INNOVATION DYNAMICS IN SERVICES:

Intellectual Property Rights as Indicators and Shaping Systems in Innovation

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1. Introduction: Perspectives on Intellectual Property Rights in the Service Economy

1.1 Perspectives on Intellectual Property Rights

The study of intellectual property rights (IPRs) covers a diverse range of subjects, disciplines and legal regimes. As such it covers a whole set of different types of legal statute such as property, contract and competition law as well as involving a wide spectrum of economic and social issues relating to, for example, trade, monopoly and competition issues. Up until recently, most of the focus of research on innovation and the IPR system has been almost exclusively in relation to the manufacturing sector, with its emphasis on protecting physical artefacts centred on new products and processes. By contrast, the nature and needs of the service economy, based on intangible assets and creative expression, has been largely ignored. Indeed a key contrast is made throughout the paper between manufacturing industry and the patent system, associated with the strong and clear protection afforded to innovations that are physical artefacts, and the service sector and the weak and idiosyncratic protection provided by the IPR system.

The research outlined in this paper concerns coevolution and inter-dependence of the service economy in relation to innovative activity and the IPR system which has grown up around it to protect such innovative activity. As such, the primary focus of the discussion surrounds the intangible nature of most (though not all) service innovations, and the various means which have been employed to protect such forms of innovation (Section 4), with a specific focus on the copyright system. In particular, the growth of new information service infrastructures and technologies has generated both unprecedented challenges and important opportunities for the copyright market ("Intellectual Property and the National Information Infrastructure" (http:// www.uspto.gov/ web/ offices/ com/ doc/ ipnii/ execsum.html)). Thus, not only does the new information paradigm indicate the greater need for copyright protection, but the copyright system also needs to undergo structural changes to more efficiently satisfy the new technological opportunities being provided within the new information economy.

1.2 Outline

A brief history and evolution of IPR in relation to services is presented in Section 2 of this paper. This section highlights how the evolution and development of IPR is directly associated with the structural dimensions of technological as well as economic development. A key issue of the IPR system is then addressed in Section 3 in terms of what is the rationale of the IPR regime itself. Why do we have such a system in the first place? What difference does it make? A further question to be raised here is what are the moral and ethical aspects as well as the economic value (economic belief or objective) of the system?

An important element to study is the micro aspects of the system concerning IPR incentives and strategies (Section 4). Some studies have already analysed this issue in relation to patenting; but little or no research has considered this in relation to the other intellectual rights, despite the increasing importance of information service innovations with respect to technological innovation as a whole. Such analysis is, in turn, related to the value of the system at the micro level, i.e. the incentive to, and benefits of, intellectual property protection.

Another main strand of work concerns the macro economic efficiency of the system (Section 5). It has been highlighted that as technology changes the efficiency of the system changes or perhaps even decreases it (see Dible (1978, 114), for example, in relation to the American Copyright Act of 1909). This suggests that it is important to understand how the dynamism of structural changes in the evolution of different types of technologies have been shaping (as well as having been affected by) the growth and evolution of the intellectual property right system. To understand this link is also important from a science and technology policy perspective, as this will help policy makers to continuously adjust the IPR system to the ever changing technological structures of the socio-economy. Thus this study will seek to analyse the nature of IPR within services as an important technological shaping element within different sectoral systems of innovation, and vice versa. It should be noted, however, that if a system is not efficient this could be due to several reasons. For example, it may not

designed to the match the technological structures of the society, or it may not be properly enforced, or users of the system may not know (or are not informed about) how to use the IPR system. Due to the growing recognition of the importance of technological change in the competitiveness and growth of firms and countries there has been a growing interest in searching for new innovation indicators. Hence, Section 6 addresses the way, and degree to which, intellectual property rights may reflect innovative creativity in the service economy. A particular focus here will be on the use copyrights as an technological indicator, and the possibilities and problems of this measure.

All these elements provide mutual insights into the innovation process within services. For example, understanding the IPR strategies of creative service firms, not only provides an understanding of the value of the IPR system itself, but also of the potential value of IPRs as innovation indicators. It also reveals how the IPR system may affect, and be affected by, the innovative practices of service firms. The final section of the paper (Section 7) provides a summary of the analysis and sets out the future research agenda.

It should be stressed here that this is a scoping paper which represents only the first stage in a long term study examining the interrelationship between IPR and the innovation system in services. Much of the analysis presented here is exploratory and has to be more rigorously explored and tested. As such, this paper is only the initial stage in the review and analysis of the issues raised here and it is intended that subsequent papers and documents produced by the two authors will investigate in more detail the propositions outlined below. Lastly, this paper will hopefully open up a dialogue with other researchers interested in this field and a fruitful exchange of ideas may result from it.

