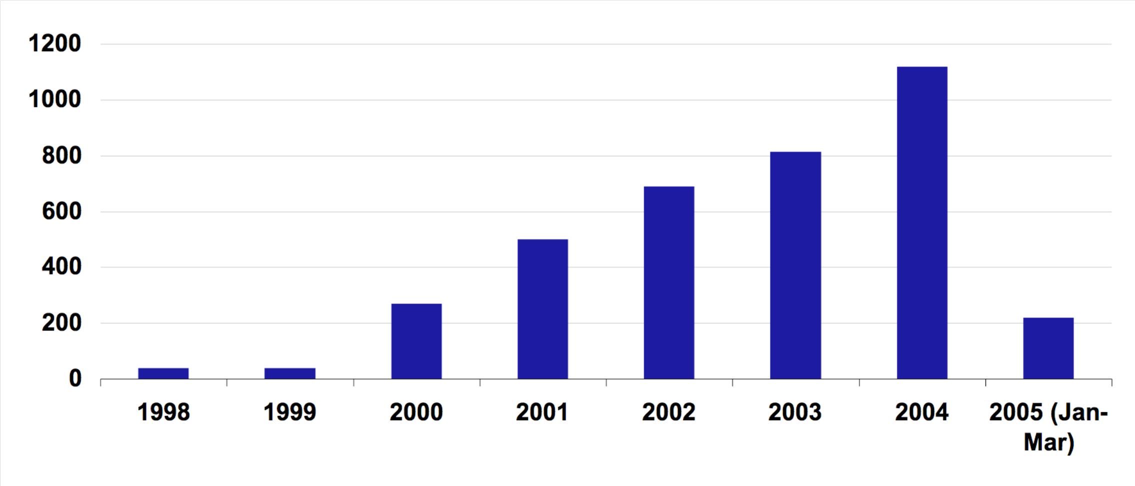
As a final element of our reasoning, let's consider the participation of SMEs in CII patents in Europe. Johnson (2005)[51] provides a relevant investigation based on a review of recently awarded CII patents in the database of the European Patent Office.

The overall conclusion of this research is that SMEs do not differ from the flow of CII patents delivered by the EPO. For example:

- SMEs account for more than 20% of all CII patents granted since 1998, with a rising annual number (from less than 300 in 2000 to more than 1.100 in 2004). This proportion of 1/5 has remained constant since the beginning of the period.
- In terms of stock, 3.700 CII patents were granted to more than 2.000 SME's and individual inventors. 81% of the assignees filed for a single patent and less than 1% have ten or more documents.
- We have a confirmation that CII is not limited to the computer industry *stricto senso*. IT creation ranges across a number of industrial activities from office and computing machinery sector (900 patents) to machinery/equipment (941), radio/television /communications (554), measuring instruments (422) and transportation equipment (64).
- A key element to account for is that CII patents are widely used by non European SMEs with United States and Japan accounting for almost half of all documents. In European countries, Germany contributes 10% and Great Britain for 8%.

51) Johnson K. (2005), European Patents on Computer-Implemented Inventions Issued to Small and Medium Enterprises, Colorado College.

Figure 8: SMEs CII patents issued by EPO



Source: Johnson (2005)

This research presents a real added value for the current debate as it leads to reconsider the generally admitted idea that SMEs were evinced of the CII patenting. And we can put forward the hypothesis that this result has been minored by an informational bias.

This is what the results of the Tang & alii (2001) inquiry suggests:

> "*Only one quarter of the SMEs indicated that they were aware of the fact that the European Patent Office had expanded the scope of software related inventions that may be patented, that is claims to a program are now possible. Similarly, only one respondent SME organisation indicated that they had used the European patent system to protect some of their software inventions*."[52]

52) Tang, P., Adams, J., and Paré, D. (2001): "Patent Protection of Computer Programs: Final Report". ECSC-EC-EAEC Brussels-Luxembourg. For different reasons, Johnson (2005) also considers that his results are conservative: "In summary, our methodology should be regarded as a conservative means of identifying a statistically reasonable and representative cross section of CII patents filed by European SMEs. The final data extraction may have patents that are no CII, may not be SMEs and certainly we have likely overlooked some number of SME-CII patents. However, we believe that the general scope and trend data are representative of macro-economic IP trends in Europe » (p.4)

