SOFTWARE PATENTS: A CLOSER LOOK AT THE EUROPEAN COMMISSION'S PROPOSAL

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Abstract

This paper attempts an evaluation of the merits of the European Commission's "Proposal for a Directive on the Patentability of Computer-implemented Inventions". The general thrust of the argument will suggest that it is indeed not surprising that the Proposed Directive has generated such an outburst of reactions. Indeed, while the Commission's Proposal has been presented as a confirmation of the *status quo*, it is difficult to question that it will have deep consequences for the design of the regime of legal protection for computer-implemented inventions. The paper addresses three main questions, namely: (a) does the Proposed Directive address worthwhile issues?; (b) is a European Directive necessary?; and (c) is the Proposed Directive likely to achieve its stated objectives? The search for an answer to these questions focuses on the likely impact of the Proposed Directive on legal certainty and innovation.

Keywords: intellectual property, computer-implemented inventions, software.

JEL classification: O34

1. Introduction

The European Commission's "Proposal for a Directive on the Patentability of computer–implemented Inventions"(hereinafter "the Proposal")[1] was introduced on 20 February 2002 for the purpose of harmonizing patent law with respect to computer–implemented inventions. The Proposal has spurred a considerable amount of controversy, becoming the object of perhaps as much criticism as praise[2]. The debate is at present still unsettled. The Proposal, subject to the codecision procedure ex art.251 (former art.189) EC, has been approved by Parliament on first reading with some major amendments. Shortly after, its discussion at the EU Competitiveness Council of 18 May 2003 has, however, led to the endorsement of a text dropping many of the amendments made by Parliament. The next step of the procedure should now be the discussion at the European Parliament on second reading.

In this paper we attempt an evaluation of the merits of the Proposed Directive. The general thrust of the argument will suggest that it is indeed not surprising that the Proposed Directive has generated such an outburst of reactions. Indeed, while the Commission's Proposal is presented as a confirmation of the *status quo*, it is hard to deny that it will have deep consequences for the design of the regime of legal protection for computer–implemented inventions, given that its provisions can be interpreted as implying the extension of patentable subject matter toward a situation nearly indistinguishable from an express deletion of the "as such" exclusion of computer programs from patentability contained in art.52(2) and (3) EPC. This is most unfortunate for at least a couple of reasons. The first is that, by presenting its proposal as a confirmation of the *status quo*, the Commission seems to suggest that no accurate cost-benefit assessment is required so that she does not take the chance of examining thoroughly the economic merits of a policy that is substantially economic in nature. The second is that, even if a sufficient economic justification for a significant extension of patentability were to be found - which does not seem to be the case in light of the economic insights offered in this paper - the purpose of legal certainty is likely to be better served by a direct modification of the EPC, to be sought through the means envisaged by the EPC itself.

In section 2 we draw a brief history of the Proposal, tracing it back to developments at the international level. The major changes concerning the legal treatment of software-related inventions in the United States and Japan are reviewed (section 2.1) before sketching out the current European

[1] COM(2002) 92 — 2002/0047 (COD).

[2] See, for example, the responses to the Commission's consultations, available at `http://europa.eu.int/comm/internal_market/en/indprop/comp/softreplies.htm`.

situation. This is done in section 2.2, where a brief introduction to both statutory law and the recent jurisprudence of the European Patent Office (EPO) Technical Board of Appeal is presented. In section 2.3, the justification for the Proposed Directive is discussed, with a view to identifying both apparent and less apparent objectives set by the Commission's Proposal, which is described in section 2.4. Section 2.5 concludes this part with the identification of the most salient steps pursued so far in the codecision procedure.

Our commentary to the Proposal constitutes the subject of sections 3 and 4. Section 3 provides some preliminary comments on the Proposed Directive by addressing three sets of questions, namely: (a) does the Proposed Directive address worthwhile issues? (section 3.1); (b) is a European Directive necessary? (section 3.2); and (c) is the Proposed Directive likely to achieve its stated objectives? (section 3.3). The main conclusion to be drawn from this discussion is that, while the need for some sort of harmonization of Member States' legislation in the field of computer–implemented inventions is undeniable, serious doubts arise as regard to the appropriateness of the approach chosen by the Commission in order to achieve the objectives of legal certainty and increased innovation, namely that of validating current EPO jurisprudence.

In section 3 we focus on legal certainty and we argue that the objective of legal certainty would be better furthered by a direct modification of the EPC, to be sought through the means envisaged by the EPC itself. The problem with the approach taken by the Proposal, based on the criterion of "technical contribution", is not so much that the word "technical" and therefore the concept of technical contribution are inherently undefinable, but rather that the only consistent way of interpreting this concept in light of the other provisions of the Proposed Directive and of the criteria developed by EPO case law implies an extension of patent protection for computer–implemented inventions close enough to a situation corresponding to an express permission for claims to computer programs "as such". This is not only in contrast with the Commission's statement of purpose, but has also the disadvantage of implementing a legal change of significant economic impact in a way that leaves room to considerable more discretion and uncertainties than an express deletion of the exclusion from patentability of computer programs "as such" contained in art.52(2) and (3).

In section 4, we consider — in light of insights from recent economic scholarship — two issues related to the question whether harmonization along the lines of EPO case law could be considered suitable to promote innovation. The first is whether computer programs "as such" should be patentable (section 4.1) and therefore whether the approach taken by EPO

jurisprudence can be said to rest on solid grounds from the perspective of economic theory. The second question concerns the way in which some of the drawbacks of the patentability of computer–implemented inventions previously identified can be limited. Addressing this issue provides us with a further chance of commenting on the question whether the balance struck by the Proposed Directive is likely to be appropriate. Section 5 concludes.

2. History of the Proposed Directive

2.1. International Context

The substantive history of the Proposed Directive can be traced back to developments at the international level. In particular, the U.S. Supreme Court's 1981 decision in *Diamond vs. Diehr* should be considered highly significant in this respect[3]. The mentioned decision determined a reversal of attitude with respect to the suspicion with which software-related patents had been regarded during the 1960s and 1970s both by the United States Patent Office (USPTO) and by the Supreme Court. In *Diehr* the Court held that the realm of patentability is precluded only to "laws of nature, natural phenomena and abstract ideas" which "should be free to all man and reserved exclusively to none" and that the mere inclusion of a mathematical algorithm or computer program in a claimed process does not imply its exclusion from patentability. In reaching its decision, the Court relied on its previous holding in *Chackrabarty*, where it had interpreted Congress' intention to be that of granting patents for "anything under the sun that is made by man"[4]. *Diehr* opened the way to the patentability of processes that involve the utilization of software, although it did not go as far as to recognize the patentability of computer programs by themselves.

Further steps in the direction of unlimited patentability of software programs have been made through a series of subsequent decisions of the Court of Appeals for the Federal Circuit [5] and with the publication by the USPTO of the proposed Guidelines for the Examination of computer–implemented Inventions in 1995. Much of the controversy surrounding software-related

[3] *Diamond v. Diehr*, 450 US 175 (1981), concerning a patent on a process for molding raw, uncured synthetic rubber into cured precision products, which involved the use of software in measuring and monitoring the process.

[4] *Diamond v. Chakrabarty*, 447 US 303 (1980), holding the patentability of a genetically-engineered bacterium.

[5] Starting from 1982 and in accordance with the Federal Courts Improvements Act, appeal of all patent cases was assigned to this newly instituted Court. The change has been said to be not only procedural, but substantial, in that it was associated to a significant rise in the probability that a litigated patent be held to be valid (Allison and Lemley, 1998; Jaffe, 2000).

patents in the U.S. revolved around the question whether software inventions could fit into one of the four categories indicated by section 101 of the U.S.Code as patentable subject matter, namely (1)processes, (2)machines, (3)manufactures, or (4)compositions of matter[6].

In *re Alappat* a software invention claimed as a machine was held to be patentable in that it did not constitute a "disembodied mathematical concept" but rather a "specific machine to produce a useful, concrete and tangible result"[7]. The significance of the *Alappat* decision is at least twofold. First, it underscored the importance of the form in which a software invention was claimed: the same invention could be denied patent protection if claimed as a process and accorded protection if claimed as a machine, the reason being that in the latter case laws of nature, natural phenomena and abstract ideas could not be preempted due to the physical structure of the invention. Second, it narrowed the interpretation of the so-called "mathematical algorithm exception" to patentability that had been introduced in the first Court decision concerning software-related inventions, namely *Gottshalk v. Benson*[8].

Both the "matematical algorithm exception" and the second relevant judicially-created exception to patentability, the "business method exception", were directly challenged shortly after *Alappat*, in the 1998 *State Street Bank & Trust v. Signature Financial Services* decision[9]. Mathematical algorithms were deemed patentable by the Court as long as they produced a "useful, concrete, and tangible result". As regards business methods, the Court held that "[s]ince the 1952 Patent Act, business methods have been, and should have been, subject to the same legal requirements for patentability as applied to any other process or method", thus yielding a decision consistent with the U.S. Patent and Trademark 1996 Examination Guidelines for Computer Related Inventions[10].

Finally, in *AT&T Corp. v. Excel Communications Inc.* the CAFC

[6]Under U.S. patent law, in addition to qualifying as an invention per section 101, subject matter must also satisfy the novelty requirement set out in Section 102 and the non-obviousness requirement contained in Section 103 to be patentable.

[7]*In re Alappat*, 33 F3d 1526 (Fed Cir 1994)(en banc), reversing a USPTO Boards invalidation of a patent on a means for creating a smooth waveform display in a digital oscilloscope.

[8]*Gottschalk v. Benson*, 409 U.S. 63, 65 (1972), rejecting a a patent on a new and faster process for converting decimal numbers to binary numbers.

[9]*State Street Bank & Trust v. Signature Financial Services*, 149 F3d 1374 (1998), reversing a district court ruling that had held invalid Signatures patent on a data processing system for use in its business administering mutual funds.

[10]The Guidelines read "[c]laims directed at methods of doing business [...] should not be categorized as methods of doing business. Instead such claims should be treated as any other claim".

not only definitively dismissed the "mathematical algorithm exception" to patentability by limiting the proscription, "to the extent it still exists", to mathematical algorithms "in the abstract", but also argued that it considered "the scope of 101 to be the same regardless of the form — machine or process — in which a particular claim is drafted"[11]. After *AT&T* the way to the patentability of pure software was thus wide open.

In the course of the nineties, the Japanese patent system has undergone developments similar to those brought about by the *Alappat, State Street* and *AT&T* decisions in the United States. Differently from the United States, however, such developments were not set off by court decisions but rather by the Japanese Patent Office (JPO), reflecting the limited role judicial precedent has traditionally played in patent matters in Japan. According to the last version of the "Examination Guidelines for Computer Software-related Inventions" software may be claimed as a process, as a product and as a record on a carrier[12]. Less certainty exists as to whether business methods constitute statutory subject matter and, in particular, whether they represent an "highly advanced creation of technical ideas by which a law of nature is utilized", namely an "invention" under Japanese Patent Law (section 2 paragraph 1). These uncertainties notwithstanding, the practice of the Japanese Patent Office has been so far favorable to the granting of business methods patents, as can be inferred from the "Implementing Guidelines for Examination of Inventions in Specific Fields" according to which utilization of a law of nature can be found, *inter alia*, when the invention implies processing operations carried out by utilizing hardware resources. It thus appears that recognition of statutory subject matter for business methods may be affected by the claim language[13].

2.2. The European Situation

Although as early as in 1975 attempts were effected to create Community-wide patents through the signing of the Community Patent Convention[14],

[11] *AT&T Corp. v. Excel Communications Inc.*, 172 F3d 1352 (Fed.Cir 1999), concerning a patent containing a claim to a method for addding a data field to a record for use in a billing system.

[12] See the JPO "Examination Guidelines for Computer Software-related Inventions" released on December 28, 2000; available at `www.jpo.go.jp/infoe/Guidelines/PartVII-1.pdf`.

[13] See Hart, Holmes, and Reid (1999).

[14] The Convention for the European Patent for the Common Market (Community Patent Convention) was signed on 15 December 1975 but was never ratified. It provides for the institution of a Community-wide patent that would be centrally issued and would have equal effect across all member countries. Attempts to revive the proposal have been made from time to time since 1975 and the issue is currently under consideration by the European Parliament and the Council.

the granting of patents at the European level is still governed by the 1973 European Patent Convention (EPC) signed by 15 member countries and five neighbouring countries[15]. The EPC created the European Patent Organization and the European Patent Office, which are therefore not institutions of the European Union, and endowed the latter with the power to issue patents that take effect in the member states of the EPC selected by the applicant. Patents granted by the EPO represent a "bundle" of national patents and are thus subject to national legislation.

To be patentable under the EPC, inventions must be "susceptible of industrial application", must be "new" and must involve an "inventive step". The mentioned requirements, set out in art.52 EPC, parallel to some extent those contained in section 35 U.S.C. The novelty requirement is satisfied as long as the invention does not form a part of the state of the art (art.54 EPC). The "inventive step" requirement bears close resemblance to the U.S.C. "non-obviousness" requirement. Indeed, art.56 EPC states that "an invention shall be considered as involving an inventive step if [...] it is *not obvious* to a person skilled in the art". However, some difference between the U.S. and European legal frameworks is apparent in regard to the "industrial applicability" requirement. Fulfillment of the latter implies, *per* art.57 EPC, that an invention "can be made or used in any kind of industry, including agriculture". Note that the letter of art.57 should not be interpreted, by analogy with 101 U.S.C. 35, as imposing a requirement analogous to the U.S. usefulness requirement. Indeed, the European Patent Office Guidelines (C-IV, 1.3) specify that "[t]he EPC does not require explicitly or implicitly that an invention, to be patentable, must entail some technical progress or even any useful effect"[16].

Further differences between the EPC and U.S.C. Title 35 lie in the fact that the EPC does not provide a categorization of patentable inventions, while U.S.C. Title 35 at 101 explicitly indicates statutory subject matter, and in the fact that art.52 EPC explicitly identifies subject matter that cannot constitute the object of an invention, while in the U.S. the only exceptions to patentability are judicially created. In particular, art.52(2) EPC lists (a) discoveries, scientific theories and mathematical methods; (b) aesthetic creations; (c) schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers; and (d) presentation of information as excluded from patentability. Art.52(3) modifies, however, the extent of such proscription, by requiring it to be applied only

[15]The text of the EPC is available at `http://www3.european-patent-office.org/dwld/epc/epc_2000.pdf`. The neighbouring countries are Switzerland, Monaco, Cyprus, Turkey, and Lichtenstein

[16]See the "Guidelines for Examination in the European Patent Office", available at `http://www.european-patent-office.org/legal/gui\_lines/pdf/gui\_e\_full.pdf`.

in so far as the mentioned subject matter is claimed *"as such"*.

The most relevant aspect of the divergence between the U.S. and the European legal frameworks in relation to the patentability of computer–implemented inventions resides in the fact that in Europe, in addition to satisfying the statutory requirements contained in art.52 EPC, an invention must be *technical* in order to be patentable[17]. This requirement has been generally derived from Rules 27(1) and 29(1) EPC[18] and has recently found an explicit recognition in the European Patent Office Guidelines[19] that read: "the invention must be of "technical character", to the extent that it must relate to a technical field (Rule 27(1)(a)), must be concerned with a technical problem (Rule 27(1)(c)), and must have technical features in terms of which the matter for which protection is sought can be defined in the claim (Rule 29(1))". In Japan, the statutory definition of invention as "a highly advanced creation of technical ideas by which a law of nature is utilized" has traditionally led to interpretations close to prevailing EPO practice. By contrast, the U.S. Patent Office Guidelines for Computer-related Inventions only require the utility of an invention to be within the "technological arts"[20]. As it will be clarified in the following paragraphs, the requirement of "technical character", while being crucial to most decisions of the EPO Technical Board of Appeal, has been the object of a protracted debate that has not, however, led to an agreed-upon and uncontroversial legal definition.

It is to the perceived lack of technical character of computer programs that the exclusion from patentability contained in subsections (2) and (3) of art.52 EPC should be attributed. Computer programs "as such" are assimilated to abstract creations such as discoveries and scientific theories (art.52(2)(a)) or non-technical objects such as presentations of information (art.52(2)(d)) and therefore considered to be non-inventions within the meaning of art.52(2). This reflects the historical development of the concept of invention in most European nations and is confirmed by both the EPC "travaux preparatoires" and by a number of decisions of the EPO Technical Board of Appeal dealing with the issue of patentability of computer-related inventions[21].

[17]For a succinct comparison of the U.S. and European legal frameworks in relation to the patentability of software-related inventions, see Guntesdorfer (2003).

[18]These rules should be considered as an integral part of the Convention, according to article 164(1) EPC.

[19]Note that the European Patent Office Guidelines do not constitute law and, indeed, they have been sometimes overturned by court decisions, as for instance it has been the case in the EPO Technical Board of Appeal IBM decisions reported later in the paper.

[20]See the 1996 USPTO Guidelines for the Examination of computer–implemented Inventions, under the heading "Identify and Understand Any Practical Application Asserted for the Invention".

[21]See, for example, Guglielmetti (1997, p.13–19), especially footnotes 21–26.