2. History of IPRs in Relation to the Changing Service Economy

Although property rights relating to intellectual endeavour are not the first official property rights enforced by law (land, capital and labour rights came well before),

Bainbridge (1996, 17) has argued that intellectual property is nonetheless the most basic form of property right because people employ nothing to produce it other than their own mind. The evolution of the IPR system is intertwined with the history of technological opportunities as well as industrial evolution and the outgrowth of the service economy. This, in turn, is related to the extent and degree to which the different types of IPRs can be used as a proxy or indicator of the different sectors of the economy, as well as in direct relation to the nature of the IPR protection system (Section 6).

Studies in the past have focused on the development of the patent systems, which took off with the rise of corporate capitalism during the Industrial Revolution (see, for example, Noble 1979; Sullivan 1989). The rise of corporate capitalism during the nineteenth and early twentieth centuries, based on the manufacturing system and associated with physical artefacts and processes helped to shape and push the development and structure of the modern patent system. The more recent growth of the service economy which has resulted in a rapid growth of information infrastructure and information service innovations (and the convergence of computer and communication technologies) has, however, revealed that these more intangible innovations cannot be adequately protected under patent law.

This perhaps describes a rather stylised picture of innovation in services, and that copyright only presents one recent aspect (see below) of the formal and informal IPR system employed by innovating service firms to protect their intellectual property rights. However, it should be stressed here that any formal means of protecting service innovations is a very recent phenomenon. Thus, copyright legislation can be traced back to the UK with the establishment by Royal Decree in 1586 to the Stationers Company, more formally incorporated under legislation associated with the Statute of Anne in 1710, and in relation to the United States with the First Federal Copyright Act of 31 May 1790 (Dik 1990). However, the history of what might be termed the application of copyright to protecting advances in science is much more recent, dating back only to the 1960s and 1970s. Indeed, it was only in June 1974 that the Director General of the World Intellectual Property Organization (WIPO) convened an Advisory Group of Experts that looked into the protection computer programs and

found that only in a few countries might computer software be adequately protected without changes to existing laws (WIPO 1987, 21). Thus, even in the UK during the 1970s, where protection afforded to computer programs was considered relatively good, this was done by treating computer programs as literary works under the Copyright Act 1956. Indeed even under the Copyright, Designs and Patents Act 1988 (Section 5) protection for computer programs still remains via the treatment as a literary work (Bainbridge 1996, 175).[i]

3. Rationale of the IPR System

The first, most obvious, question to be addressed in relation of the economics of IPR is "What is the rationale of having the system in the first place?" It is presented here that the rationale for protecting innovation in services is no different than for innovations in manufacturing, and therefore this section will describe the general raison d'être of the overall IPR system in relation to both 'artefact' and 'intangible' innovations.

Basically two forms of rationale for having an IPR system have been found in the literature: one being moral or ethical and the other economic.

3.1 Moral Rationale

i) Human Rights and Business Ethics: A basic moral or ethical reason for owning IPRs is that people should own their own creativity: "[A] man should own what he produces, that is what he brings into being. If what he produces can be taken from him, he is no better than a slave" (Bainbridge 1996, 17). Furthermore, "[A] person who creates a work or has a good idea which he develops has a right, based partly on morality and partly on the concept of reward, to control the use and exploitation of it, and he should be able to prevent others from taking unfair advantage of his efforts." (Bainbridge 1996, 17). Hence the law should provide remedies against those who appropriate the ideas of others, and a person who has devoted time and effort to create

something has a right to claim the thing as his own and also has a right to obtain some reward to all his work.

ii) Consumer Ethics: Another rationale relates to the consumer ethic where IPRs function as a safeguard for consumers against confusion of products and quality as well as deception in the marketplace (this indeed applies mostly to trademarks). IPRs also protect the consumer, for example, in the case of healthy and safety issues to keep the product up to standard.

3.2 Economic Investment Rationale

i) Incentives to Creativity: It is believed that by issuing IPRs provides the prospect of reward which in turn encourages technological advancement by increased incentives to invent, invest in, and innovate new technology. With reference to inventions Bentham as early as in 1843 (vol. 3, 71) noted that "who has no hope that he shall reap will not take the trouble to sow". Cheung's (1986) review of the basic philosophy behind the patent system is extremely useful here. What might be termed the 'system believers' (who included Bentham 1843; Say 1834; Mill 1862; Clark 1907) have argued that patent rights are absolutely necessary to encourage inventions. All of them argued that with the patent system we gain 'something for nothing'. The 'something-for-nothing' thesis was most firmly set out by Clark (1907, 360-361; though, later Clark himself uncovered defects in the 'something-for-nothing' thesis) who noted: "If the patented article is something which society without a patent system would not have secured at all - the inventor's monopoly hurts nobody … his gains consist in something which no one loses, even while he enjoys them." More recently, Arrow (1962) and Samuelson (1954) have argued that although property rights are clearly useful for invention and investment purposes, they are nonetheless inferior to direct government investment in inventive activities; hence with the patent system we gain something (but not enough) for something. Interestingly, Cheung himself argued that all the 'system believers' failed to take in transaction costs.

ii) Increased Competition: IPR also helps cover the fixed costs of inventing and producing a new product as well as protecting against new marked entry. This stimulates a creative dynamic environment as well as strengthen and broaden continuous innovators (re. Schumpeter Mark I). Malerba and Orsenigo (1995) and Metcalfe (1995) have argued that this goal of establishing a creative, dynamic environment should be the primary focus of government action, although they never discussed using the patent system as the means to reach this goal. Hence, registration of IPR assists businesses in protecting investments and promoting goods and services. This should increase economic prosperity, employment and a healthy competitive dynamic environment.