3.3 Costs and risks of international heterogeneity

CII patentability should not be exclusively addressed in a purely microeconomic manner. The efficiency of the system to be implemented is, in fact, impacted by the relative choices made outside of Europe. In other words, defining an optimal system "in vitro" does not make sense since the efficiency is contingent to choices made outside of Europe. This extra-European dimension does not induce the necessity of a perfect regulatory homogeneity with commercial partners or competitors. But, given the fine-tuning period of the final Directive (e.g. the discussion about the "technical effect"), the moment is appropriate to remember the overall context. And, by the way, the initial objective to introduce some internal coherence in Europe as to drop internal barrier to mobility should not be forgotten.

3.3.1 Potential costs of widened asymmetries between Europe and the USA

Within the OECD, patent systems historically tend to converge towards stronger protection. This phenomenon has been highlighted by Lerner (2002)[53] who analysed 177 policy shifts in 60 countries over a 150-year period. His main finding is that a stronger patent protection is the long period trend with a combination of extending patent protection length and patent subject matter. This trend was analysed over 1960-2000 by the OECD for Japan, USA, France, UK and Germany[54].

In terms of IP software a too-pronounced USA-Europe asymmetry might lead to following configuration:

- In the USA, erecting an important barrier to entry for European software that potentially infringes on the rights of US software. The consequence is that the US market is more concentrated and can provide a better return on investment.

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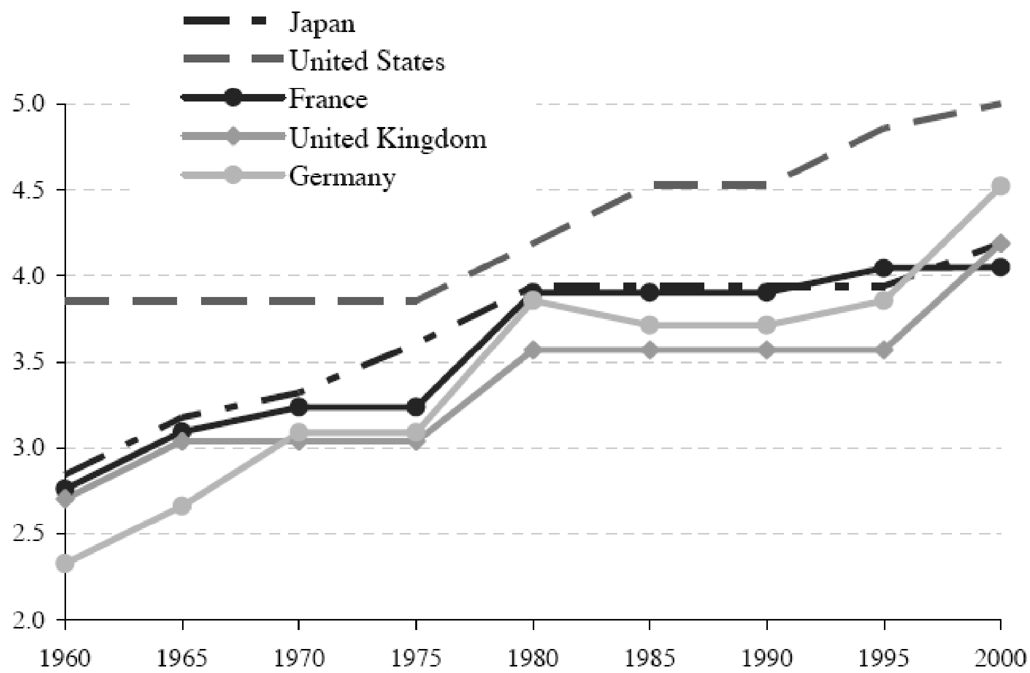
53) Lerner J. (2002), 150 Years of Patent Protection, American Economic Review Papers and Proceedings, 92.

54) Guellec D., Martinez C. (2004), Overview of recent changes and comparison of patent regimes in the United States, Japan and Europe, Patent innovation and Economic performance, OECD conference proceedings.

- In Europe, competition focuses on software offering the same features as its US counterparts since US software can be imitated.