The European Patent Office attitude toward software patents has been opposite to its American counterpart. Indeed, up to the release in 1995 of the proposed Guidelines for the Examination of computer–implemented Inventions, the USPTO had shown appreciable reluctance to endorse the granting of software patents mainly on grounds that it was ill-equipped to process software-related patents and suffered from a lack of both funds and expert examiners[22]. By contrast, the European Patent Office, while aware of the practical difficulties inherent in the granting of software patents, already in the course of the 1985 revision of its Guidelines seemed to have positively received the position of the computer industry stating that practical difficulties should not justify a restrictive approach on patentable subject matter[23]. Moreover, the Office has shown a tendency to interpret the art.52 sections (2) and (3) computer program exception more and more narrowly over the past fifteen years, relying on a progressively more lenient understanding of the criterion of "technical character". The favourable attitude of the EPO toward patentability of computer–implemented inventions has thus translated into the granting of around 20.000 patents as of 2002.[24]

The basis for EPO practice with respect to computer–implemented inventions can be safely identified in the case law starting with the *VICOM* case[25]. In this circumstance, the Court held, among other things, that "even if the idea underlying an invention may be considered to reside in a mathematical method, a claim directed to a technical process in which the method is used does not seek protection for the mathematical method as such". The *VICOM* decision is the first of a series of decisions that mirror, to some extent, the U.S. 1981 *Diehr* case where it states that the mere inclusion of a mathematical algorithm or computer program in a claimed process does not purport exclusion from patentability.

On the same tone are, for instance, the *Method for interactive rotation of displayed graphic objects/IBM* decision[26], in which it was held that methods comprising excluded features were to be considered as making a technical contribution to the state of the art, to the extent that they solved a techni-

[22] See Soma, Leyendeker, and Webb (2000), stating that in so doing, the USPTO took a stance that was directly in contrast with that taken by the other governmental body relevant to issues of patentability, namely the Court of Customs and Patent Appeals (CCPA). The position of the USPTO reflected that of the computer industry, concerned that a strong form of software protection could impede the diffusion of hardware.

[23] See Hart et al. (1999).

[24] As reported by the Explanatory Memorandum to the Commission's Proposal.

[25] T 208/84; OJ 1987, 14, concerning a "method of digitally filtering a two-dimensional data array (representing a stored image)".

[26] *Method for interactive rotation of displayed graphic objects/IBM*, T 59/93, concerning claims to a method for entering a rotation angle value into an interactive graphic system.

cal problem and brought about technical effects, and the *SOHEI* decision[27], which set out that inclusion of an additional feature that as such would be excluded from patentability does not negatively affect non-exclusion from patentability[28]. Conversely, in the later decision *Pension Benefits System*[29] the EPO Technical Board of Appeal stated that "a feature of a method which concerns the use of technical means for a purely non-technical purpose and/or for processing purely non-technical information does not necessarily confer a technical character to such a method". In the occasion, however, the EPO appellate body also held that the "technical character" requirement was to be deemed fulfilled whenever the invention achieved a "technical effect" or required "technical considerations" to be carried out.

Also in line with the U.S. *Diehr* decision is the 1987 *X-ray Apparatus/ Koch&Sterzel* decision[30] where it specifies that for purposes of assessment of patentability an invention must be assessed *as a whole* and therefore recognition of the technical character of an invention should not be precluded by the use of non-technical means. The *Koch&Sterzel* decision is also important because for the first time it clarifies that the mere inclusion in the patent application of a known computer does not automatically turn a computer program into a patentable object, independently of the technical effect the program produces. However, while the mentioned decision indeed suggests that substance should prevail over form in the assessment of patentability, in many of the early cases involvement of traditional hardware technology played a decisive role[31].

Among the Technical Board of Appeal decisions most directly addressing the issue of the proper interpretation of the exclusion from patentability of programs for computer under 52(2) and (3) EPC are the two *IBM Computer Program Product* cases[32]. These decisions, both delivered on the basis

[27] *SOHEI*, T769/92; OJ 1995, 525; concerning a computer system for plural types of independent management including at least inventory and financial management and a method for operating said system.

[28] In the case at issue, the *per se* non-patentable feature was represented by management systems and methods that could be considered within the meaning of the art.52(2)(c). The *SOHEI* decision thus could perhaps be considered as the closest to the U.S. CAFC *State Street* decision.

[29] *Controlling Pension Benefits System/PBS PARTNERSHIP*, T931/95; OJ 2001, 441; upholding claims to a method for controlling a pension benefits program.

[30] *X-ray Apparatus/ Koch&Sterzel*, T 26/86; OJ 1988,19, concerning the patentability of an X-ray apparatus incorporating a data processing unit operating in accordance with a routine.

[31] See Bakels and Hugenholtz (2002).

[32] T935/97 and T1173/97; OJ 1999, 609 upholding claims directed to computer program products directly loadable into the internal memory of a digital computer or stored in a computer usable medium or on a computer-readable medium, having a program recorded thereon.

of the same reasoning, are relevant in at least three respects.

First, the Board expressed the view that "a computer program claimed by itself is not excluded from patentability if the program, when run on a computer, brings about, or is capable of bringing about, a technical effect which goes beyond the 'normal' physical interactions between the program (software) and the computer (hardware) on which it is run." Thus, while specifying that technical character is not to be found for the sole reason that normal physical modifications of the hardware derive from execution of the computer program instructions, the Board held that patentability is to be admitted (provided the other statutory requirements are met) for computer programs producing a "further" technical effect.

Second, the Board expressed the opinion that the "further" technical effect may be known in the prior art and thus clarified the distinction between fulfillment of the "technical character" requirement and determination of a technical contribution to the prior art[33].

Third, the Board stated that a "computer program product may [...] possess a technical character because it has the potential of producing a predetermined further technical effect" and, under the latter circumstances it is, in principle, not excluded from patentability under Article 52(2) and (3)[34]. It is important to note that the Board also clarified that "it does not make any difference whether a computer program is claimed by itself or as a record on a carrier", which opens up the way to claims for computer–implemented inventions distributed over the internet.

On the basis of the case law briefly reviewed in the previous paragraphs, it is possible to provide a succinct taxonomy of inventions that are, in principle, amenable to patent protection under EPO practice. The taxonomy includes: (a)inventions in which the program produces technical effects internal to the computer[35]; and (b) inventions in which the program achieves a technical effect external to the functioning of the computer itself and consist-

[33]Prior to this decision, the Board had adopted the approach that technical character was to be found when the claimed invention provided a technical contribution to the art in a field not excluded from patentability under art.52(2) EPC (see for instance decisions T 121/85, T38/86 and, more recently T833/91 and T77/92). The two IBM computer program product decisions made clear that this approach confused the requirement of "invention" with requirements of "novelty" and "inventive step".

[34]In this connection, note that the significance of allowing claims for computer programs as products resides in the fact that the patent holder can bring direct patent infringement suits against the unauthorized sale of its own programs, whereas the remedies available to holders of process patents are limited to defense against indirect (or contributory) infringement, which is more difficult to prove.

[35]See, for instance, the case Data processor network/IBM (T 6/83), concerning software used for the coordination and exchange of data between interconnected processors; the case

ing in the control of an industrial apparatus or process[36]. Note also that, as mentioned above with reference to the two IBM decisions, computer–implemented inventions of the two kinds just indicated may in principle be claimed both as processes and as products.

As a final note on the state of software patentability in Europe it is worth commenting on the issue of business method patents. Contrary to a widespread perception, and in spite of the explicit exception contained in art.52(2) and (3) EPC, methods of doing business have been granted patent protection in a number of instances under case law of the EPO Technical Board of Appeal. The *SOHEI* case mentioned above constitutes one case in point. The patent at issue in this case covered a general-purpose business management system comprising a screen display with peculiar attributes that were found to satisfy the "inventive step" requirement. The case constitutes by no means an isolated event. Indeed, many more patents relating to the field of business models and e-commerce have been already granted and for many others the application is currently pending[37].

The key test applied to determine the admissibility of claims to business methods under EPO case law seems to be, as in the case of other computer–implemented inventions, whether the invention involves a technical effect of some kind. Thus, provided the invention can be claimed in terms of the technical structures of a computer program and some technical aspect of the invention can be said to provide a contribution to prior art (e.g. involve an "inventive step"), it should be expected to be granted patent protection[38]. The need for fulfillment of a "technical character" requirement distinguishes EPO practice from the prevailing practice in the US, where patents have

T 110/90 in which software implementing "control of hardware such as a printer" was not considered to fall within the exclusion of art.52(2) and (3); and, more recently, the decision T 513/98, which involved an invention aiming at making more efficient and economical the use of mailer stations having computer controllable databases interconnected, by a communication link, with a computerized central data station.

[36]See Guglielmetti (1997). Cfr., among others, the *VICOM* case (T208/84) in which a method of digitally processing images was deemed patentable; the *Koch&Sterzel* decision, concerning a program controlling X-Ray apparatus; and the *Queuing system/Patterson* decision (T 1002/92), concerning claims to a system for determining the queue sequence of customers at a plurality of service points.

[37]Examples of business management and financial systems patents (reported by Beresford (2001)) include European patent 407,026B (Reuters Ltd.), concerning a computer trading system involving a reduced amount of data transmission with respect to prior art; EP 701,717B (Shepherd), protecting a system for setting up insurance contracts by computer; and EP 838,063B (Realkredit Denmark A/S), covering a computer system and the relative software apt to perform the calculations required by specific financial instruments.

[38]Note that, in contrast to the U.S., patentability of business methods is harder to obtain in Europe in case the novel and inventive features contained in the application concern the business method itself, rather than the technical means by which it is implemented. See Beresford (2001); Fink (2004).

been granted even for business models claimed independently of computer systems or any other technology[39]. However, it appears to be the case that the requirement of "technical character" could be stretched enough to allow the granting of patents for inventions of the kind involved in the *State Street* decision mentioned in section 2.1, although the corresponding European application for the latter happens to have been first rejected by the examining division and then abandoned by the applicant[40]. On balance, it could be argued that patenting of business methods presents some additional difficulties with respect to the US, but in many instances such difficulties do not seem to be unsurmountable.

2.3. Justification for the Proposed Directive

The European Commission's "Proposal for a Directive on the Patentability of computer–implemented Inventions"[41] was introduced on 20 February 2002 for the purpose of harmonizing patent law with respect to computer–implemented inventions. In the view of the Commission, the Directive should seek this objective "while avoiding any sudden change in the legal position, and in particular any extension of patentability to computer programs 'as such'"[42].

According to the Directive, "computer–implemented invention" means "any invention the performance of which involves the use of a computer, computer network or other programmable apparatus and having one or more *prima facie* novel features which are realized wholly or partly by means of a computer program or computer programs" (Art.2). In light of this definition, both inventions relating to the core areas of information technology and inventions utilized in the context of more traditional technical domains such as the mechanical or the automobile industry fall within the scope of the Directive. As stressed by the explanatory memorandum accompanying the Proposal, there can thus be no doubt as to the economic relevance of the issue the latter addresses.

The relevance of the software sector has increased steadily in the overall ICT sector in recent years, accounting for a growing share of investments

[39] For a more nuanced comparison of Japanese, European and U.S. practice in the field of business methods see Biddinger (2001).

[40] See Beresford (2001).

[41] Proposal for a Directive of the European Parliament and of the Council on the patentability of computer–implemented inventions, COM(2002) 92 — 2002/0047 (COD).

[42] Proposal for a Directive of the European Parliament and of the Council on the patentability of computer–implemented inventions — Explanatory memorandum, p.11 (COM(2002) 92 final, 2002/0047(COD)).

and contributing significantly to output growth.[43] In consideration of the significance of the interests at stake, it is not surprising that the issue of the appropriate form of legal protection for software-related inventions has been the subject of heated discussion in the major industrialized countries in the past few decades. In Europe, the debate intensified for the first time in the mid-80s, focusing mainly on the question whether software was to be considered sufficiently creative to deserve copyright protection. The question, raised by German case law[44] (that had given an answer in the negative), was finally resolved by the Council Directive on the Legal Protection of Computer Programs of 14 May 1991 (Directive 91/250/EEC). The Directive, usually referred to as the "Software Directive", was intended to harmonize Member States' legal provisions on the legal protection of computer programs by setting a minimum level of protection and establishing the threshold of originality computer programs must possess to deserve copyright protection. In particular, it provided that Member States "shall protect computer programs, by copyright, as literary works within the meaning of the Berne Convention for the Protection of Literary and Artistic Works" and that a computer program "shall be protected if it is original in the sense that it is the author's own intellectual creation"[45].

At the time Directive 91/250 was issued, there was a sufficient degree of consensus within the European software industry on the preferability of copyright protection over patent protection for computer programs. Some significant advantages were attributed to copyright, and in particular the low level of bureaucratic requirements of the procedure for obtaining legal protection, its low costs compared to patents, the fact that the granting of protection is immediate and automatic and the length of protection were all positively valued by software enterprises. However, the "Software Directive" purposefully left the door open to further extensions and refinements in the legal protection of computer programs, especially as regards to the possibility of providing for the patentability of computer programs. This is apparent both where it specifies that copyright protection applies to the expression of a computer program and not to ideas and principles underlying it (art.2) and where it states that its provisions "shall be without prejudice to any other legal provisions such as those concerning patent rights [...]" (art.9(1)).

The implementation of the Software Directive was successful both in re-

[43] See, generally, the OECD Information Technology Outlook (2002).

[44] *Inkasso-programm*, BGH GRUR 1991, 449,452.

[45] This uniform provision has led twelve Member States to lower and three Member States to raise their required thresholds for copyrightability, according to the Report from the Commission to the Council, the European Parliament and the Economic and Social Committee on the implementation and effects of Directive 91/250/EEC on the legal protection of computer programs, COM(2000)199 final.

moving inconsistencies among Member States' IP laws[46] and in reducing piracy and bit-to-bit copying. According to data provided by the Business Software Alliance, the piracy rate has fallen in Western Europe from an average of 78 percent in 1990 to 36 percent in 2003.[47] Nevertheless, the 90s saw an increase of the pressures exerted by large software companies to obtain an express recognition of the patentability of computer programs, at a time in which any remaining barrier to patentability was being progressively removed in the United States[48] and technical advances in communication platforms (e.g. the Internet) were increasing the scope of both legal and illegal forms of distribution of digitized works[49].

The European Commission has not proven insensitive to the concerns voiced by that part of the software industry, both European and non-European, represented in particular by the European Information and Communication Technology Association (EICTA), the European IT Services Association, and the Business Software Alliance (BSA). In 1995, it issued a "Green Paper on Copyright and Related Rights in the Information Society", expressing concern on the rise of the illegal reproduction of digitized works. In 1997 the Commission directly addressed the issue of patentability of computer programs in the "Green Paper on the Community patent and the patent system in Europe", followed by a 1999 follow-up summarizing the Commission's proposed action on the issues raised by the 1997 document and the consultations launched thereon. In the 1999 follow-up to the "Green Paper" the Commission recognized the urgent need to prepare a Draft Directive aimed at harmonizing Member State's legislation on the patentability of computer programs and suggested the need for contracting states to the Munich Convention to "take steps to modify Article 52(2)(c) of the European Patent Convention, in particular to abolish computer programs from the list of non-patentable inventions"[50]. Such steps were expected to be taken at a Diplomatic Conference to Revise the European Patent Convention held in Munich between November 20 and November 29 2000. However, perhaps partly as a consequence of intense (and apparently unexpected) lobbying by the Open Source community, the members of the EPC to the Conference decided in that occasion to make no changes to article 52(2) EPC where it concerns computer programs[51].

[46] Note that prior to the Directive as many as seven of the then twelve member states lacked any legislation for the protection of computer programs.

[47] First Annual Business Software Alliance and IDC Global Software Piracy Study 2003, released in July 2004.

[48] Cfr. *supra*, par.2.1.

[49] See, for example, Smith and Mann (2004), discussing the change in attitude of the U.S. IT industry toward patents for software-related inventions.

[50] "Promoting innovation through patents: The follow-up to the Green Paper on the Community Patent and the Patent System in Europe" (COM(1999) 42 final), p.14.

[51] For a comment on the Diplomatic Conference see Basinski (2000/2001).

While harmonization constitutes the primary objective set out by the proposed Directive, the Recitals make clear that the Commission also sets a number of additional objectives to be achieved through the expected transparency and legal certainty harmonization should bring about. Thus, the first Recital makes reference to the promotion of investment in the field of computer–implemented inventions that should follow from their effective and harmonized legal protection. Recital 2 alludes to the removal of barriers to trade that could be created by the divergent administrative practices and case law of Member States. Recital 4 recalls the need to "ensure that an optimum environment exists for developers and users of computer programs in the Community" in light of the critical role played by computer programs in technological innovation. According to Recital 5, the legal certainty resulting from harmonization should also "enable enterprises *to derive the maximum advantage from patents for computer–implemented inventions* and provide an incentive for investment and innovation".