Figure 9: Patent strength index, 1960-2000



Source: Guellec and Martinez (2004)

Stronger IP in the USA compared to Europe could foster and concentrate R&D efforts in the USA, whereas European consumers benefit from competition set off by software imitation. In short, the asymmetry could also lead limit firms' incentive to invest in the country or the economic area which provides insufficient IP.

This negative potential effect is stressed by Branstetter, Fisman and Foley (2002):

> "*In the absence of strong IPR protection, multinationals may limit the deployment of certain critical technologies – typically, more advanced technologies -- for fear that they will be imitated by local rivals. The*

existence of stronger IPR could induce multinationals to deploy these technologies because they now have a legal remedy against imitation."[55]

Another license-related effect is that markets which protect software are more attractive. Licenses can be considered as a key factor for innovations occurring on the basis of a first 'radical' invention. There could become a global effect due to the fact that IP homogenisation creates or develops new markets by inducing R&D projects.

This asymmetrical situation between two countries or economic areas can be illustrated by the classical "prisoner's dilemma". The idea here is that asymmetry may have hidden costs, even if, by hypothesis, one considers that a patentless system might be superior to a patent-based system.

Let's compare the USA and Europe in two opposite situations, software patentability and software non-patentability. Even if the reward is the highest when the two players simultaneously decide not to grant software patents, the only stable equilibrium consists on patenting software on both sides:

- If one player decides not to patent, the other player can decide to patent and benefit from a competitive advantage for the reasons mentioned above (R&D attractivity, licensing).
- The 'prisoner's dilemma' results are in an equilibrium which is not globally optimal, but which allows the two players to avoid the worst situation for each, when taken independently.

This dilemma can be summarised as follows:

		USA	
		No patent	**Patent**
Europe	**No patent**	(3,3)	(1,4)
	Patent	(4,1)	(2,2)

55) Branstetter L., Fisman R., Foley C.F. (2002), Do Stronger Intellectual Property Rights Increase International Technology Transfer? Empirical Evidence from U.S. Firm-Level Panel Data, Working Paper, Columbia University, December.

3.3.2 Considering IP strategies in India and China

The problem's international dimension is not restricted to the OECD. China and India are taking active positions in software and, as they emerge as industrial powers in an ever-growing range of sectors, they are concerned by the capacity to embed software.

Athreye (2002), in his analysis of the Indian software industry, underlines that IP rights will count:

> *"Through the late 80s and 90s, many more multinational firms followed the example set by COSL and TI. Later multinationals such as Microsoft, HP and Motorola conducted these activities on a much larger scale. Most notable among these are Adobe and Microsoft, who have also filed for patents based upon R&D work done in India."*[56]

China reveals that some countries have the critical mass to offer a sufficiently important internal market for them to thrive (as shown with its own standards in wireless telephony). Alex Banh, CEO of Sun Wah Linux in Nanjing, proposes "*The Asia Open Source movement is gathering momentum for the next stage of explosive growth. Co-operation is the essence to achieve success in any given open source project*"[57].

Porter et al. (2002) tried to measure China's potential in emerging technologies such as optical communications, computer hardware, advanced materials for computing/communication technologies, biotechnology and software. Of the 33 nations they surveyed (based on scientific publications), China ranked between fourth and the seventh, close to countries like Germany, UK and France[58].

What (conservative) lessons shall we retain from these emerging phenomena?

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56) Athreye S.S. (2002), Multinational firms and the evolution of the Indian software industry, Open University, 12, December 2002.

57) www.sw-linux.com . Sun Wah Linux and VA Linux Japan Form Strategic Alliance To build. 1 March 2005.

58) Porter et al. (2002), Measuring national emerging technology capabilities. Science Public Policy, 29. See also Yang D., Clarke P. (2005), Globalisation and intellectual property in China, Technovation, 25. Fai F.M. (2005), Using intellectual property data to analyse China's growing technological capabilities, World Patent Information, 27. Yang D., Sonmez M., Bosworth D. (2004), Intellectual Property Abuses: How should Multinationals Respond? Long Range Planning, 37. Wang L. (2004), Intellectual property protection in China, The International Information & Library Review, 36.