The wording of the mentioned recitals clearly reflects the concerns of that part of the European software industry that has gone through a substantial change of attitude with respect to the perception of the most appropriate form of protection for computer-related inventions during the 90s. In fact, such concerns have so well been taken into account that it has been observed that the crucial points of the Proposal are a literal reproduction of a text attributed to a lawyer of the Business Software Alliance.[52]

From a joint reading of the explanatory memorandum and the recitals (cfr. Recital 16), it is easy to get the impression that the objective of improving Europe's competitiveness in the global arena by creating a level playing field with Europe's major commercial partners is all but a minor one. In this regard, the Explanatory memorandum notes that "it could have been considered desirable to widen the scope of protection and bring European patent law in this field more in line with the U.S. law. One could have conceived, in particular, to allow for the patentability of computer–implemented business methods." The argument in support of this view, and of the "enhance competitiveness" objective of the Directive more generally, is based on the perception that the misalignement of Europe's intellectual property framework with respect to U.S. and Japan in the field of computer related inventions could result in a distortion of investment decisions and put European firms at a disadvantage vis-á-vis their patent-rich American and Japanese counterparts.

[52]Cfr. a letter from Jorg Tauss, president of the New Media Commission of the German Federal Parliament to the German minister of justice Prof. Herta Daubler-Gmelin, available at `http://swpat.ffii.org/papers/eubsa-swpat0202/tauss020312/tauss020312.en.pdf`.

Finally, it is somewhat more implicit but nonetheless apparent from the Explanatory memorandum that an attempt to increase small- and medium-sized enterprises' (SMEs) recourse to patents is part of the aim of the Directive. The Explanatory memorandum makes reference to a study commissioned by the Commission's Directorate General Enterprise and investigating IP practices of SMEs.[53] The study reveals the reluctance of SMEs to use patents both as a protective and informational means and is interpreted as suggestive of the need of increasing the awareness of patents[54].

2.4. The Original Draft

The Proposal originally presented by the Commission is composed of 19 recitals and 11 articles, the first six of which contain substantive provisions. The approach taken by the Commission in order to harmonize Member States' patent law, while providing an ex-post broad recognition of current EPO practice in the field, does not go as far as to reach a complete alignment with U.S. practice. In particular, this would have been achieved by dropping the requirement of "technical contribution" entirely.

The draft Directive builds on the general patent law principles that inventions need to be industrially applicable and new and need to involve an inventive step in order to be patentable, as stated in art.52(1) EPC and art.27(1) of the TRIPs Agreement.[55] As expressily stated in the 15th recital, the Directive "should be limited to laying down certain principles as they apply to the patentability of [computer–implemented] inventions". The distinction between patentable and unpatentable subject matter is drawn in a way that closely reflects the case law of the EPO Technical Board of Appeal. This is evident in particular in three respects. First, the question — crucial to most EPO Technical Board of Appeal's case law — of the conditions pursuant to which computer programs have to be considered inventions in that they possess a technical character is resolved by the Proposed Directive by stating that computer–implemented inventions are considered, by definition, to belong to a field of technology[56]. This is in line with the recent decision

[53]See the study "Patent protection of computer programmes" (Contract no. INNO-99-04), available at `ftp://ftp.ipr-helpdesk.org/softstudy.pdf`.

[54]It is probably worth mentioning that the study's empirical evidence is based on responses to a questionnaire provided by only 12 SMEs.

[55]See art.4(1) of the draft Directive that provides that "Member States shall ensure that a computer–implemented invention is patentable on the condition that it is susceptible of industrial application, is new, and involves an inventive step". See also recital 6, making reference to the TRIPs Agreement.

[56]Art.3 of the Proposed Directive reads: "Member States shall ensure that a computer–implemented invention is considered to belong to a field of technology".

Controlling Pension Benefits System/PBS PARTNERSHIP[57], in which the Board observed that programs functioning on a computer are technical by definition, as the computer is a machine, and can therefore be considered inventions.

Second, and especially important, is the fact that the Directive specifies that the presence of a "technical contribution" is essential for the purpose of assessing the existence of an inventive step[58]. The directive also specifies that, by "technical contribution" it is meant "a contribution to the state of the art in a technical field which is not obvious to a person skilled in the art"[59]. As clarified in the explanatory memorandum, this requirement is intended to serve as a qualification and not a substitution of art.56 EPC, which provides the conditions under which an invention can be regarded as involving an "inventive step"[60]. These provisions thus echo the established EPO practice initiated by the *Vicom* case mentioned in par.2.2 and imply that patentability will be denied for lack of inventive step to inventions that, while providing a non-obvious non-technical contribution to the prior art, do not provide any contribution of a technical character[61]. It should also be noted that, pursuant to art.2 of the Directive, the requirement of technical contribution is not to be assessed in connection with novelty[62]. This implies that it is not necessary for an invention to be patentable that its novelty resides in a technical aspect[63].

Third, the proposed Directive receives the indications of EPO's case law also where it provides that determination of the technical contribution should be made with reference to the invention assessed *as a whole*[64]. The explanatory memorandum makes clear that this provision implies that the presence of a non-obvious technical contribution is sufficient to render

[57] *Controlling Pension Benefits System/PBS PARTNERSHIP*, T 931/95, OJ 2001, 441.

[58] See art.4(2) and recitals 11, 12 and 15 of the Proposed Directive.

[59] See art.2 of the Proposed Directive.

[60] Art.56 EPC reads: "An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art. If the state of the art also includes documents within the meaning of Article 54, paragraph 3, these documents are not to be considered in deciding whether there has been an inventive step."

[61] See Explanatory memorandum p. 14.

[62] Art.2 of the Directive provides that "computer–implemented invention means any invention the performance of which involves the use of a computer, computer network or other programmable apparatus and having one or more prima facie novel features which are realised wholly or partly by means of a computer program or computer programs".

[63] See the Explanatory memorandum, p.13.

[64] See art.4(3) of the Directive, according to which: "[t]he technical contribution shall be assessed by consideration of the difference between the scope of the patent claim considered as a whole, elements of which may comprise both technical and non-technical features, and the state of the art". The relevant EPO jurisprudence includes the *Koch&Sterzel* case and the *Controlling Pension Benefits System* case.

patentable an invention that comprises aspects falling under the exclusion set out in art.52(2) EPC.

The clearest divergence between the proposed Directive and EPO practice emerges in art.5 of the Directive, specifying the form of allowable claims to computer–implemented inventions. According to this provision, such inventions may be claimed both as products and as processes. Claims to computer programs "by themselves" or as a record on a carrier are thus not allowed, in contrast with the EPO Technical Board of Appeal's IBM Computer Program Product I and II decisions. This choice is motivated in the explanatory memorandum by the concern that the latter category of claims could be interpreted as allowing patents for computer programs "as such".

The Directive also provides (in its art.6) for the preservation of the equilibrium of interests achieved under the current copyright regime as set out by Directive 91/250/EEC. In particular, it provides that patent protection granted to inventions within the scope of the directive should not affect acts permitted under Directive 91/250/EEC and especially those acts relating to decompilation and interoperability. Art.7 and 8 establish an obligation for the Commission to monitor the impact of computer–implemented inventions on innovation and competition and to report to the Parliament and to the Council on the operation of the Directive. The remaining three articles (9, 10 and 11) are the standard procedural articles relating to the coming into force of the Directive and its transposition into Member States' national laws.

2.5. State of Advancement of the Proposal

Given the objective of establishing a functioning internal market, the Proposed Directive relies on Article 95 of the EC Treaty as its legal basis and is therefore subject to the codecision procedure set out in article 251 (ex 189b) EC. As reported in the Explanatory memorandum accompanying the Proposal, this choice of legal basis is in line with previous directives aimed at harmonizing national laws on intellectual property and, in particular, with the recent Directive 98/44/EC concerning the harmonization of the patentability of biotechnology inventions[65].

Shortly after receiving the Commission's Proposal, on 4 March 2002, the Council consulted the European Economic and Social Committee (ESC) under Article 95 of the EC Treaty. The ESC adopted its opinion on Septem-

[65]The choice of legal basis was examined thoroughly by the Court of Justice in the latter case in the context of the case C-377/98 Pays-Bas v. Parliament and Council.

ber 19 2002[66]. The view expressed by the ESC can be said, on balance, to be rather skeptical of the adequateness of the Commission's proposal to achieve its stated objectives. In particular, the document adopted by the ESC manifested concerns that the Proposed Directive would effectively extend the scope of application of patentability in such a way that it could "thereafter be extended without limit to software programs and intellectual methods at successive legal rulings of the technical chambers of the EPO, irrespective of the exclusion provided for in Article 52 of the EPC"[67]. In this connection, the ESC was especially troubled by the indefinite nature of the notion of "software producing technical results" and by the admission, in the Proposal, that the "technical effect" can amount to the simple fact of a program running on a standard computer, while the ESC would advocate a much stricter understanding of "technical effect" whereby the presence of effects of a physical nature would be pivotal.

Moreover, the ESC also held the view that the Proposed Directive, far from harmonizing national intellectual property regimes, run "the risk of exacerbating divergent practices in national offices and jurisprudence"[68] due to the ambiguity of common legislation in the internal market. The ESC thus suggested a serious revision of the Proposed Directive and recommended that more detailed legal and economic investigations be pursued in order to better assess both the merits of patent protection and its impact on consumers, investments, employment and SMEs.

The broad agreement on a common approach reached on November 14 2002 by the Competitiveness Council reflected few of the reserves expressed by the ESC's report[69]. Somewhat more in line with the mentioned ESC's concerns about the legal tightness of the original draft of the Proposed Directive was the report by Arlene McCarthy adopted on 17 June 2003 by the Parliament's Committee on Legal Affairs and the Internal Market, although the latter document broadly approved the proposal, subject to a number of amendments[70]. The European Parliament reviewed the draft Directive on

[66] "Opinion of the Economic and Social Committee on the "Proposal for a Directive of the European Parliament and of the Council on the patentability of computer–implemented inventions", OJ C 61, 14.3.2003, p.154. The Economic and Social Committee's opinion was prepared by the Section for the Single Market, Production and Consumption (rapporteur Mr Retureau) and was adopted at the ESC 393rd Plenary Session by 43 votes to 18, with 9 abstentions.

[67] OJ C 61, 14.3.2003, p.157.

[68] OJ C 61, 14.3.2003, p.161.

[69] PRES/O2/344.

[70] Report on the proposal for a directive of the European Parliament and of the Council on the patentability of computer–implemented inventions — Committee on Legal Affaiers and the Internal Market, Rapporteur Arlene McCarthy, PE A5-0238/2003, hereinafter "McCarthy Report".

first reading on 24 September 2003, approving an amended version of the Commission's proposal that undoubtely made some steps in the direction of improving clarity in the definition of patentable subject matter in the field of computer–implemented inventions[71].

The main amendments approved by Parliament include a clarification of the conditions under which computer–implemented inventions can be said to make a "technical contribution". The basic test proposed by Parliament involves assessing whether the invention "constitutes a new teaching on cause-effect relations in the use of controllable forces of nature and has an industrial application in the strict sense of the expression, in terms of both method and result" (art.4.4). The text approved by Parliament on first reading also specifies that the "technical contribution" made by the computer–implemented invention must be new, non-obvious and susceptible of industrial application to deserve a patent. In addition to this, the Parliament's proposal also called for the confirmation and clarification of Article 52 EPC and clearly defined what was to be excluded from patentability. In particular, the processing, handling and presentation of information and data-processing were identified as not considered to belong to a field of technology and computer–implemented solutions to technical problems whose only effect is that of improving the efficiency in the use of resources within the data processing system were expressly excluded from patentability.

The most recent step of the procedure involving the proposal has been its discussion at the EU's Competitiveness Council on 18 May 2004. The Council reached political agreement on a common position concerning the proposed Directive by a slim majority. A text prepared by the then Irish presidency and dropping many of the amendments made by Parliament was approved in spite of Spain's opposition and the abstention of Belgium, Italy and Austria. The sudden switch in Germany's position was pivotal in allowing the reach of an agreement on a compromise document that rejected crucial amendments that Germany itself had proposed, and in particular a specification of the requirement of technical contribution according to which the use of natural forces to control physical effects beyond the digital representation of information is considered to belong to a field of technology, while the mere processing, handling and representation of information is not.

The agreement reached at the Council's 18 May meeting almost immediately showed signs of a breakdown. With an unprecedented move, for

[71] European Parliament legislative resolution on the proposal for a directive of the European Parliament and of the Council on the patentability of computer–implemented inventions, PE T5-0402/2003.

instance, the Dutch Parliament asked its delegation at the Council to withdraw its support to the proposed Directive by changing the "yes" vote it had cast at the Council's meeting. Similar political turmoil invested other countries, including Germany, where motions were introduced to change the initial vote[72]. Moreover, a number of members of parliament has recently presented a motion demanding that the legislative process begin again from scratch, invoking Article 55 of the Rules of Procedure of the European Parliament. This article stipulates that members of Parliament be allowed to reconsider a proposal by the EU Commission, such as a draft directive, when "the nature of the problem with which the proposal is concerned substantially changes; or...new elections to Parliament have taken place since it adopted its position". Though unusual, the motion has some merit, given that new elections to the Parliament were held in June 2004.

3. Some basic questions to be asked about the Proposed Directive: preliminary comments

The aim of this section is to provide some preliminary comments on three basic questions concerning the Proposed Directive and worth of some reflection. First, does the proposal presented by the European Commission address the appropriate issues? Second, is a European directive on computer–implemented inventions necessary or could the issues underlying it be addressed in a different way, as for instance by leaving matters to the EPO and national courts or through a direct modification of the EPC? Finally, is the Proposed Directive likely to achieve its stated objectives? The comments made at this stage will be of a preliminary nature, as we proceed from the assumption that a more thorough investigation of the merits of the Commission's Proposal cannot dispense with an objective evaluation of the insights offered by recent economic scholarship, reviewed in the next section.

3.1. Does the Proposed Directive address worthwhile issues?

The main issues addressed by the Proposed Directive were briefly exposed in the previous section. Of course, the issue more directly tackled is that of the harmonization of Member States' legislation concerning the patentability of computer–implemented inventions. It was pointed out, however, that a few other aims — such as increased investment and innovation, increased competitiveness of European companies in the global arena and increased patenting by SMEs — were also set by the Commission as objectives to be achieved through harmonization. The question we focus on in this section

[72] See International Herald Tribune, 7 July 2004, "Europe's software patent policy under siege".

thus boils down to asking, first and foremost, whether harmonization is required at all. To make things clear from the outset, we submit that this is undoubtedly a worthy objective to pursue, for a variety of reasons.

The first reason relates to the lack of clarity of statutory law. It is widely acknowledged that the wording of art.52(2) and (3) EPC is particularly unfortunate and constitutes the source of much confusion[73]. Ironically enough, it has been argued that the inclusion of such provisions in the EPC and the consequent exclusion of computer programs "as such" from patentability was motivated by an attempt to guarantee legal certainty and avoid exactly those inconsistencies that the Proposed Directive now aims to remove[74]. This should not sound too surprising, however, in light of the fact that failed attempts to provide unequivocal legal reference points seem to be ubiquitous in the history of software-related legislation.[75]

As a consequence of the persistent divergences in the interpretation of art.52(2) and (3) EPC, the relevant case law has developed largely independently in Member States, so that the need for some sort of harmonization of Member States' legislation concerning the patentability of computer programs is now unquestionable. The problem is compounded by the fact that national courts are not bound by the precedent set by the EPO Technical Board of Appeal, which is not an institution of the European Union, with the consequence that there can be inconsistencies between decisions taken by the EPO appellate bodies and national courts and among national courts themselves. Such inconsistencies, in turn, may result in a lack of legal certainty and transparency and, in the view of the Commission, "can have a real and negative effect on investment decisions and free movement of goods within the internal market"[76].

The most apparent divergences in interpretation are those existing between German and UK courts as regards to the criteria for patentability of computer related inventions. UK jurisprudence diverges from EPO practice in that it applies stricter criteria. The *Merrill Lynch* case[77] illustrates that methods for doing business implemented through a computer cannot be

[73]See, for example, De Santis at 57 ss.; Blind at al. 2001 at VII, stating that it is impossible to develop a reasonable interpretation of the statutory exception of "computer programmes as such".

[74]See, for example, Ammendola (1981) and Cataldo (1988) stating that the express exclusion of computer programs from patentability was due to a need for certainty in the legal system.

[75]The Copyright Directive 91/250 is, for instance, another case in point: it became apparent immediately after its implementation that the doctrinal debate had been all but settled by the new legislation.

[76]Explanatory memorandum, p.9.

[77](1989) RPC 569.

patented in the UK even if they provide a technical contribution. The same is true of computer–implemented mental acts, under the precedent set by the case *Raytheon Co's Application*[78]. By contrast, German case law has, at some point, extended the domain of patentable computer-related inventions beyond the limits set by EPO case law, admitting patentability of business methods possessing some technical aspect to the extent they made even a non-technical contribution[79]. However, Germany's Federal Court of Justice (*Bundesgerichtshof*) has subsequently clarified that the correct approach is the one taken by the EPO Technical Board of Appeal[80]. Although the national courts and patent offices of those countries have at times shown a willingness to adhere to the precedent set by EPO case law, it is apparent that divergences are there to stay, at the expenses of transparency and legal certainty[81]. The case for harmonization thus seems to be a strong one.

A second good reason to argue that the Commission's effort to harmonize legislation in the field of computer–implemented inventions rests on solid grounds is suggested by the results of the consultations launched by the Commission itself[82] and by national governments such as the French[83], German[84] and British[85] governments. While answers related to the question

[78](1993) RPC 427.

[79]Cfr. for instance the *Automatic Sales control* case, (1999) GRUR 1078.

[80]See also Blind et al. 2001, stating that the most recent decisions of the German Federal Court of Justice (BGH) gives the impression that patent eligibility of computer programs is not limited at all.

[81]Consider for instance the case of the United Kingdom. In April 1999 the UK Patent Office made an attempt to clarify the conditions for patentability of computer programs by publishing a Practice Notice — "Claims to Programs for Computers" — that expressed the intention of adapting to EPO practice. However, only a few years later, in Hutchin's Application, the UK patent office Hearing Officer refused to follow the viewpoint taken by the EPO Technical Board of Appeal in the IBM Computer Program Product I case (T 0931/95).

[82]The patentability of computer–implemented inventions: consultation paper by the services of the Directorate-General for the Internal Market (19 October 2000). Paper available for downloading at `http://europa.eu.int/comm/internal_market/en/indprop/softpaten.htm`. The results of the consultation exercise are analysed in a report by PbT Consultants: "The Results of the European Commission Consultation Exercise on the Patentability of Computer Implemented Inventions" (contract number PRS/2000/A0-7002/E/98).

[83]See the "Rapport du groupe de travail interministriel:'Quelles protections pour les logiciels?"', 13 juillet 2001, available at `http://www.industrie.gouv.fr/enjeux/rapport4.htm`.

[84]See the study "Micro- and Macroeconomic Implications of the Patentability of Software Innovations. Intellectual Property Rights in Information Technologies between Competition and Innovation." Blind, Edler, and Nack (2001), available at `http://www.bmwi.de/Navigation/Service/bestellservice,did=31948.html`.

[85]See "Should Patents be granted for Computer Software and Ways of Doing Business? - The Government's Conclusions", available at: `http://www.patent.gov.uk/about/consultations/conclusions.htm`.

of the appropriate form of legal protection of computer–implemented inventions tended to be sharply divided, agreement was much more widespread on the need for some form of clarifying intervention, be it achieved through a more stringent exclusion of software-related inventions from patentability, through a definitive extension of patentability or through a modification reflecting some intermediate position.

Third, one aspect that is sometimes obscured by the hard-nosed debate spurred by the Proposed Directive is the importance of bringing the issue of patent protection of computer–implemented inventions within Community competence. Indeed, with the effort to implement a Community-wide patent still underway, there are not many alternatives to a specific Directive to avoid that a matter so important for the European economy be left to the discretion of the EPO and of its appelate bodies. This is all the more important if one takes the view that a move toward U.S. practice in the realm of patentability of computer–implemented inventions would be undesirable. In addition to this, it should be noted that a Directive would endow the Court of Justice with jurisdiction to give preliminary rulings, which would help securing legal certainty in case of divergence of Member States' case law.[86]

As for the objectives that the Proposal posits as objectives to achieve through harmonization of legislation, a few words will now suffice. Few doubts can be expressed on the worthiness of the objectives of promoting investment and innovation in the field of computer–implemented inventions (cfr. Recital 1) and of removing law-related barriers to trade, to the extent they exist, so as to ensure the proper functioning of the internal market (cfr. Recital 2). Similarly, we deem the objective of increasing European enterprises' competitiveness in the global arena surely apposite, although it should be noted that the most recent Global Competitiveness Report published by the World Economic Forum reports that the strength of protection offered by the intellectual property system in most European countries is perceived to be as high as in the United States by the world's leading business executives[87].

We cannot avoid expressing some more doubts, however, on the remaining issues raised, directly and indirectly, by the Proposal. In particular, Recital 5[88] seems to imply that the objective of allowing firms to derive

[86]See the Explanatory statement of the McCarthy report.

[87]The Global Competitiveness Report gathered responses from 7,741 business executives. Table 6.04, part 3, section 6, p.473 reports that Germany, UK, Denmark and Finland are rated 6.2 on a scale ranging from 1 (weaker) to 7 (stronger), exactly as the United States. Sweden and the Netherlands also rank highly, with 6.0 and 5.9 respectively.

[88]Recital 5 of the Draft Directive reads: "Therefore, the legal rules as interpreted by

the maximum advantage from patents should be valued as an end in itself, while it should more appropriately be considered as a means to the end of promoting innovation[89]. Moreover, to the extent that the explanatory memorandum can be read in conjunction with the text of the Proposal as implying an interest in increasing patenting by SMEs, it is not straightforward to conclude that this is an issue the Commission should address *per se*.[90] Indeed, while some evidence exists, both anecdotal and empirical, concerning the positive role patenting may play for SMEs especially in facilitating venture capital financing and access to markets, no evidence so conclusive as to justify setting increased patenting as a worthy policy objective *per se* has yet been provided. The policy objective worth pursuing is really increased innovation by SMEs, rather than increased patenting.

3.2. Is a European Directive Necessary?

If, as we have argued in the previous section, there is a real need for some form of legislative intervention and the objectives set by the Proposed Directive can be said to be overall worth pursuing, it is interesting to ask whether a European Directive constitutes the appropriate instrument to pursue them. A hint for an answer to this question was provided in section 3.1, where it was suggested that addressing the issue of harmonization through a Directive has the merit of bringing the issue within Community competence. This can be considered as an advantage of the Directive when we compare it to the alternative of relying exclusively on a modification of art.52(2) and (3) EPC to be sought through the means set by the EPC itself.

However, we submit that a more general answer to this question depends on whether the case law of the EPO Technical Board of Appeal constitutes an appropriate basis for harmonization. Issuance of an European Directive can be said to be necessary and timely only if a positive answer can be given to the latter question. If EPO jurisprudence were found to be an inadequate basis for harmonization, it would follow that it might be preferable to make recourse to the intergovernmental negotiations necessary to amend the EPC in a way that unequivocally reflects the extent of protection chosen as op-

Member States' courts should be harmonised and the law governing the patentability of computer–implemented inventions should be made transparent. The resulting legal certainty should enable enterprises to derive the maximum advantage from patents for computer–implemented inventions and provide an incentive for investment and innovation."

[89] A concern similar to the one we express here results from the McCarthy Report.

[90] See, for instance, the Explanatory Memorandum at p. 12, where it is stated that "Harmonization and greater transparency should provide an incentive for European companies, and in particular for SMEs, to use such patents in order to fully exploit their computer–implemented inventions."

timal. While it is apparent that intergovernmental decision processes bring about substantial difficulties and recourse to a Directive bears on its face the promise of providing a more rapid solution to the issues addressed, there might not be much of an alternative to this action if a more radical form of intervention than a validation of the judicially-created *status quo* were found to be necessary. Indeed, issuance of a Directive containing provisions substantially diverging from EPO case law could create more problems than it was meant to solve and exacerbate the lack of legal certainty, unless the EPO showed a willingness to modify its practice in accordance with the Directive as it has been the case for the Biotech Directive[91]. This is not a likely outcome, however, if the Directive was going to set more restrictive terms for patentability because, among other things, of the obvious interest in increased patent applications a self-funding agency is likely to have.

We postpone the answer to the question whether EPO case law constitutes an adequate basis for harmonization to the following sections. Here we only anticipate that we suspect the answer should be given in the negative: harmonization along the lines of EPO case law is not likely to bring about any of the objectives set by the Proposal. If our reasoning in the following pages has some merits, it follows that this is indeed not the most opportune time for proposing the issuance of a Directive: a Proposal that followed EPO case law, as the one currently submitted by the Commission does, is highly likely to fail to achieve its stated objectives, while a Proposal diverging from EPO case law can exacerbate the lack of legal certainty by creating further inconsistencies with the practice of the EPO appellate bodies. There are two forms of legislative intervention that it might be desirable to pursue before making recourse to a Directive explicitly targeting the patentability of computer–implemented inventions. In addition to the already mentioned modification of the EPC, there is also the possibility of pushing forward the project of a Community patent, which could help to address many of the issues raised by the Proposed Directive.

In particular, the availability of community-wide patents is likely to help tackling the problem of the high costs of patent prosecution and to improve the accessibility of the patent system to SMEs. Most importantly, if much of the discretion in setting the boundaries of patentability is to be left to courts (as implied by the Proposal, which adopts a vaguely specified criterion of technical contribution) the creation of a centralized litigation court under the Proposal for a Community patent could become crucial to ensure legal certainty and predictability of litigation outcomes (as it has been the case for the CAFC in the US)[92]. The problem with the Community Patent

[91] See, for instance, Gold and Gallochat (2001).

[92] We refer here to the creation of the Common Appeal Court, envisaged by the Protocol

in the form established by the Community Patent Convention (CPC) is that it builds upon the structure of the EPO: Community patents are granted and maintained by the EPO. The uncertainties associated to the provisions relating to computer programs would thus be there to stay, unless a direct modification of the EPC was pursued.

A related question is whether a Directive in the field of computer–implemented inventions is necessary in order to bring European legislation in line with the Agreement on Trade-related Aspects of Intellectual Property Rights (the TRIPs Agreement), by which both the Community and its Member States are bound[93]. The Proposal makes explicit reference to the TRIPs agreement in its recital 6, which reflects the view, on which there is no clear consensus among legal scholars, that art.27(1) TRIPs should be read as implying that software should necessarily be granted patent protection. Art.27(1) states that "[...] patents shall be available for any *inventions*, whether products of processes, *in any field of technology*, provided that they are new, involve an inventive step and are capable of industrial application". While patent proponents obviously share the view expressed in recital 6, an alternative viewpoint has also been proposed according to which no unequivocal obligation to allow patent claims for software follows from the TRIPs agreement.

The argument rests on both the history of the TRIPs agreement and on a strict interpretation of its article 10. As for the first line of reasoning, it proceeds from the observation that the TRIPs agreement has not provided an harmonized legal definition of "invention", thus leaving it to the States participating to the agreement to determine what an invention is in line with their legal traditions. Now, the reason why computer programs are subject to the "as such" exclusion within the meaning of article 52(2) and (3) EPC is exactly that the legal tradition of European Member States has historically qualified them as "non-inventions"[94], which implies that no

on litigation concerning the infringement and validity of Community Patents entered into as part of the Luxembourg Agreement of 1989. The Protocol also requires Member States to designate in their territories a limited number of national tribunals of first and second instance to be known as "Community Patent courts". See Prime (2000).

[93]Cfr. Council Decision 94/800/EC of 22 December 1994, concerning the conclusion on behalf of the European Community, as regards matters within its competence, of the agreements reached in the Uruguay Round multilateral negotiations (OJ L 336, 23.12.1994, p.1).

[94]Cfr., for instance, Hart (1997), reporting the opinion expressed by Gunter Gall — Director Legal Affairs European Patent Office — in a paper given at a conference organized in Paris in the occasion of the introduction of the 1985 guidelines for examination at the European Patent Office: "The main reason why computer programs are excluded from the range of patentable inventions is therefore to be found in the concept of the Invention, which grew out of national traditions and forms the basis of the EPC. Even if programs for computers were not explicitly excluded from patenting by Article 52(2) EPC,

strong case can be made of the existence of a specific obligation to provide patent protection for computer programs under TRIPs[95]. To this I'd like to add that it is at least odd that the Commission has apparently failed to recognize that this alternative view merits some consideration. Indeed, one of the aims of the Commission's directive is arguably that of clearly stating what kind of computer–implemented products and processes should be considered inventions within EU patent law. If that issue had really been solved by the TRIPs agreement, as the view of software patents proponents would imply, the need for harmonization would be much more limited, as the TRIPs agreement is already binding on both the Community and Member States.

The second line of reasoning takes as its starting point a restrictive interpretation of Article 10 TRIPs, stating that "[c]omputer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971)". The reasoning then proceeds by noting that literary works are by definition not inventions, which would therefore contradict interpretations of art.27(1) leading to state the existence of a prohibition to exclude computer programs from patentability under TRIPs.

In sum, it is probably safe to say that the TRIPs Agreement contains no express obligation to allow claims to computer programs, although it does imply that software cannot be explicitly excluded from patentability either[96]. What is important to note, in this connection, is that if the Commission's Proposal were definitely approved in its current form, it would have the effect of making it compulsory for the European intellectual property system to grant patent protection for computer programs, as the Proposal provides that "Member States shall ensure that a computer–implemented invention is considered to belong to a field of technology"[97]. This would have, in turn, the effect of considerably restraining Europe's freedom to decide over the implementation of future legal changes in the field of computer–implemented inventions, because restrictive changes would then have to be negotiated at the WTO level.

European patents could not be granted in respect of them because they do not constitute a patentable invention as defined in Article 52(1) EPC".

[95] See, for instance, Bakels and Hugenholtz (2002, p.15).

[96] See also Taketa (2002) at p.963 ff. as regard to the analysis of the TRIPs treaty obligations with respect to business methods patents.

[97] See art.3 of the Proposed Directive.

3.3. Is the Proposed Directive likely to achieve its stated objectives?

To simplify things at the extreme, let us for now focus on harmonization and increased innovation as the two main objectives pursued by the Proposed Directive. One may then ask whether the Directive is likely to achieve both of them, none or only one of them. The answer depends, as mentioned above, on the question whether EPO practice can be considered as the most appropriate basis for harmonization. To address this issue a twofold approach should be taken asking, first, whether harmonization along the lines of EPO practice is likely to provide legal certainty and, second, whether the standards set by EPO case law are the most suitable to promote innovation. The two questions are, of course, intertwined to some extent. In particular, it is highly likely that a negative answer to the first would also imply a negative answer to the second: if EPO judicial standards are not likely to provide legal certainty, they will be even less likely to promote innovation. However, it could also be the case that a transparent and tight legal system failed to promote innovation because of the inadequate standards it sets. In this section we will address mainly the issue of whether the conditions for patentability derived from EPO case law and incorporated into the Proposed Directive are likely to bring about legal certainty, whereas the second question will be the subject of section 4.1, where it will be considered mainly in light of economic insights.

As was briefly reported in section 2.2, it is to the criteria of "technical character", "technical contribution" and "technical effect" that the EPO Technical Board of Appeals attributes a critical role when deciding on patentability of computer–implemented inventions. The Commission's Proposal validates this approach by specifying that it is meant to "ensure that inventions which belong to a field of technology and make a technical contribution are susceptible of protection, and conversely to ensure that those inventions which do not make a technical contribution are not so susceptible" (recital 15). The approach may be said to have some merit. First of all, it should be noted that the requirement of technicality has always been part of the European patent law tradition. To state it clearly in the Proposed Directive means therefore adopting an approach consistent with a systematic reading of other sources of law.[98] Secondly, it has been argued that formalizing the criterion of technical contribution has the merit of bringing the issue of inventive step into the assessment of patentability[99].

[98] See *infra*, section 2.2.

[99] See Cook (2002), stating at p.199 that "expressly integrating the assessment of exceptions into that of inventive step might herald, in the longer term, a significant difference in approach to software patents, both by patent offices and by those opposed to software patents, in that most real objections to software and business methods patents lie in the belief that they are granted for contributions that are obvious, an issue that has been overshadowed in European patent law and practice by the sterile focus on exceptions".

Finally, one positive consequence of the Commission's approach is that so-called transition costs are reduced to a minimum. To take a different stance would have implied, among other things, the problem of deciding what to make of previously issued patents.

In spite of the above-mentioned advantages, in this section we will argue that the answer to the question whether we should expect increased legal certainty to follow from the Proposal's approach to pursue the harmonization objective along the lines of EPO jurisprudence should be given in the negative. Part of the reason lies in the fact that the requirements of "technical character", "technical contribution" and "technical effect" are inherently undefinable and are therefore considered by many as not sufficiently stringent to distinguish in any predictable way between patentable and unpatentable computer–implemented inventions. The indefinite nature of these criteria implies that in order to adopt them as a benchmark for patentability one of two routes must be taken: either the technical requirement is interpreted in the restrictive meaning developed by the German legal tradition, or computer programs are defined as technical by definition and the task of filling up the word "technical" is left to courts. Neither of these options is free of problems. The problem with the second, which is the one adopted by the Commission's Proposal, is that the only consistent way of interpreting the ensuing set of conditions for patentability implies an extension of patent protection for computer–implemented inventions close enough to a situation corresponding to an express permission for claims to computer programs "as such". This is not only in contrast with the Commission's statement of purpose, but has also the disadvantage of implementing a legal change of significant economic impact in a way that leaves room to considerable more discretion than an express deletion of the exclusion from patentability of computer programs "as such" contained in art.52(2) and (3).

The extent of the confusion surrounding the requirements of "technical effect" and "technical contribution" can be fully appreciated by reading the opinions expressed in this regard by the Economic and Social Committee[100], by responders to the survey by the French "groupe the travail interministeriel"[101], and by responders to a questionnaire diffused by the International Association for the Protection of Intellectual Property (AIPPI)

[100] See the "Opinion of the Economic and Social Committee on the 'Proposal for a Directive of the European Parliament and of the Council on the patentability of computer–implemented inventions"', OJ C61/154, 14.03.2003, stating that "the distinction between software 'by itself' and 'software producing technical results', the product of legal casuistry, is indefinable in practice as all software is made to run on a computer or an electronic component, either as a system or as an application."

[101] Rapport du groupe the travail interministeriel "Quelles protections pour les logiciels?", 13 July 2001, available at `http://www.industrie.gouv.fr/enjeux/rapport4.htm`.