- A patent is a tool to establish cooperation with Asian firms. As such 2/3 of the patents granted by the Chinese State Intellectual Property Office belong to foreigners. And 50% of the EPO patents granted to Chinese firms are in fact share with non-Chinese firms. In such a prospect, a patent is more appropriate than copyright, even in the field of software.
- The Open Source movement may induce an acceleration of the Asian catching-up process and contribute to erode some European comparative advantages[59]. Even if the wide diffusion of technical progress may be associated with strong positive externalities, this specific issue has to be stressed.

3.3.3 <u>It's time to homogenise the internal rules within Europe</u>

One final international issue is internal to Europe and is the main priority of the Directive on the CII patent. This issue is clarifying a situation within Europe where different administrations (European and nationals) apply different rules. There is no need for a specific demonstration as this issue is obvious:

> "*While statutory provisions setting out the conditions to grant such patents are similar, their application in case law and the administrative practices of Member States diverge. There are differences, in particular, between the case law of the Boards of Appeal of the European Patent Office and the courts of Member States. Thus, a computer implemented invention may be protected in one Member State, but not in another. This implementation process has direct and negative effects on the proper functioning of the internal market*"[60].

For example, regarding software patentability EPO law can be regarded as more liberal than the individual laws of EPO member countries, such as Spain or Switzerland.

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59) Akamatsu's paradigm of "flying geese" of dynamic advantage has accurately depicted the East catching-up process and may be read again. See Kasahara S. (2004), The flying geese paradigm : a critical study of its application to east asian regional development, UN Conferences on Trade and Development, Discussion Papers, n°169.

60) Proposal for a Directive of the European Parliament and of the Council on the patentability of computer-implemented inventions COM(2002) 92 final 2002/0047.

This situation is not specific to CII. Efforts to homogenise IPR rules in Europe have been underway for more than 40 years. The idea that a “common” market must encompass a common patent goes back to the Treaty of Rome[61]. But this goal has not been achieved since there is no stable consensus on a Community Patent (notably for language translation reasons). The consequence is that the average cost to obtain and maintain a European patent designating eight countries was approximately three to five times the cost to obtain and maintain a patent in Japan or in the US in the same year[62].

The present situation induces hidden costs in the field of CII, since it’s difficult to develop a strong industry where software plays an ever increasing role (as embedded software or as such), and which is furthermore, a costly system where legal frameworks coexist. This heterogeneity is one of the reasons why some European firms prefer be legitimated by American software patents.

Of course, the patent issue is not the sole factor inducing internal costs and leading to a European area which is less homogeneous than the US. Nevertheless, the specific problem linked to the divergent conditions of CII patentability in Europe must be solved as soon (and coherently) as possible. Notably because SMEs are obviously more sensitive to the afferent consequences.

3.4. An unconstructive ambiguity for European firms

Not all of Europe’s lobbies (or at least those which voice their opinions) have converging interests regarding IP software. If this were so, there would quite obviously be no debate. Looking beyond these oppositions, it is surprising to observe that the current situation, is as complex as it is ambiguous: Patents already granted have been attributed in regulatory loopholes, and SMEs find obscure or little known laws to protect their inventions.

While some ambiguity may be constructive economically speaking (e.g. in terms of monetary policy), this is not true here. Since CII patentability mostly implies firms which have embedded software in their products or industrial processes,

61) Schatz U. (2004), Recent changes and developments in patent regimes: a European perspective, Patent innovation and Economic performance, OECD conference proceedings.

62) Schmiemann M., Lockner R. (2005), Technology Commercialization in Europe after the Failure of the Community Patent” Paper presented to the ninth biennial EUSA conference.

the ambiguity focuses on a wide range of European champions, from various sectors. Even if some 20% of the patents have been filed by SMEs, it is hard to imagine this figure going up much further without being clearer.

The status quo is, therefore, quite costly, even if, these costs are hidden. In this chapter we have tried to show that the associated stakes for Europe's industries are not minor ones.

4 THE EUROPEAN UNION IS WELL GEARED TO DESIGN AN INSTITUTIONAL FRAMEWORK AIMING AT EFFECTIVE AND BENEFICIAL CII PATENTS

4.1 Identifying problem spots of the American software patent system

If we compare the application of patent law in the American market with European jurisprudence, the European patent system can be regarded as an "exclusion system," in which the invention is carefully examined by the EPO prior to issuing the patent. This is the opposite of the prevailing US patent system which is an "inclusion system", where a patent can be easily issued by the USPTO, but in which patent risks can also be invalidated by the courts more frequently.