Special Committee on computer software, information networks, artificial intelligence and integrated circuits[102]. The latter document is particularly significant in that it addresses directly the question of the meaning of the word "technical" in expressions such as "technical effect", "technical problem" and "technical contribution" and gathers opinions from a large number of AIPPI national groups. In addition to making it clear that there is no universally accepted definition of the word technical, the AIPPI report reaches the striking conclusion that "a majority of the groups considers that trying to define the words "technical" or "technology" is a dead-end". Better would be, according to the surveyed groups, to consider in broader terms the question of the definition of a third set of conditions for patentability, in addition to novelty and inventive step.

Interestingly enough, the above-mentioned difficulties are recognized even in the material accompanying the Proposal, although the concept of "technical contribution" plays in it such a pivotal role[103]. The Commission suggests that the very fact that the patent system protects what is novel, and therefore not previously known, implies the inherent impossibility of defining in a legal text such as the Proposed Directive what the definition "technical" encompasses. The latter assessment should therefore be left to courts in the opinion of the Commission. In this connection, it should be noted that the TBA itself has recognized that "[i]t may very well be that [...] the meaning of the the term "technical" or "technical character" is not particularly clear"[104].

The fact that the word "technical" and therefore the concepts of "technical character", "technical effect" and "technical contribution" are inherently undefinable, as it seems unquestionable in light of the above, implies that there are only two possibilities available in order to use such concepts. The first is to accept the positive definition of technological invention developed in the German legal tradition, which is very restrictive in that it links the fulfillment of the technicality requirement to the "planned use of controllable natural forces in order to achieve predictable results"[105]. This solution has a number of drawbacks. First, it reflects a view of technology that it is not difficult to qualify as obsolete. In fact, the definition was developed at a time when inventions related predominantly to the realm of mechanics,

[102]EXCO Lisbon 2002, report of the Special Committee Q132 — Computer software, information networks, artificial intelligence and integrated circuits.

[103]Proposal for a Directive on the patentability of computer–implemented inventions — frequently asked questions, available at `http://europa.eu.int/comm/internal_market/en/indprop/02-32.htm`

[104]Cfr. the decision *Controlling Pension Benefits System/PBS PARTNERSHIP*, T931/95; OJ 2001, 441.

[105]German Supreme Court, 27 March 1969, GRUR 1969, 672 (*Rote Taube*).

much before the appearance of the first universal programmable machines. Second, the fact that the latter test was elaborated before the EPC but that the EPC drafters chose not to adopt it as part of the definition of patentable subject matter may be taken as a hint of the fact that this interpretation of the notion of technicality is not congruent with a systematic reading of other sources of European law[106]. Third, adoption of the German notion of technicality may create the undesirable outcome of inducing applications to be drafted in a way that unnecessarily emphasizes the presence of some physical apparatus, while the importance of the invention relates exclusively to the software implementation. Finally, legal doctrine suggests that this interpretation may, in the end, be no less indefinite than others.

The second option is to state that all programs functioning on a computer are technical by definition and leave to courts the task of filling up the concepts with a specific meaning. This is the solution adopted by the EPO Technical Board of Appeal in the decision *Controlling Pension Benefits Systems*[107] and also by art.3 of the draft Directive. Taking this second route, however, implies that the range of computer–implemented inventions excluded from patentability becomes extremely narrow. This is especially apparent when art.3 of the Proposal is read in conjunction with other criteria developed by EPO practice or with other provisions contained in the Proposed Directive. Consider for instance the criterion of "further technical effect" introduced by the TBA in the two *IBM Computer Program Product* cases. Once it is recognized that the nature of any computer–implemented invention is technical and given that any computer program will bring about an effect which is "further" with respect to the "normal" physical interaction between the program itself and the computer, as any program is meant to achieve some effect or purpose, consistency will require that any computer program be considered to imply a further technical effect.

A similar reasoning holds for the criterion of "technical contribution" expressed in artt.2 and 4 of the Proposal, especially in light of the fact that the presence of a technical contribution has to be "assessed by consideration of the difference between the scope of the patent claim considered as a whole, elements of which may comprise both technical and non-technical features, and the state of the art", as art.4.3 specifies along the lines of the *Koch&Sterzel* and subsequent EPO decisions. Note also in this regard that EPO jurisprudence has made it clear that "a technical contribution may arise if there has been some improvement in the way that processes are car-

[106] See the Explanatory Statement of the Report of the Committee on Legal Affair and the Internal Market on the Proposal for a Directive of the European Parliament and of the Council on the patentability of computer–implemented inventions (COM(2002) 92 — C5-0082/2002 — 2002/0047(COD)), at p. 23.

[107] *Controlling Pension Benefits System/PBS PARTNERSHIP*, T931/95; OJ 2001, 441.

ried out or resources used in a computer"[108]. If this is the case, then it would not be difficult for patent-seekers to draft claims in a way that emphasizes the existence of some sort of improvement.[109]

If an invention's contribution only requires to be implemented through a computer in order to be considered technical, and an invention has to be considered "as a whole" for the purposes of assessing the presence of a technical contribution, then application of this criterion brings within the realm of patentable matter practically any computer program, perhaps with the only exception of programs destined to the solution of abstract mathematical problems and with no concrete application[110]. Indeed, it has been suggested that by giving a broader interpretation of the requirement of technical contribution it would even be possible to bring the scope of protection of computer programs granted in Europe in line with that of the United States[111]. Moreover, it is a fact that the application of the EPO criteria has not prevented the granting of patents on business methods, on the undesirability of which there seems to be a rather widespread consensus.

In sum, the Proposed Directive in its present form cannot be said to adequately serve the purpose of increasing legal certainty. The main problem with the approach taken by the Proposal is that it establishes a set of conditions for patentability whose only meaningful and consistent interpretation coincides with a significant extension of patentability, close to the situation corresponding to a deletion of art.52(2) and (3). The criteria proposed leave nonetheless considerable room to uncertainties, clever drafting of claims and exaltation of form over substance, with the consequence that it is highly likely that issuance of a Directive in the form proposed by the Commission would have the only foreseeable effect of increasing, on one side, patent applications and, on the other side, IP-related litigation.

The objective of legal certainty would be, in our opinion, better furthered by a deletion of the "as such" provision of art.52(2) and (3) EPC to be pursued at the intergovernmental level, if convincing arguments on

[108] See the Proposal for a Directive on the patentability of computer–implemented inventions — frequently asked questions. MEMO/02/32.

[109] The German Federal Patent Court has followed a line of reasoning similar to the one we have suggested in the *Error Search* decision of 26 March 2002, where it rejects an EPO patent on grounds that the EPO doctrine of "technical contribution" makes all business methods patentable and is therefore in violation of the European Patent Convention.

[110] See Guglielmetti (1997), especially at pp.185-190.

[111] See Hart et al. (1999, p.24), stating that "[t]o address the difference between the scope of protection in the U.S. and Europe it would be necessary either to amend the implementing regulations (rules 27 and 29) or to give a broader interpretation to technical contribution, such as that suggested by the United Nations where technology is defined as 'a combination of equipment and knowledge"'.

the merits of such a move were found. Issuance of a Directive would under these circumstances be more difficult to justify, but it would still have the merit of bringing the issue of patentability of computer–implemented inventions within Community competence and could help to fine-tune the legal protection accorded to computer-programs by addressing directly the most sensitive issues. Alternatively, if the EPC is there to stay in its current form, an attempt to find criteria more stringent than those contained in the Commission's Proposal for a distinction between patentable and unpatentable subject matter should be pursued. This is the approach taken by Parliament in the amendments approved on first reading.[112]

As a final note, consider also the question whether the Proposed Directive is likely to favor an increase in patenting by SMEs. Of course a clarification of the conditions for patentability is likely to have some positive effect in this respect, and the publicity (both positive and negative) enjoyed by the Proposed Directive could be expected to have some effect in terms of increased awareness of the patent system. However, it could be the case that SMEs' low propensity to patent depends on reasons different from a lack of information, given that it is currently low also in countries where software has long been patentable[113]. That the most pressing problem concerning the use of the patent system by SMEs is given by an information deficiency is questionable at best: the report commissioned by the Directorate General for Enterprise[114] interprets statements concerning the complexity, expensiveness and unreliability of the patent system as a sign of the low level of awareness of the patents as a means of protection, while it would have been much more straightforward to conclude that the real problem of European patents for SMEs is their cost. To the extent this is really "the" critical issue, it would perhaps be better addressed by the long-awaited creation of a Community patent.

[112]The approach is that of specifying that a "'technical contribution', also called 'invention' means a contribution to the state of the art '*in a field of technology*"' and that "[t]he use of natural forces to control physical effects beyond the digital representation of information belongs to a field of technology" (art.2(b), as amended). The text approved by Parliament thus positively receives the opinion expressed by the Committee on Culture, Youth, Education, the Media and Sport, rather than the approach taken by the Committee on Legal Affairs and the Internal Market — appointed as the Committee responsible for examination of the Proposal.

[113]See the empirical study of the Canadian and U.S. software industry by Chabchoub and Niosi (2004), finding that firm size is strongly related to patent propensity: very few SMEs request and obtain patents and 90 per cent of U.S. software patents is currently held by a handful of firms.

[114]See Tang, Adams, and Paré (2001).

4. Back to basics: patents, software and economic reasoning

In this section we consider two issues related to the question whether the approach chosen by the Proposed Directive — harmonization along the lines of EPO case law — is likely to promote increased innovation. The previous discussion has raised some doubts on the likelihood of a positive answer by putting into question the suitability of the Proposal as a means to bring about legal certainty. Indeed, it is unlikely that a legislative initiative that failed to achieve the objective of increasing legal certainty could be an appropriate means of promoting innovation. This section goes more directly to the point by considering insights from recent economic scholarship.

The first question we address is whether computer programs "as such" should be patentable (section 4.1) or, more clearly, whether the "as such" provision contained in art.52(2) and (3) should be deleted. A positive answer to this question would imply that the Directive is going in the right direction, although the reasoning of the previous section implies, on one side, that an inconsistency should be registered between the actual outcome of the Directive and the aim, expressed in the Explanatory memorandum, of avoiding an extension of the patent protection available for computer-programs and, on the other side, that a direct modification of the EPC would be preferable in order to increase legal certainty. By contrast, a negative answer would imply a need for a radical rethinking of the approach. Unfortunately, the economic evidence surveyed in this section, both theoretical and empirical, does not allow straightforward conclusions. The only unquestionable conclusion is, perhaps, that there is a need for more economic analysis targeted specifically to the software sector in order to inform policy making.

The second question is the following: how can the drawbacks of the patentability of computer–implemented inventions be limited (section 4.2)? Addressing this question provides us with a further chance of commenting on the question whether the balance struck by the Proposed Directive is likely to be appropriate. Indeed, one could argue that, although a direct modification of the EPC would be preferable, issuance of a Directive would still have the merit of targeting some problems associated to the patentability of computer–implemented inventions that are more directly addressed through a Directive than through other means. However, it appears that the Commission's Proposal does not take this chance.

We proceed from two methodological assumptions. The first is that the issues under consideration are substantially economic issues. Basing the rationale for policy intervention on an assessment of the ensuing benefits and costs to society seems a much more promising avenue to take than relying on inherently uncertain distinctions based on semantics. After all, it should

not be forgotten that the primary rationale for the very existence of the patent system is the objective of increasing innovation, so that decisions concerning its modification should be taken on the basis of an assessment of the measures that would best serve this purpose, rather than by focusing exclusively on the internal consistency of the system as it has historically developed. Note also that in the present case, the truly economic nature of the decisions underlying the Proposal has been somewhat obscured by the fact that the Commission insists she is only providing a confirmation of the *status quo*, which seems to suggest that no accurate cost-benefit assessment is required.

The second assumption is that, in considering changes to the *status quo*, the burden of proof should be on those proposing the changes. This implies that if, as argued in the previous section, the Proposed Directive is likely to result in a significant extension of patent protection granted to computer programs, we think the Commission should provide a much more compelling economic justification for its Proposal. Only few studies considering the economic impact of the patentability of computer–implemented inventions have been reportedly taken into consideration by the Commission and among those, only the results of a study conducted by the London Intellectual Property Institute (which is by no means an economic think-tank) on behalf of the Commission are expressly mentioned, with the consequence that the Proposal appears to reflect a degree of consensus on the economic merits of the patentability of computer–implemented inventions that can only be the outcome of scarce attention paid to recent economic scholarship.

4.1. Should computer programs "as such" be patentable?

In this section we address a question whose real meaning may well be not entirely clear, as the "as such" provision has been interpreted in various ways. What we are really asking here is whether it would be wise to recommend patentability of computer programs in general and thus delete the exception contained in art.52(2) and (3). We seek an answer considering insights from the economic literature on intellectual property rights in light of the specific characteristics of software innovation. While the argument has been often advanced that there are no valid reasons to discriminate against the software field by not allowing patent protection to be granted to software creations[115], the peculiar features of software innovation may warrant particular caution in evaluating the likely economic impact of the patentability

[115]See, for instance, Dam (1995); Dryja (1995); Syrowik (1995/1996); Gruner (2000); Evans and Layne-Farrar (2004).

of computer–implemented inventions[116].

Competition, monopoly and cumulative innovation

The primary rationale for granting patent protection is to provide incentives to innovate to economic actors facing difficulties in appropriating the returns from their intellectual creations - the so-called incentive function of patents. Society is ready to grant a limited monopoly on the newly created ideas in return for the inventor's innovative effort, so that a trade-off between monopoly costs and benefits in terms of increased innovation is established. The convenience of incurring such trade-off, however, has long been put into question by those emphasizing the virtues of competition as a stimulus to innovation. This alternative view, expressed among others by Kenneth Arrow[117] and more recently by Boldrin and Levine[118] and Quah[119], stresses the existence of incentives to innovate other than state-created monopolies over ideas and suggests that monopoly may be less effective than competition in creating an environment conducive to innovation.

The possibility that both of these views have some merit cannot be ruled out all-together. Empirical studies of the mechanisms employed to appropriate innovation returns have shown that patents play a very different role in different industries[120]. The recent Carnegie Mellon 2000 survey[121] indicates, for instance, that the importance attributed to patents is high primarily in pharmaceuticals, while a combination of legal and non-legal mechanisms such as lead time, secrecy and possession of complementary capabilities plays a more decisive role in all of the other sectors considered. The mentioned study does not provide clear indications as regard the software sector. One could thus hypothesize that patent incentives may be as important in software as in other fields of technology and that the evolution of the software industry, with the associated increase in average R&D costs and decrease in the costs of copying, may warrant an increased reliance on patents[122].

[116]We have chosen not to address directly the issue of the impact of patentability of computer–implemented inventions on EU global competitiveness. However, note that if a positive impact of patentability on innovation cannot be clearly established, as we are going to argue, it becomes hard to make a case for patentability as a means of increasing EU Global competitiveness.

[117]See Arrow, 1962.

[118]See Boldrin and Levine (2002).

[119]See Quah (2002).

[120]See Mansfield (1968); Taylor and Silberston (1973); Levin, Klevorick, Nelson, and Winter (1987). See also Merges and Nelson (1990) for evidence of a more anecdotal nature.

[121]Cohen, Nelson, and Walsh (2000). For similar results in the European context see Arundel and Kabla, 1998.

[122]See Smith and Mann (2004); Gruner (2000).

There are various reasons, however, to suspect that the incentive function performed by patents may not be particularly strong in the case of software.

The first reason relates to the nature of innovation in the software industry. Bessen and Maskin describe it as both sequential and complementary[123]. Sequentiality refers to the fact that innovations build upon each other and each innovation constitutes an incremental improvement over the previous one. Complementarity indicates the existence of some sort of positive externality among the research paths taken by different innovators, i.e. by taking a different research line each potential innovator increases the overall probability of success in a given innovative endeavour[124]. Under such circumstances, the two authors conclude for the superiority of a setting characterized by competition and rapid imitation on the basis of both a dynamical model and some empirical observations concerning the natural experiment occurred in the U.S. software industry as a consequence of the courts' change of attitude towards software patentability in the 80s. More generally, recent economic scholarship has recognized that, in contexts characterized by cumulative innovation of this kind, patents may create some additional problems with respect to industries producing products of a more discrete nature. In order for patents to really serve their purpose of promoting innovation, patent design needs to optimally solve the problem of dividing profits between pioneers and improvers, and between successive innovators in general[125]. Increasing protection for early innovators raises the costs of improvements. If an appropriate balance is not found, it is possible for patents to constitute a drag, rather than a stimulus, to innovation.

The second reason why the incentive rationale for patent protection may not be as strong in software as in other sectors is that the costs of R&D may be relatively low in software as compared to other industries. Although circumstances may have significantly changed over time, and development costs are on the rise especially for operating systems, it remains true that the prototypical innovator in software is identifiable with the young engineer working in a garage. This is not to say that the somewhat idealized image of the innovative garage synthesizes the normal innovative conditions of the software industry, but rather to emphasize the fact that the most important input to software production is human capital, rather than laboratories and other facilities involving significant fixed costs as, for instance, in pharmaceuticals and biotechnology (where the human capital input is as important

[123]See Bessen and Maskin (2000).

[124]The congruence of this description with the nature of software innovation is confirmed by the empirical study conducted in Germany by Blind and Edler (2002), that also finds evidence of some idiosincracies between patenting and the software development process.

[125]see, generally, Scotchmer (1991); Chang (1995); Green and Scotchmer (1995); Scotchmer (1999).

as in software, but fixed costs are significantly more binding). If this is true, then patents may not be indispensable to recoup investments in software innovation[126].

This is especially true in light of the availability, in the software sector, of alternative forms of incentive - which brings us to the third aspect limiting the importance of the incentive function played by patents in software. All of the empirical studies we are aware of reveal that firms in the software industry, and especially SMEs, tend to rely predominantly on means other than patents in order to protect their innovations[127]. Being the first to market is often indicated as the most effective way of gaining a competitive advantage from one's own innovations. Copyright is generally regarded as a cost-effective means of protection, especially if coupled with secrecy, although its limitations are becoming apparent also to SMEs, that most heavily rely on this form of IP protection[128]. Informal methods of protection such as the creation of customer/supplier relational trust and the creation of a market niche can also be relied upon. To this it should be added that the very success of free and open source software (F/OSS) provides a strong indication of the effectiveness of alternative forms of incentive in stimulating software innovation (in the case of F/OSS, even non-economic). Of course patent protection is increasingly sought by large firms, especially in the U.S., but the existence of this trend does not prejudice the above observation on software firms more generally.[129]

As an additional factor, consider also the rapid pace of innovation characterizing the software industry. That innovations occur at a particularly rapid pace means, on one side, that the lengthy patent grant procedure may not satisfy the need for protection when it is felt the most and, on the other side, that the statutory length of patent protection of 20 years may not balance the incentives of successive innovators correctly. Initial patent-holders

[126]As a qualification of this argument note, however, that a substantial fraction of the costs incurred by large software firms is related to the costly gathering of information concerning consumers' needs and the characteristics of demand. To the extent patent protection incents this socially-beneficial activity, recovery of these costs may constitute an argument in support of software patenting. It should be noted, however, that large software firms can generally rely on means different from patents in order to protect their investments, the case of Microsoft being one notable example in this respect.

[127]See, in particular, the survey of both attorneys and developers conducted by Effy Oz, finding that the preferred means of protection for the wide majority of developers and for two-third of attorneys is copyright (Oz, 1998). See also the studies by Tang et al. (2001); Blind et al. (2001); Tirole, Henry, Trommetter, Tubiana, and Caillaud (2003)

[128]See Tang et al. (2001).

[129]See Graham and Mowery (2002), studying the trend in software patenting in the United States during the period 1987-1987. Note that the sample used in this study includes the 100 largest U.S. packaged-software firms and the largest 12 U.S. electronic systems firms.

may continue to exact a toll on future innovations long after the contribution from their innovation has been exhausted[130].

Finally, there are reasons to think that software may suffer particularly from the drawbacks of monopoly and the risks to continued innovation inherent in the tendency toward concentration of intellectual assets in the hands of few. One aspect of this problem is related to the network effects prevalent in software[131]. Patents may have particularly insidious effects when they impinge upon widespread network standards: they may create durable market power and can be utilized to impede competition within the standard[132].

Patents, copyright and markets for technology

A second line of argument advanced in support of the granting of patents in general and of software-related patents in particular, is identifiable with the so-called transactional function of patents. Patents aim to solve the well-known Arrovian paradox, allowing for the exchange of intangibles. This is true not only when intangibles are in the form of end-products, but especially when they constitute inputs into further innovative activities. Thus, the existence of patent protection over the inputs to a collaborative research endeavor may facilitate inter-firm R&D collaboration. Small firms that lack resources to effectively commercialize their inventions may access the market by becoming specialized technology suppliers[133]. By assigning ownership entitlements to successive innovators, patents determine bargaining positions that facilitate welfare-enhancing transactions and enable some sort of division of profits among subsequent contributors to a given stream of research[134]. A more radical view holds that, by enabling bargaining, the assignment of strong and broad patent rights may provide incentives for further product development and refinement and may help to coordinate development effort in such a way so as to reduce the duplication of innova-

[130] On this point see also Cohen and Lemley (2001); Commission (2002b). Note, however, that this reasoning may be flawed if applied to embedded software, i.e. software integrated in physical systems such as planes, mobile phones etc., in that the useful life of the latter may be long as that of other machinery.

[131] Direct network effects arise when the value consumer derive from a given product is a positive function of the number of other consumers that purchase the same product — the typical example being the telephone network. Indirect network effects arise when increased demand for one product involves an increase in supply of complementary products.

[132] However see Dam (1995), for a critique of the relevance of network externalities in the software industry.

[133] See, for instance, Merges (1999).

[134] This is the rationale underlying, for instance, the U.S. doctrine of blocking patents, intended as a means of "forcing" transactions.

tive efforts[135].

It has been argued that this function may be particularly relevant in software. The hypothesis underlying this conclusion is that patents are more suitable than copyright as a means to enable transactions and the creation of a market for intangible software creations[136]. A shift in legal protection from copyright to patents, in this perspective, would encourage the development of a market for software components by forcing competitors to seek licenses from patent owners instead of replicating the innovative and unprotected ideas contained in copyrighted works. In the process, society would also benefit from a reduction of the inefficiencies of reinvention.[137]

What proponents of the above view emphasize as an advantage of patents, namely that patents make licensing indispensable in order to combine existing technologies into new ones, represents a cause of concern for other scholars. In the context of biotechnology, for instance, Michael Heller and Rebecca Eisenberg have warned about the potentially disastrous consequences of the excessive fragmentation of intellectual property entitlements - the so-called "anticommons" problem[138]. When development depends on the combination of multiple components each of which may be the object of patent protection, as it is the case for complex and cumulative technologies like biotechnology and software, transactional hurdles may end up exerting an excessive "tax" on future innovations.

We consider impediments to IP-related contracting in general elsewhere[139]. Here, we would like to consider some reasons why problems may be exacerbated in the case of software. One factor that tends to increase the likelihood of anticommons problems is the degree of dispersion of ownership of intellectual assets. While at present ownership of software-related patents is highly concentrated[140], to the extent the patent system becomes truly available for firms of all sizes, we should expect ownership to become increasingly fragmented. Indeed, the software industry is one in which the role of individual inventors and micro-firms is particularly relevant. A second problem may stem from the scarce informative role played by patent databases in software. Firms in the software industry are generally very reluctant to consult patent databases and they are even advised to refrain from consulting

[135]Kitch,in his landmark article of 1977, exposes the so-called "prospect theory" according to which patents may be analogized to mineral claims, in that they facilitate the orderly exploration of a given research field.

[136]On markets for technology in general see, for instance, Arora, Fosfuri, and Gambardella (2001).

[137]See Lemley and O'Brien (1997); Somaya (2001).

[138]See Heller and Eisenberg (1998).

[139]See the second chapter of this dissertation.

[140]See, for instance, the already mentioned 2004 study by Chabchoub and Niosi.

them, because doing so may cost them a charge of willful infringement[141]. This, of course, raises the possibility of inadvertent infringement and may, in the long run, create the feeling of the existence of a "patent landmine" with obvious adverse consequences for innovation. Finally, the above problems are compounded by the fact that patents tend to be granted for rather trivial innovations. This is as much a problem due to the lack of easily accessible collections of prior art as a problem of inherent indeterminacy of the non-obviousness (or inventive step) standard. Whatever the origin, the problem with trivial patents is that they exert an unnecessary toll on innovative activities and create risks and uncertainties easily overcome by large companies, but pernicious for SMEs[142].

As far as transactional issues are concerned, "anticommons" represent only one side of the coin, the other being the creation of patent portfolios and the adoption of "patent thicket" strategies. The mentioned Carnegie Mellon survey suggests that firms involved in innovation in "complex" technologies tend to accumulate portfolios of patents to be used as bargaining chips in negotiation. The accumulation of patent portfolios may, in some industries, be the only way around the problems posed by the existence of "patent thickets" and at the same time may contribute to enhance such problems. Difficulties associated to the existence of "patent thickets" arise when the rights over components necessary to develop a marketable invention partially overlap, so that no developer is free to commercialize his invention without infringing, or potentially infringing, someone else's patent. Building a portfolio of patents on related technologies can both protect firms from potential hold-ups and provide a means of limiting entry by competitors. The problem is related, but not identical to the "anticommons" problem[143].

Under such circumstances, patent pools and patterns of cross-licensing generally develop to enable continued innovation. This has been proved, for instance, for the semiconductor industry, where Hall and Ziedonis have found the increase in patenting to be strongly related to the adoption of patent portfolio strategies and have highlighed the existence of clear patterns of cross-licensing among established industry players[144]. Evidence of the strategic use of patents as bargaining chips and of the increase in patenting associated to these patenting strategies exists also for the IT field. One study relevant in this regard is the OECD/BIAC survey. This study finds, among other things, that more than three-quarters of the ICT firms surveyed now patent technologies they would not have patented one decade

[141]See, for instance, Blind et al. (2001); Tang et al. (2001).
[142]See, for instance, Kahin (2003) and Gosh and Kesan (2003).
[143]For a clear distinction between the two phenomena see Burk and Lemley (2003)
[144]See Hall and Ziedonis (2001).

ago, even if patentability was then unrestricted[145].

Another piece of empirical evidence concerning the software industry has been recently offered by Bessen and Hunt (2003). The two authors examine a comprehensive database of U.S. patents on inventions that use software granted between 1976 and 1999. The results of their analysis are taken to suggest not only that software patents are particularly "cheap" to obtain and that they are generally acquired for the purpose of building patent thickets, but also that greater use of software patents is associated to lower R&D intensity. Bessen and Hunt's study has been criticized on various grounds[146]. Of particular interest in this respect is the survey conducted in 2004 by Ronald Mann. Mann forcefully rejects the "myth" of a software patent thicket on the basis of interviews conducted among 50 industry executives (including software developers, venture capitalists, lenders etc.). Indeed, respondents to Mann's survey explicitly exclude the existence of a patent thicket when asked a direct question. However, the interviews reported by no means indicate an overall positive role for patents as Mann's argumentation would suggest. In short, Mann demonstrates that small firms value patents in a world in which they are already available to large companies, but that does not demonstrate that small firms would value them if the rest of industry were not already endowed with large patent portfolios. In other words, rather than showing that possession of patents has some value for small firms, the analysis of the interviews gathered by Mann suggests that the lack of patents constitutes a danger for small firms and that this danger is becoming more and more prominent[147]. Note also that participants to the U.S. Federal Trade Commission's Hearings on Competition and Intellectual Property Law have, for the most part, given responses of a totally different tone than Mann's responders, confirming the existence of a software patent thicket.

In sum, it seems reasonable to conclude that while it could be the case that "anticommons" and "patent thickets" are not currently posing as much problems as some scholars would suggest, continued and widespread reliance on patents for software may go in the direction pointed at by Cassandras. The question is thus one of balance of benefits and costs. It is certainly true that patent holders' initiatives such as patent pools and cross-licensing

[145]See Sheelan, Guellec, and Martinez (2003, forthcoming).

[146]See, specifically, Hahn and Wallsten (2003).

[147]See, for instance, Mann (2004, p.37), as regards the choice of patenting: "[i]f anything is clear, it is that the difficulty of this strategic choice, coupled with the difficulty in accurately predicting the future prospects for their products and their IP, doubtless leads to many of the failures in the industry". See also p.53: "industry executives do accept a premise of the patent-thicket thesis: that software patents are multiplying so rapidly that it is likely that many products startups are developing ultimately will infringe patents held by large companies".

may reduce the adverse consequences of patent-related transactional difficulties, but the question remains as to whether the overall benefits of software patents outweigh their costs, including the costs of devising these private solutions.

Secrecy, disclosure and intellectual property rights

One of the beneficial effects attributed to patents resides in the fact that they enable disclosure of technical information that would otherwise be kept secret by its possessor. This "disclosure function" of patents is often referred to as a bargain between the inventor and the public in which legal protection is granted in exchange for the free diffusion of the innovative ideas contained in the patent application[148].

The relevance of this function of patents — it is often argued — is even higher for software than for other fields. This is because, absent patent protection, the alternative means of appropriation available to firms would reduce information spillovers to a minimum. Software firms generally rely on a combination of copyright and secrecy to protect their products, and may even make recourse to technological means of protection such as encryption technologies. Since patents protect software functionality, and thus provide a defense against both servile and more creative forms of imitation — the argument goes — they provide an incentive to renounce to secrecy and reveal one's own source code without fears of misappropriation.

On its face, the argument seems well-grounded. However, one consideration concerning the possibility of the creation of perverse incentives and a couple of practical observations may somewhat undermine it. The first consideration derives from a simple question: in the absence of an explicit requirement to disclose the invention source code, what are the incentives for firms to effectively disclose the technical knowledge contained in their inventions? Basically none. Indeed, by making available the source code an inventor facilitates competitors' search for proof of infringement, while not gaining any appreciable benefit. Conversely, if software is distributed only in binary form, the legal prohibition on decompiling deprives competitors of any legal means to detect infringement. It follows that software patenting may even increase secrecy, rather than reducing it[149].

As for the two practical observations consider, first, that due to the length of the patent prosecution process, information is made available much later than the time of invention. This is of course true for all technologies,

[148]For a recent treatment, see Denicoló and Franzoni (2004).
[149]See Smets-Solanes (2001, p.67–68).

but in the rapidly changing software environment it may mean that information disclosed through patents may end up being of very limited utility when it reaches its potential users. It is perhaps for this reason that all the empirical studies we are aware of concord that software patent databases are rarely utilized as a source of information.

Second, the empirical evidence existing for countries where patent protection has been available to software for a while, most notably the U.S., show that the concrete application of the disclosure requirement has failed to implement a real dissemination of technical knowledge. This is apparent when studying the majority of U.S. Federal Circuit decisions involving software, in which the disclosure requirement has been interpreted very strictly as not implying an obligation to disclose information directly useful to competing inventors[150]. It is also apparent when looking directly at patent applications. Greg Aharonian has, for instance, conducted a statistical study showing that 90% of the software-related patents granted in the U.S. is characterized by an extremely low degree of novelty and an often high degree of triviality, so that they tend to be of very little value as a source of information[151].

Venture capital financing and SMEs' access to market

In addition to the previously mentioned functions, patents have also been credited with a "signaling" function. Possession of patents, according to this view, serves the purpose of signaling a firm's innovative capabilities and increases its ability to raise the necessary capital, especially through venture capital financing. This function is, of course, critical to SMEs, who may not have much opportunities alternative to venture capital investors to find the capital necessary to commercialize an invention and enter a new market. The link between patenting and venture capital financing has been highlighted as fundamental especially in biotechnology[152].

Why this link may not be as stringent in the software domain it is difficult to explain, but it is a matter of fact that, while the importance of patents signaling function is often claimed as a reason why patents should be considered indispensable to small firms, empirical data tend to reject the hypothesis. This is true both for the U.S., where recourse to venture capital

[150] See Burk and Lemley (2003).

[151] "The patent examination system is intellectually corrupt", Greg Aharonian, available at `http://www.bustpatents.com/corrupt.htm`.

[152] See, for instance, Coriat and Orsi (2002), arguing for the existence of an "institutional complementarity" between the U.S. intellectual property system and the nature of financing — venture capital financing — prevailing in the most innovative milieu of the U.S. economy.

financing is particularly widespread, and for Germany, where the diffusion of venture capital investments is more limited[153]. The results of the already mentioned survey of U.S. small firms by Ronald Mann indicate that "patents are not often useful in helping the early-stage software company demonstrate the sustainable differentiation from its competition that is the focus of the venture investor". This might be attributed mainly to two reasons. The first is that, differently from biotechnology, a single patent does not confer any real protection against competitors in software, where end-products may comprise large numbers of (patentable) functionalities. The second is that, in order to provide a shelter against competition, patents need to be enforced, and it is doubtful that investing scarce monetary resources in patent lawsuits constitutes a sensible strategy for SMEs. As for Germany, the survey conducted by Blind et al. in 2000 on behalf of the Federal Ministry of Economics and Technology clearly states that "the theory that patents facilitate market access, above all for young companies, could not be confirmed".

Strategic patenting and anticompetitive litigation

It has often been mentioned, in the previous sections, that patenting occurs for strategic reasons, both offensive and defensive, in industries characterized by complex and cumulative technologies such as software. The strategic nature of patenting has, in turn, brought to the fore a variety of issues related to patent litigation. There exists now a consistent body of literature not only on the details of patent litigation, but also on the anticompetitive aspects of IP litigation. This literature has shown, among other things, that: (a) there exists a risk of "predatory litigation", namely litigation aimed at excluding competitors from the market or deterring entry of competitors on the basis of weak claims of dubious validity or an aggressive use of the instrument of "preliminary injunctive relief" (in the U.S. legal context)[154]; (b) the costs of litigation fall most heavily on small firms[155]; and (c) litigation costs may distort investment patterns, especially by SMEs[156].

These issues are likely to be of particular concern in the software industry for various reasons. First, there is the question of the high number of trivial software patents patent offices routinely grant. This does not seem to be only an administrative problem requiring an increase in funding for

[153]See the data on the diffusion of venture capital financing contained in the OECD Science and Technology Indicators Scoreboard 2003, table A.7.