The origin of this difference is solely legal and not due to diverging patent conditions. Founded forty years the "legendary rigor" of the USPTO examiners has progressively loosened up as the number of patent applications filed in the United States has increased, to the advantage of ICT enterprises. Today, a number of analysts state that 60 % of the U.S. patents issued have been invalidated through court proceedings[63]. The deeply litigious-conscious US has granted software patents to companies seeking to protect their software and business methods, making software patents legally dependant on the court's good will.

In this context, an increasing number of companies have made trading patents a business activity instead of filing patents as a means to promote R&D. These companies practice a form of legal terrorism. They research the similarities between various patents, to find the infringements, and then obtain compensation, either after negotiations or through onerous legal actions.

A problem spot is the so-called hidden or submarine patents: a company secretly navigates the patent application process for a computing format in order to reveal it if the format gains wide acceptance. If the trapped companies do not cooperate with the submarine patent holder, they may suffer from

63) Michaux B. (ed) (2003), Introductory report « software, business methods & patents », Arcelor Chair, University of Louvain (2003).

litigation and it has become clear that these practises impede innovation in the software industry[64].

On both sides of the Atlantic, the higher number of patents has also mechanically led to the creation of real patent portfolios for some businesses (IBM, Microsoft, etc…). First, patent portfolios are allegedly intended to promote the creation of research centres and joint industrial projects, mergers and acquisitions and the transfer of knowledge between companies. Second, patent portfolios can be used to prevent patent-less candidates or candidates with only a few patents, from entering an industry or developing a market. Market entry candidates are being threatened, by incumbent players, with infringement suits that new candidates generally do not have the means to finance.

Building patent fences around discrete innovations can constitute, according the metaphor used by Carl Shapiro[65], patent thickets implying strong inefficiencies in the innovation systems. Patent thicket can best be described as "*It is as if, in order to develop new software, one first has to clear a path through a dense undergrowth of patents or risk inadvertent infringement*" (Campbell-Kelly 2003).

4.2 A traditional focus on technical effects in Europe

By many respects, the US case is frightening. But, in the heat of the debate, the very essence of the European Commission's proposed CII Directive seems to have been forgotten. The Directive's purpose was to ensure that pure software would not be patented, and presents a consistent and efficient patent regime across all Member States. Pure software, algorithms and business methods, as well as "trivial patent applications" are explicitly excluded from the proposed directive. For instance, the famous "Amazon one click" software patented under the United States regime in the nineties could be neither patented in Europe today, nor under the directive proposal[66].

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64) Evans D.S., Layne-Farrar A. (2004), Software Patents and Open Source: The Battle Over Intellectual Property Rights, summer, Virginia Journal Of Law & Technology Vol. 9, No. 10, University of Virginia

65) Shapiro C. (2001), Navigating the Packet Thicket: Cross Licenses, Patent Pools, and Standard Setting, in Jaffe A. et al. eds., Innovation Policy and the Economy.

66) McGann M. (2005), Software Patents | Industry Comment Myths & Misunderstandings, the Parliament magazine, 65.

The overall institutional process has been driven to keep a safe distance from the American system. The European Commission has accepted the new term "computer-implemented inventions" to explicitly oppose the software patent used in the USA. It does not mean that, "as such", the reference to CII was sufficient to draw aside all risks (and the common efforts to define ex ante the notion of technical effect is useful). But, it clearly expressed a political orientation, not found in the Japanese reform of 2002.

The new directive is not a novelty, it legalises current European Union jurisprudence to create visibility and provide a safer framework for the business community. The European Commission's directive proposal provides a better-defined scope of action than the current practice in United States. On the contrary, the criteria on which patents will be granted according to the directive are not as permissive as those finally imposed by American jurisprudence. The European directive does not discard the fundamental basis in which EPO jurisprudence is built and merely prolongs the effect of technical criterion. Whereas the American system relies on the "utility" criterion, the European approach is based on the "technical effect"[67]. Even if the notion needs to be more precise to be fully operational, the basis for preventing abuse is set in the proposal.