[154]See Lanjouw and Lerner (2001); Meurer (2003).

[155]See the survey of the empirical literature on the enforcement of intellectual property rights by Lanjouw and Lerner (1997)

[156]See Lerner (1995), examining the patenting behavior of 519 new U.S. biotechnology firms and finding that firms with high litigation costs are less likely to patent in subclasses with many previous awards by rival biotechnology firms.

prior art searches. For one thing, it is unlikely that complete and reliable documentation of prior art will ever be available. As a matter of fact, the only industry-led effort in this direction to date, the Software Patent Institute, has been abandoned. An even more radical impediment to solving the problem of triviality lies in the very application of the standard of non-obviousness (inventive step). For instance, in the practice of the European Patent Office, as reflected in the Examination Guidelines, patents are rarely denied because of failure to pass the test of non-obviousness. The abundance of trivial patents means that society has to bear a heavy burden of litigation costs, as the only way to get rid of those patents is to litigate them[157]. This is consistent with the finding that the probability of litigation is much higher in software than in other sectors such as chemical and semiconductors[158].

Second, the risk of inadvertent infringement is particularly high in the software field. For the reasons mentioned above, patent databases are rarely consulted, if not in the attempt to avoid stepping on a patent landmine. Moreover, many patents cover implementations of ideas that may appear obvious to most software professionals for which the existence of such patents may thus become an unexpected and sad ex-post discovery. The study by Blind et al. referred to above reports that "ca. one third of the companies in the primary branch and over two thirds of the independent developers have already been hindered in the execution of own projects by patents belonging to others"[159].

4.2. How can the drawbacks of patenting of computer–implemented inventions be limited?

On the basis of the available evidence reviewed in the previous section it would not be wise to recommend patentability of computer programs and therefore a deletion of the "as such" provision of art.52(2) and (3) EPC. However, a compelling argument for excluding completely software objects from patentability cannot be made either. It should follow that the approach taken by the Commission's Proposal is, on its face, correct in that it is meant to "harmonize protection for computer–implemented inventions

[157] One could object that the re-examination procedure in the U.S. system and the opposition procedure in the European system may be relied upon as means to limit the negative effects of the proliferation of trivial patents. The problem with this view is empirical: indeed one recent study on the EPO opposition system was unable to confirm the hypothesis that this process operates quickly or cheaply to resolve questions of patent validity (Graham, Hall, Harhoff, and Mowery, 2003).

[158] See the empirical study by Deepak Somaya (2001).

[159] Blind et al. (2001). The "primary branch" refers in this study to enterprises whose main aim is the development of software, while the "secondary branch" indicates enterprises from the manufacturing industry that produce software themselves.

while avoiding any sudden change in the legal position, and in particular any extension of patentability of computer programs 'as such"'[160]. The problem with such conclusion arises if, as we have argued in the previous sections, the choice of EPO practice as a basis for harmonization contrasts with this statement of purpose. If this is the case, then the previous section may be read as a warning of the negative consequences in terms of innovation that may ensue from an approach grounded on EPO case law.

In this section we set aside this problem and we take as a starting point the current state of legislation, according to which patentability of computer programs cannot be ruled out alltogether. We ask, on one side, how a balanced approach could be construed so as to limit the foreseeable drawbacks of software-related patents and, on the other side, whether the provisions contained in the Commission's Proposal are likely to strike an appropriate balance. In answering to these questions, we choose not to propose a new criterion for the determination of software patentability and we rely, instead, on some insights offered by the law and economics (L&E) literature.

Insights from the L&E literature

The L&E literature offers two general suggestions concerning the measures to take in order to reduce the drawbacks associated to software-related patents. First, we can extract from the literature a case for a high non-obviousness (inventive step) requirement. Second, the literature seems to provide good reasons to argue for narrow patents in the software field. We will consider these issues in turn.

The few studies directly addressing the issue of the appropriate non-obviousness (inventive step) standard in a context of cumulative innovation have identified a number of different reasons why a high requirement should be applied. First, it has been argued that a high non-obviousness (inventive step) standard has the benefit of inducing higher incentives to race with respect to a low standard, and the race accelerates progress[161]. Second, the possibility that a high non-obviousness standard may create incentives for firms to seek larger innovations and thus increase R&D has also been considered[162]. Note, in this regard, that the argument could be reversed: providing incentives only for pioneer innovations may engender

[160] See the Explanatory Memorandum, p.11.

[161] See Scotchmer and Green (1990). Note that they refer to the novelty requirement rather than to the non-obviousness requirement. However they define a high novelty standard as a standard implying that only large improvements are patentable, so that the analysis can be easily applied to the non-obviousness requirement.

[162] See O'Donoghue, Scotchmer, and Thisse (1998).

a "winner-takes-all" race that in the case of software would result in an excess of investment in major innovations and a lack of investment in application programs[163]. Casual empiricism suggests, however, that this should not be the case of software innovation. Finally, the opportunity of imposing a high non-obviousness hurdle has been suggested also in the context of an analysis that takes explicitly into consideration the pace of innovation in different industries[164]. The basic intuition of this analysis is that a high non-obviousness requirement is apposite in industries characterized by rapid innovation such as software. This is because the choice of the non-obviousness standard involves a trade-off: increased probability of obtaining a patent versus decreased patent value. It is the welfare effect of such trade-off that tilts the balance in favor of a high non-obviousness threshold in rapidly innovating industries[165].

So much for the advantages of a high non-obviousness requirement. The L&E literature has also warned about the disadvantages of the diffusion of an excessive number of trivial patents consequent to the adoption of a low non-obviousness (inventive step) standard. In addition to the issues identified in the previous section, it is worth recalling at least another couple of scholarly comments. Although some have argued that patent offices decision not to invest additional resources in the screening of low quality patents results from a rational choice[166], the consequences of a proliferation of low-quality patents should not be underestimated. One thing to worry about is, for instance, the feed-back effects that may result from the increase in patent applications associated to a low non-obviousness threshold. The more the applications, the higher the pressure put on patent offices, the lower is likely to be the quality of the patents granted[167]. The most worrying effect of this vicious circle is the increased uncertainty innovators will face as regard the validity and enforceability of both their own and their competitors' patents. It is thus possible that a patent system with a low non-obviousness (inventive step) standard will bring about an increase in transaction costs (and in particular negotiation and litigation costs) without a corresponding increase in incentives to innovate.

Having said this, it should be noted that it might be particularly difficult to practically implement a high non-obviousness (inventive step) threshold

[163]See Denicoló (2000).

[164]See the work of Hunt (1999).

[165]Other scholars have also argued in favour of increasing the non-obviousness threshold and, more generally, raising the standards for patentability. See, for instance, Kasdan (1999); Barton (2000); Cooper Dreyfuss (2000); Lunney (2001); Bakels and Hugenholtz (2002); Meurer (2002).

[166]See Lemley (2001).

[167]See Hall (2003).

in software, because of the difficulty of defining the very meaning of inventiveness in the software field. Software innovation involves the computer implementation of ideas that may often not be particularly innovative *per se*. Indeed, the specific contribution of a software developer very often lies in finding an efficient and effective way to solve a rather shallow problem. Thus, it may well be the case that patents be granted to those that are the first to be confronted with a problem, rather than those who find the most innovative technical solution to a problem[168].

Consider now the issue of the breadth of software patents[169]. Cohen and Lemley have argued at great lengths that software patents are likely to be very broad if no special measure is taken to narrow their scope[170]. These two authors, together with others[171], have also advanced reasons why it might be wise to construct patents for software narrowly. One of the main arguments they propose in support of this view is that a policy attributing strong protection to pioneer inventors is not appropriate for an industry characterized by networked, interdependent products. In such a context, according protection only to pioneer inventors may encourage the realization of larger rather than smaller changes to existing programs. "The resulting pattern of innovation by leaps and bounds (rather than incremental innovation) may actually decrease social welfare, both by reducing interoperability among programs (and therefore foregoing the corresponding network benefits) and by rendering the resulting untested programs less reliable"[172].

A more general argument can be derived from the literature on cumulative innovation. One general conclusion that can be safely drawn from such literature is that the appropriate patent design is critically dependent on the ability of private parties to contract around their property entitlements so as to rearrange assigned rights in privately and socially beneficial ways[173]. Whether broad patents are efficient thus depends on whether efficient licensing will take place, allowing follow-on improvers to build on previous innovations. Bearing this in mind, an argument for narrow patents in the software field can be construed on the basis of the fact that the heterogeneous and dispersed nature of industry players, the frequency of new entries and the fine-grained nature of inventions constitute impediments to

[168]See, for instance, Grover (2000).

[169]Note that the two issues we are considering — the appropriate non-obviousness (inventive step) requirement and the choice of patent breadth — are very much related. The choice of the non-obviousness threshold affects the determination of the minimum quality improvement that avoids infringement, defined by some as patent scope, or leading breadth (O'Donoghue et al., 1998).

[170]See Cohen and Lemley (2001)

[171]See, for instance, Samuelson (1995); Warren-Boulton, Baseman, and Woroch (1995).

[172]See Cohen and Lemley (2001).

[173]See, for instance, Gallini and Scotchmer (2001).

contracting that are likely to make broad claims suboptimal.

In addition to this, some recent empirical evidence on the effects of patent scope on innovation may further raise doubts as to the advisability of granting broad software patents. We refer, in particular, to the work of Sakakibara and Branstetter, exploring the effect of the 1988 legal change to the Japanese patent system that has brought about an increase in patent scope. According to the two authors, the impact of such increase on R&D activity of Japanese firms has been very limited.

Does the Proposed Directive conform with the insights from the L&E literature?

In order to answer to this question, we briefly deal with the two abovementioned L&E insights in turn and conclude that the Proposed Directive does not conform with any of them. As for the opportunity to set a high inventive step requirement, we refer to the discussion of section 3.3, where it was held that the Proposal, while preserving the general provisions of the EPC, and in particular art.56 EPC, introduces a criterion of "technical contribution" for the assessment of inventive step that is likely to be particularly weak if interpreted in light of EPO practice as the Proposal suggests to do. Moreover, the Proposal does not contain any explicit provision or recital clearly addressing the problem of triviality.

As far as patent breadth is concerned, the Proposal contains in its art.5 one limitation to the scope of allowable claims, in that it excludes claims to computer program products. While we do not intend to rehash all the arguments in support or criticism of this provision, we think it important to stress two points. The first is that we think supporters of an express exclusion of computer program product claims have the better part of the argument. The second is that, in spite of this, we think some doubts should be raised on the question whether this is a sensible limitation to impose in the broader context of the Proposal. The problem with the exclusion of claims for computer program products we want to point out is that it is inconsistent with the adoption of the criterion of technical contribution as a benchmark for patentability. Indeed, computer programs "by themselves" (e.g. on a carrier such as a CD-ROM) will be deemed unpatentable under the Proposal even if they involve a technical contribution, the practical consequence of this being that proof of infringement may become particularly difficult[174]. There are reasons to think that the Commission's apparent attempt to avoid that patentability of computer programs "by themselves"

[174]See, for instance, Basinski (2002, p.4).

be interpreted as patentability of computer programs "as such" may cause more problems than it was meant to solve by jeopardizing the effectiveness of enforcement. The Proposal would perhaps gain in consistency if an attempt was made to find criteria for patentability that leave no room for such misinterpretations, rather than relying on provisions such as art.5.

Another provision relevant to the determination of the breadth of patents for computer–implemented inventions is contained in art.6 of the Proposed Directive, concerning the relationship with Directive 91/250 EC on the legal protection of computer programs by copyright[175]. The provision is meant to expressily preserve "the application of the provisions on decompilation and interoperability in Directive 91/250/EC"[176]. The importance of this provision cannot be overstated. It is a peculiarity of software that reverse engineering almost inevitably constitutes patent infringement[177]. The very moment a patented program is run on a computer for decompilation, a copy of the program in the RAM memory is realized which could be interpreted as an infringement[178]. This is not true of all software-related inventions, as it is unlikely that reverse engineering of the software contained in a computer–implemented physical process be interpreted as infringement[179]. But, while reverse engineering through decompiling would almost certainly be judged illegal under European patent law, the long-lived debate on the issue has identified a number of reasons why it should not.

Samuelson and Scotchmer suggest that the difficult balance of the benefits and costs of allowing for reverse engineering may lean towards a prevalence of benefits in that increased interoperability should (a) increase the availability of applications; (b) reduce waste in application development costs; (c) lessen the potential for tipping into monopoly; and (d) contain the market power of monopoly platforms by providing application devel-

[175]See also recital 18 in this regard.

[176]See the Explanatory Memorandum, p.15.

[177]See Cohen and Lemley (2001).

[178]Under the EPC definition of the acts constituting infringement is left to national laws. However most national laws include provisions preventing third parties without the proprietor's consent from (a) making, offering, putting on the market or using a product which is the subject matter of the patent, or importing or stocking the product for these purposes; (b) using a process that is the subject matter of the patent, or, when the third parties knows, or it is obvious in the circumstances, that the use of the process is prohibited without the consent of the proprietor of the patent, from offering the process for use; and (c) offering, putting on the market, using, or importing or stocking for these purposes the product obtained directly by a process which is the subject-matter of the patent. See the Proposal for a Community Patent, art.26(1).

[179]See Karjala (1998), distinguishing between "pure" software patents (those covering programming improvements or inventions contained completely in a program) and "computer-related" inventions of which the software implementation constitutes only one aspect.

opers with means of entry alternative to licensing[180]. A different set of considerations in support of reverse engineering rights under patent law is offered by Cohen and Lemley. The two authors focus on four potential benefits of reverse engineering patented software that are more related to the specifics of patent law. The first is that reverse engineering can allow the realization of the disclosure bargain between the inventor and the public that has proved particularly hard to implement in the case of software and that it is essential to ensure that follow-on inventors can effectively build on patented components. The second is that reverse engineering rights prevent patentees from exercising control over unpatented components of their inventions that are not accessible in absence of such rights. The third benefit relates to the preservation of the balance struck by different intellectual property doctrines, and especially copyright and trade secret law. Finally, the fourth benefit is associated to the fact that, absent a reverse engineering right, both providing proof of infringement and questioning the validity of software-related patents may become particularly difficult, as was argued in section 4.1.3.

Unfortunately, the exact wording of art.6 of the Proposal can hardly be considered a clear-cut provision[181]. Simply stating that "[a]cts permitted under Directive 91/250/EEC [...] shall not be affected through the protection granted by patents for inventions within the scope of this Directive", while clearly indicating that decompiling will continue be lawful under copyright law, may not specify clearly enough that a right to decompilation for the purposes of interoperability exists under patent law for inventions within the scope of the Directive. The sensitivity of this issue was proven by the vivid reactions it has spurred among both patent proponents and patent opponents, but we think the insights from economic theory are stringent enough to unarguably suggest the desirability of a more explicit limitation of patent rights on computer–implemented inventions for the purposes of interoperability[182]. The alternative could be to insert a provision requiring a more stringent application in the domain of computer–implemented inventions of art.83 EPC, corresponding to the enablement requirement of

[180]See Samuelson and Scotchmer (2002).

[181]See, for instance, the opinion in this regard expressed in the McCarthy Report, p.15-16.

[182]See the comment from the Foundation for a Free Information Infrastructure (FFII) available at `http://swpat.ffii.org//papers/eubsa-swpat0202/itop/index.en.html`. See also the opinions expressed by the European Information and Communication Technologies Association (EICTA) and by the "Mission of the United States of America to the European Union" in Brussel available, respectively, at `http://swpat.ffii.org//players/eicta/index.en.html` and at `http://swpat.ffii.org//papers/eubsa-swpat0202/usrep0309/index.en.html`. Note also that the amendment to art.6 of the Commission's Proposal, approved by Parliament on first reading, constitutes one of the sources of greatest controversy.

U.S. patent law and demanding that patent applications must disclose sufficient information to enable a skilled person to reproduce the invention. We suspect, however, that an express recognition of the existence of a right to reverse engineer software for the purposes of interoperability would be less exposed to the vagaries of interpretation.

5. Conclusive remarks

The present paper considers the European Commission's "Proposal for a Directive on the patentability of computer–implemented inventions" currently under review by the European Parliament and the Council. In the balance of the article we conclude that, while the Proposal addresses an issue whose significance is difficult to underestimate — namely the need for increased legal certainty as regards the patentability of computer–implemented inventions — it is highly questionable that it will be able to achieve its stated objectives. One of the problems with the approach taken by the Commission is that issuance of a Directive can hardly be considered the most adequate starting point to confront the problem of the lack of legal certainty in this field, irrespective of the Proposal's specific content. Indeed, if the Directive proposed a set of conditions for the patentability of computer–implemented inventions different from those developed by EPO jurisprudence it would run the risk of creating further inconsistencies and uncertainties, unless EPO showed a willingness to conform to Community legislation. The latter is not a likely outcome, however, if the Directive set more stringent criteria than those inferable from EPO case law, among other things because of the incentives a self-funding agency such as the EPO is likely to face.

If, on the contrary, the Directive chose to adhere to EPO jurisprudence as a basis for harmonization, as the Proposal submitted by the Commission does, it is doubtful that it would be able to serve well either the purpose of increasing legal certainty or the objective of promoting innovation. As for the first objective, we argue that the set of criteria for the patentability of computer–implemented inventions contained in the Proposal and derived from current EPO practice can be interpreted as implying the extension of patentable subject matter toward a situation nearly indistinguishable from an express deletion of the "as such" exclusion of computer programs from patentability contained in art.52(2) and (3) EPC. If this is the case, then it follows that the objective of legal certainty would be better served by a direct modification of the EPC, enacted through the means envisaged by the EPC itself. We acknowledge that recourse to a Directive bears on its face the promise of providing a more rapid solution to the issues addressed, but there might not be much of an alternative than facing the difficulties and delays of an intergovernmental decision process if the uncertainties associated to

the use of inherently undefinable concepts such as those of "technical contribution", "technical character" and "technical effect" have to be removed.

As for the objective of increasing innovation in the software sector, our negative conclusion on the ability of the Commission's Proposal to achieve it comes from a survey of recent economic literature. The evidence surveyed, while not conclusive, can by no means be interpreted as a proof of the existence of a link between extension of patentability and increased innovation, which the Commission seems to assume. The evidence gathered in relation to the recent experience of the United States with the removal of the obstacles to the patentability of software-related inventions suggests the only clear conclusion that we should expect the Directive in its present form to bring about an increase in patent applications and a correspondent increase in litigation. Predictions beyond these are much more difficult to make.

One thing we can state with certainty is that much more economic evidence specifically targeted to the software sector is needed before enacting any change in legislation. We also feel confident about concluding that, once the nature of the legal changes required has been determined on the basis of a thorough economic evaluation of the different options available, the preferred way to pursue such changes should be considered a direct modification to the EPC, although we acknowledge the difficulties associated to taking this course of action.

In addition to this, before enacting any specific legislation in the field of computer–implemented inventions, it might be worthwhile to push forward the project of a Community Patent, which would help tackling many of the issues raised by the Commission's Proposal, and in particular it would help reducing the cost of patents to SMEs and thus raise the accessibility of the European Patent system to companies of all sizes. Issuance of a Directive at a later point in time may still have some merit. In particular, it could have the effect of bringing the issue of patent protection of computer–implemented inventions within Community competence (note than neither the EPC nor the Community Patent Convention constitute legislation under the power and authority of the Treaty of Rome) and could help to fine-tune the legal protection accorded to computer-programs by addressing directly the most sensitive issues.

Indeed, the economic evidence considered in this paper suggests that software possesses some peculiar characteristics that deserve special attention in devising patent policy. In particular, we think three conclusions can be safely drawn from such literature: (a) software presents some peculiar obstacles to the consummation of the traditional protection-for-disclosure bargain inherent in the functioning of the patent system so that steps should be

taken to ensure that the the EPC requirement that patent applications must disclose sufficient information to enable a person skilled in art to reproduce the invention[183] should be applied strictly, perhaps requiring compulsory disclosure of the invention source code; (b) the characteristics of innovation in the software industry suggest that an "inventive step" requirement more stringent than in more traditional industrial fields should be applied: this would have also the positive effect of addressing more directly than through administrative measures the problem of the proliferation of trivial patents; and (c) software-related patents should be narrowly construed; in this regard, it is of particular relevance to ensure that a limited reverse engineering right along the lines of that envisaged under copyright law by Directive 91/250 be introduced also under patent law. Unfortunately, the Proposal currently submitted by the Commission does not take the chance of addressing these issues adequately. We hope, however, that the recent decision of the Commission to issue a tender for a study into the effects of allowing patent claims for computer–implemented inventions[184] can be interpreted as a sign of an increased interest of the Commission in exploring the economic rationale of the legal changes it proposes.

References

John R. Allison and Mark A. Lemley. Emirical evidence on the validity of litigated patents. *AIPLA Quarterly Journal*, 26(3):185–275, 1998.

M. Ammendola. *La brevettabilit nella Convenzione di Monaco*. Giuffré, Milano, 1981.

Ashish Arora, Andrea Fosfuri, and Alfonso Gambardella. *Markets for Technology*. MIT Press, Cambridge, MA, 2001.

R. Bakels and P.B. Hugenholtz. The patentability of computer programs. Amsterdam: IViR, 2002.

John H. Barton. Reforming the patent system. *Science*, 287:1933–1934, 2000.

Erwin J. Basinski. An open-and-shut case: the diplomatic conference to revise the articles of the european patent office votes to maintain the status quo regarding software patents in europe pending issuance of a new software patent directive by the european union. *International Journal of Communications Law and Policy*, 6, winter 2000/2001.

[183] Art.83 EPC.

[184] Contract notice 2004/S 165-142264, 25 August 2004.

Erwin J. Basinski. European union's proposed directive on computer-implemented inventions. *World E-commerce & IP Report*, 2:3–5, 2002.

Keith Beresford. European patents for software, e-commerce and business models inventions. *World Patent Information*, 23:253–263, 2001.

James Bessen and Robert M. Hunt. An empirical look at software patents. Federal Reserve Bank of Philadelphia, working paper n.03-17., 2003.

James Bessen and Eric Maskin. Sequential innovation, patents and imitation. MIT Economic Department Working Paper, Cambridge, MA, 2000.

Brian P. Biddinger. Limiting the business method patent: A comparison and proposed alignment of european, japanese and united states patent law. *Fordham Law Review*, 69:2523, 2001.

K. Blind, J. Edler, and R. Nack. Micro- and macro-economic implications of the patentability of software innovations. intellectual property rights in information technologies between innovation and competition. Fraunhofer Institute and Max Plance Institute, Karlsruhe/Munich, 2001.

Knut Blind and Jakob Edler. Idiosyncrasies of the software development process and their relation to software patents: Theoretical considerations and empirical evidence. mimeo, Fraunhofer Institute for Systems and Innovation Research, 2002.

Michele Boldrin and David K. Levine. Perfectly competitive innovation. Sta. Report 303, FRB Minneapolis Research Department, Minneapolis, 2002.

Dan L. Burk and Mark A. Lemley. Policy levers in patent law. *Virginia Law Review*, 89:1575, 2003.

V. Di Cataldo. *I brevetti per invenzione e per modello.* Giuffré, Milano, 1988.

Norhéne Chabchoub and Jorge Niosi. Explaining the propensity to patent computer software. *Technovation*, 20, 2004.

Howard F. Chang. Patent scope, antitrust policy and cumulative innovation. *RAND Journal of Economics*, 26:34–57, 1995.

Julie E. Cohen and Mark A. Lemley. Patent scope and innovation in the software industry. *California Law Review*, 89(1):1–57, 2001.

Wesley M. Cohen, Richard R. Nelson, and John P. Walsh. Protecting their intellectual assets: Appropriability conditions and why u.s. manufacturing firms patents (or not). National Bureau of Economic Research Working Paper 7522, 2000.

European Commission. The patentability of computer-implemented inventions: consultation paper by the services of the directorate-general for the internal market. Paper available for downloading at `http://europa.eu.int/comm/internal_market/en/indprop/softpaten.htm`, October 2000.

European Commission. Proposal for a directive on the patentability of computer-implemented inventions. COM(2002) 92 - 2002/0047 (COD), February 2002a.

U.S. Federal Trade Commission. Competition and intellectual property law and policy in the knowledge-based economy. available at `http://www.ftc.gov/opp/intellect/index.htm`., 2002b.

PbT Consultants. The results of the european commission consultation exercise on the patentability of computer implemented inventions. Report to the European Commission under contract n.PRS/2000/A0-7002/E/98, 2002.

Trevor Cook. "i wouldn't start from here if i were you" - intellectual property protection for computer software in europe and the proposed new directive on computer-implemented inventions. *Computer Law and Security Report*, 18(2):197–200, 2002.

Rochelle Cooper Dreyfuss. Games economists play. *Vanderbilt Law Review*, 53(6):1821, 2000.

Benjamin Coriat and Fabienne Orsi. Establishing a new intellectual property rights regime in the united states: origins, contents and problems. *Research Policy*, 31:1491–1507, 2002.

Kenneth W. Dam. Some economic considerations in the intellectual property protection of software. *Journal of Legal Studies*, 24:321–377, 1995.

Vincenzo Denicoló. Two-stage patent races and patent policy. *RAND Journal of Economics*, 31:488–501, 2000.

Vincenzo Denicoló and Luigi A. Franzoni. The contracts theory of patents. *International Review of Law and Economics*, 23:365–380, 2004.

Michael A. Dryja. Looking to the changing nature of software for clues to its protection. *University of Baltimore Intellectual Property Law Journal*, 3:109, 1995.

David S. Evans and Anne Layne-Farrar. Software patents and open source: the battle over intellectual property rights. mimeo, available at www.ssrn.com, 2004.

Matthew E. Fink. Patenting business methods in europe: what lies ahead? *Indiana Law Journal*, 79:299, 2004.

International Association for the Protection of Intellectual Property. Exco lisbon 2002, report of the special committee q132 - computer software, information networks, artificial intelligence and integrated circuits. mimeo, 2002.

Nancy T. Gallini and Suzanne Scotchmer. Intellectual property: When is it the best incentive mechanism? In Joshua Lerner Adam Jaffe and Scott Stern, editors, *Innovation Policy and the Economy*, volume 2. MIT Press, Cambridge, MA, 2001.

Richard E. Gold and Alain Gallochat. The european biotech directive: Past as prologue. *European Law Journal*, 7(3):331–366, 2001.

J.H.S. Graham, B.H. Hall, D. Harhoff, and D.C. Mowery. Post-issue patent 'quality control': A comparative study of u.s. patent re-examinations and european patent oppositions. In Wesley Cohen, editor, *Intellectual Property in the Knowledge-Based Economy*. National Academies Press, Washington D.C., 2003.

J.H.S. Graham and D.C. Mowery. Intellectual property protection in the u.s. software industry. working paper Haas School of Business, UC Berkeley, 2002.

Jerry R. Green and Suzanne Scotchmer. On the division of profit in sequential innovation. *RAND Journal of Economics*, 26:20–33, 1995.

Derrick Grover. Software patents - damage limitation. *Computer Law and Security Report*, 16(1):39–40, 2000.

Richard S. Gruner. Better living through software: Promoting information processing advances through patent incentives. *St. John's Law Review*, 74:977, 2000.

Giovanni Guglielmetti. *L'invenzione di software*. Giuffré Editore, Milano, 1997.

Michael Guntesdorfer. ibrief/patents and technology: Software patent law: United states and europe compared. *Duke Law and Technology Review*, 6, 2003.

Robert W. Hahn and Scott Wallsten. A review of bessen and hunt's analysis of software patents. working paper, AEI-Brookings Joint Center, 2003.

Bronwyn H. Hall. Business method patents, innovation, and policy. UC Berkeley, Department of Economics, working paper n. E03-331, 2003.

Bronwyn H. Hall and Rosemary H. Ziedonis. The patent paradox revisited: An empirical study of patenting in the u.s. semiconductor industry, 1979-1995. *RAND Journal of Economics*, 32:101–128, 2001.

Robert Hart, Peter Holmes, and John Reid. The economic impact of patentability of computer programs. Report to the European Commission, 1999.

Robert J. Hart. The case for patent protection for computer program-related inventions. *Computer Law and Security Report*, 13(4):247–252, 1997.

Michael Heller and Rebecca S. Eisenberg. Can patents deter innovation? the anticommons in biomedical research. *Science*, 280:698–701, 1998.

Adam B. Jaffe. The u.s. system in transition: policy innovation and the innovation process. *Research Policy*, 29:531–557, 2000.

Brian Kahin. Information process patents in us and europe: Policy avoidance and policy divergence. *First Monday*, 8(3), 2003.

Dennis Karjala. The relative roles of patent and copyright in the protection of computer programs. *Marshall Journal of Computer Information Law*, 17:41, 1998.

J. Kasdan. Obviousness and new technologies. Columbia University Center for Law and Economics Studies Working Paper No. 146, 1999.

Edmund W. Kitch. The nature and function of the patent system. *Journal of Law and Economics*, 20:265–290, 1977.

Jean O. Lanjouw and Josh Lerner. The enforcement of intellectual property rights: a survey of the empirical literature. National Bureau of Economic Research working paper n.6296, 1997.

Jean O. Lanjouw and Josh Lerner. Tilting the table? the use of preliminary injunctions. *Journal of Law and Economics*, pages 573–603, 2001.

Mark Lemley. Rational ignorance at the patent office. *Northwestern University Law Review*, 95(4):1495–1532, 2001.

Mark A. Lemley and David W. O'Brien. Encouraging software reuse. *Stanford Law Review*, 49:255, 1997.

Josh Lerner. Patenting in the shadow of competitors. *Journal of Law and Economics*, 38(2):463–496, 1995.

R. Levin, A. Klevorick, R.R. Nelson, and G. Winter. Appropriating the returns from industrial r&d. *Brookings Papers on Economic Activity*, 3: 242–279, 1987.

G.S. Lunney. e-obviousness. *Michigan Telecommunications Technology Law Review*, 7:363–422, 2001.

Ronald J. Mann. The myth of the software patent thicket: an empirical investigation of the relationship between intellectual property and innovation in software firms. University of Texas School of law, Law and Economics working paper n.022, 2004.

E. Mansfield. *Industrial Research and Technological Innovation: An Econometric Analysis*. W.W. Northon, New York, 1968.

Robert P. Merges. Intellectual property rights, input markets, and the value of intangible assets. mimeo, U.C. Berkeley School of Law, 1999.

Robert P. Merges and Richard R. Nelson. On the complex economics of patent scope. *Columbia Law Review*, 90(4):839–916, 1990.

Stephen A. Merril, Richard C. Levin, and Mark B. Myers, editors. *A patent system for the 21st century*. The National Academies Press, Washington D.C., 2004.

Michael J. Meurer. Business method patents and patent floods. *Washington University Journal of Law and Policy*, 8:309–340, 2002.

Michael J. Meurer. Controlling opportunistic and anticompetitive intellectual property litigation. *Boston College Law Review*, 2003.

T. O'Donoghue, S. Scotchmer, and J.-F. Thisse. Patent breadth, patent life and the pace of technological progress. *Journal of Economics and Management Strategy*, pages 1–32, 1998.

OECD. *Information Technology Outlook*. OECD, 2002.

OECD. *Science and Technology Indicators Scoreboard*. OECD, 2003.

Committee on Legal Affairs and the Internal Market. Report on the proposal for a directive of the european parliament and of the council on the patentability of computer-implemented inventions. PE A5-0238/2003, June 2003.

Effy Oz. Acceptable protection of software intellectual property: a survey of software developers and lawyers. *Information and Management*, 34: 161–173, 1998.

Terence Prime. *European Intellectual Property Law*. Ashgate, Aldershot, 2000.

Danny Quah. 24/7 competitive innovation. mimeo, London Scool of Economics, 2002.

Pamela Samuelson. An entirely new legal regime is needed. *The Computer Lawyer*, 12(2):11–17, 1995.

Pamela Samuelson and Suzanne Scotchmer. The l&e of reverse engineering. *Yale Law Journal*, 111, 2002.

Suzanne Scotchmer. Standing on the shoulders of giants: Cumulative research and the patent law. *Journal of Economic Perspectives*, 5:29–41, 1991.

Suzanne Scotchmer. Cumulative innovation in theory and practice. mimeo, Goldman School of Public Policy and Department of Economics, University of California, Berkeley, 1999.

Suzanne Scotchmer and Jerry Green. Novelty and disclosure in patent law. *RAND Journal of Economics*, 21:131–146, 1990.

J. Sheelan, D. Guellec, and C. Martinez. Business patenting and licensing: Results from the oecd/biac survey. In *Patents Innovation and Economic Performance, proceedings of the OECD conference on IPR, Innovation and Economic Performance*. OECD, 2003, forthcoming.

Jean Paul Smets-Solanes. Stimulating innovation and competition in the information society. working paper available at `http://www.pro-innovation.org`, 2001.

Bradford L. Smith and Susan O. Mann. Colloquium: Innovation and intellectual property protection in the software industry: An emerging role for patents? *University of Chicago Law Review*, 71:241, 2004.

John T. Soma, Kurt Leyendeker, and Steve W. Webb. Software patents: a U.S. and E.U. comparison. *University of Baltimore Intellectual Property Journal*, 8, 2000.

Deepak Somaya. Incentives, organizational choices and transactional challenges in software production. working paper, University of Mariland, 2001.

David R. Syrowik. Position paper: Software patents - just make a good thing better. *Michigan Telecommunication Technology Law Review*, 2: 113, 1995/1996.

Puay Tang, John Adams, and Daniel Paré. Patent protection of computer programmes. Report to the European Commission, Directorate General Entreprise(Contract no. INNO-99-04), available at `ftp://ftp.ipr-helpdesk.org/softstudy.pdf`, 2001.

C.T. Taylor and Z.A. Silberston. *The Economic Impact Of The Patent System: A Study Of The British Experience*. Cambridge University Press, Cambridge, 1973.

Jean Tirole, Claude Henry, Michel Trommetter, Laurence Tubiana, and Bernard Caillaud. *Proprié t é intellectuelle*. La Documentation française, Paris, 2003.

F.R. Warren-Boulton, K.C. Baseman, and G.A. Woroch. Copyright protection of software can make economic sense. *The Computer Lawyer*, 12(2): 18–28, 1995.