Both drafts insist on reaffirming that a new technical contribution is a prerequisite to obtain a CII patent. This requirement cannot be satisfied simply by using a computer programme to execute the innovation. Further, under these drafts, neither pure software alone nor business methods are patentable. Contrary to widespread belief, both the Council's and the Parliament's drafts prevent the extension of European patent law towards the American model[68].

The number of "CII patents" in Europe does not compare with what has happened in the United States. To date, roughly 30.000 patents have been granted compared with the 20.000 patents granted annually since 1998 in the United States[69]. There is no acute risk of software patent explosion in Europe as the directive proposal aims at echoing the already mature and stable

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67) Liotard I. (2002), La brevetabilité des logiciels : les étapes clés de l'évolution jurisprudentielle aux États-Unis, Revue d'Economie Industrielle, Numéro spécial, 2e trimestre.

68) Lind R.C. (2004), Choosing a Way for Europe on Patents for Computer Implemented Invention, Charles Rivers Associates, London.

69) Bessen J., Hunt R.M. (2003), An Empirical Look at Software Patents, MIT and the Federal Reserve Bank of Philadelphia, working paper.

jurisprudence and practise of EPO. European patent and national authorities are indeed undeniably more restrictive on granting patents for algorithms, business methods and CII inventions than American authorities due to the excessive blur of non-patentability scope in United States.

4.3 Room for ecosystems combining Open Source and CII patent in Europe

Anti-patent advocates sustain that free software development experienced the same hurdles as traditional software since developers are likely to use existing functionalities protected by a patent. The patentability of proprietary innovations may thus lead to an asymmetric framework where de facto proprietary innovators can directly access functionalities developed by free software. But the reverse relationship is not easy. Moreover, as source codes are disclosed for free software, it is easier to detect licence or patent protection infringements. Necessary precautions increase strong development costs of free software in comparison with the development cost of patented software. Opponents to software patentability argue that a patent system would jeopardise the development of free software if it were to compete with proprietary software.

Members of the open source movement, however, fear that trivial patents might be granted and on the whole are not valuable and are susceptible of being annulled by a judicial authority. In fact, the trivial patents could cover entire programming segments and hence prohibit access to programmers who do not have the appropriate license[70]. By adopting an anti-commercial stance and distributing their software free-of-charge, some of the open source movement affirm that they will not have the financial resource necessary to be used as a negotiation tool.

However, some counter-arguments to this thesis have to be stressed, remembering that the question is “will a CII patent system in Europe threaten the Open Source movement?” and not in general terms “is a software patent a threat?”.

70) Michaux B. (ed) (2003), Introductory report « software, business methods & patents », Arcelor Chair, University of Louvain (2003).

- ✓ It is worth noting that free software and open source have always co-existed alongside proprietary software products, even if the launch of the Internet has considerably enhanced the dynamics of the free software movement. This coexistence has not prevented some free and open source software from becoming "killer apps". The Apache servers and Open office suite software for personal computers (text processing, spreadsheets, etc.) of the versions have succeeded in becoming a real alternative to proprietary equivalent products.

- ✓ Even in the United States where software patents are easily granted, open software remains very dynamic. True complementarity exists between the proprietary world and the free software community, this complementarity cannot be mechanically destroyed because of a patent extension to proprietary software. And, the original goal of the Directive is not to extend the patenting scope, but to define and adapt it. If there is no "regulatory capture", the Directive will not mean the beginning of a Big Bang. In reality, these arguments contribute less to rejecting the principle of CII patentability creations than to legitimate the reinforcement of a rigorous and balanced implementation of the patent systems in IT.

- ✓ As Open Source is often associated with commercial strategies, pleading the lack of financial resources is not completely relevant. Of course, a requirement for free software projects to engage costs to be insured against a "patent thicket" might deter the development of such software. But, the Directive is not dedicated to delivering "tickets for thicket" and the Open Source movement is not completely "free". Commercial interests cover many of the real costs of the OSS movement, and gain financial benefits to offset those costs. For example, in February 2005, Open Source Development Labs raised US $ 4.25 million to fund a new body called the Software Freedom Law Centre[71] which will provide free legal services to open-source developers. In addition, as many OSS vendors are commercial entities with thriving businesses, arguing that the cost of patents is a problem for all OSS developers is oversimplifying the problem. As a final argument, we may say that the highly cooperative orientation of firms like IBM towards the Open Source movement reveal its "sound" bargaining power intimately linked to the efficiency of its model.

71) http://www.softwarefreedom.org/

- ✓ The very nature of the tools means that the patent system is more relevant than the copyright to develop open standards and interfaces. Inventions will be shared more freely and easily between different industries - which can foster product interoperability – because they feel protected as their inventions are patented. The development of the patent pool offers a framework to explore. One can imagine creating a cross-license agreement in which participants can use each other's patents. This will not automatically solve standardisation issues, by widely diffusing patent[72]. This possibility is illustrated by Red Hat's initiative, announced on June 15th, to create a Software Patent Commons to help promote the development of innovative software by sharing information. It means that, for standardisation purposes, the disclosure associated with the patent is better than copyright opacity.

- ✓ Coexistence could be furthered for a wider patent disclosure. This idea is put forward by Caillaud (2003): "*The publication of source codes, particularly on interfaces, and the registration of patents in an easily accessible central database (at the World Intellectual Property Organisation) would facilitate procedures for assessing novelty, enabling users to evaluate the risk of conflict, and could facilitate the establishment of an active market for existing licences and patents. The negotiation of operating licences, R&D agreements or joint ventures and cooperative agreements for sharing software patents must be encouraged, under the surveillance of the competition authorities*" (p.191)[73].

Nevertheless, there is no clear evidence that patents on CII are weapons against Open Source. The US case, even with its inflationary character, did not lead to the disappearance or weakening of Open Source. Moreover, the conventionally less permissive rules on this side of the Atlantic will not define a European-specific battlefield.

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72) Merges R.P. (2001), Institutions for Intellectual Property Transactions: The Case of Patent Pools, in Rochelle Cooper Dreyfuss et al. eds, Expanding the Boundaries of Intellectual Property.

73) Caillaud B. (2003), La propriété intellectuelle sur les logiciels, in Tirole J. et alii, Propriété intellectuelle, Conseil d'Analyse Economique.

5 TOWARDS AN ONGOING ADAPTATION PROCESS?

The publication of the Green Paper in 1997 on Europe's patent system, sparked off a debate, which as of 2000 focussed on computer-related inventions. In July 2005, the European Parliament will have to vote. This decision will be of a strategic importance for many European firms, whatever their size, and, especially, for firms competing on the inventiveness of their embedded software. Considering the evolution of IP software protection in US and Japan, the evolution of industrial strategies regarding software in China and India, there is no necessity to demonstrate once again the degree of importance of the Directive.

But, even after the European Parliament's decision, the debate will continue. Quite obviously, the discussions on this Directive have, above all, underlined the stakes for Europe. More, these discussions highlight unanswered questions on software, and more important, on embedded software. As we move forward towards the future of European technology these issues will stay on the agenda.

Another reason why the decision will not end the debate is because the decision is intimately linked to the Lisbon strategy. Once again, if Europe does not give itself the financial means to spearhead R&D and higher education in member States', then Europe needs a ever more efficient and monitored regulation system, as a means to counter the first handicaps. The 1973 Munich Convention is no longer the appropriate framework, leaving confusion as to sectors well outside of the IT realm. Tomorrow's rules will have to ensure better quality.

This need for efficiency raises the following points:

- ✓ To ensure the system's efficiency, with shorter time delays to meet technological rhythms: delivery windows, timeframe to react, arbitrage timeframe,… This means that the European Patent Office will be endowed with the appropriate means and tools, and that the national counterparts will also have the powers once the national laws are adopted.

- ✓ In the same mindframe, the timespan for patents and their longevity must be shorter to limit strategic use, and once again to account for technological innovation and to provide a quicker diffusion.
- ✓ The patent must vehicle value-rich information, an added value compared to the copyright. Disclosure rules must point to technical progress and steer past research. Creating a European database, for example, may help research in previous findings and improve accessibility to patent offices for firms and scientists.
- ✓ Special support for SMEs may be created to inform, facilitate their patent strategies, share legal expertise and mutualise litigation risks.

Europe needs to endow itself with a quality-level CII patent system — and non-inflationary. Patent systems must not only accompany technical change, they must adapt to change. Since the very beginning, the aim of the Directive is to clarify and harmonise the conditions of patentability of CII and not to open the door to a free patentability of software.

. TABLE OF FIGURES

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