3.3 Economic Rationale of Organising Science and Technology

i) Order: It has been argued that "The prizes of industrial and commercial leadership will fall to the nation which organises its scientific forces most effectively" (Elihu Root in Noble 1979, 110). Hence, the organisation of science and technology as reflecting the rise of corporate capitalism does not only apply to the establishment of scientific labourites, but also to the creation of an adequate science and technology system organised at the nation level.

ii) Increased Information: This facilitates the developments and sharing of new technologies world wide. For example, patents are archived for inspection and when they expire anyone is free to make the product or use the process. In addition, patents when filed provide immediate information to rivals who can incorporate into their own knowledge bases even though they cannot make direct commercial use of it. This might create a more coherent technological and industrial development, faster knowledge spill-over and technological progress which strengthens the national economy

iii) Better Advice: An intellectual property system also offers information concerning structural changes in technological development as well as technological capabilities of industry allowing governments' to be more effectively advised on science and

technology policy matters. Hence, in relation to shaping the overall direction and 'mission' of the IPR system in the United States, the United States Patent and Trademark Office (besides administrating the laws relating to patents and trademarks) provides advise to the U.S. Secretary of Commerce, the President and the wider U.S. federal government administration on trade-related aspects of intellectual property rights.

iv) Uniformity: Finally, a national system brings in national uniformity giving equal rights and avoiding determining and enforcing rights under different state or regional laws. This uniformity also makes it possible to (or seeks to) promote cross-country trade in IPR and international integration of science and technology, stimulating prosperity worldwide.

3.4 National Systems of IPR: Different Rationales for the Existence of Intellectual Property Rights

The rationale of the IPR system can often be found by viewing the government institution or agency under which the system is based. This is often historically determined. Table 1 provides examples of where the IPR system in relation to patents, trademarks and copyright is administered by national governments in each of the following major industrialised economies: the US, UK, Germany, France and Japan. It could be argued that patents and trademark systems in the US as well as the entire IPR system in the UK illustrate an overall 'economic rationale' being allocated under the Department of Commerce and Department of Trade and Industry respectively. By contrast, in Germany the IPR system is administered by Department of Justice which suggests an 'economic rationale of organisation or order' of science and technology as well as a 'moral and ethical' rationale based on 'rights'. Finally, in relation to the copyright system, the US as well as the entire IPR system of France are administered by the Library of Congress and Department of Culture respectively, reflecting a strong historical moral and ethical rationale basis of IPR protection of intellectual creativity. This emphasises the importance of acknowledging the historical and evolutionary aspects of institutional systems between countries when analysing

how different the national systems of innovation are interrelated with their IPR systems.

Table 2

Government Departments under which Patents, Trademarks and Copyright are Administered

Country:	US	UK	Germany	France	Japan
Patents and Trademarks	Department of Commerce	Department of Trade and Industry[1]	Department of Justice	Department of Culture	Ministry of International Trade and Industry[2]
Copyright	Library of Congress	Department of Trade and Industry[1]	Department of Justice	Department of Culture	Ministry of International Trade and Industry[2]

Notes:

1) via the Patent Office, an executive agency of the Department of Trade and Industry

2) via the Patent Agency within the Ministry of International Trade and Industry

4. IPR and the Firm: Strategies for IPR and Propensity to Copyright

Although much has been published on the propensity and benefits to patent within the context of manufacturing firms, much less has been written about IPR strategies and the propensity to use copyright and other forms of IPR within the context of service firms. The patent system is based on protecting technological advances which can be incorporated into products. The copyright system originates on protecting the written word. Material protected by copyright is existing information expressed in a particular way. The ideas are not protected, at least in theory, but their arrangement and expression is. With patents the emphasis is on the information which is new. With copyright the information can be old or new (Eisenschitz 1986, 263). Notwithstanding this copyright seeks to stress 'originality' as the key in the way it is legally applied.

Copyright, unlike patenting, is a relatively inexpensive form of IPR protection since it is 'there' by right and does not require registration (although this was not the case in the United States until 1 March 1989, before this date a 'copyright notice' was mandatory; United States Copyright Office 1997). Much of the innovative output generated by service firms cannot be protected under the patent system, although patent restrictions were relaxed somewhat in most developed economies in the 1970s and 1980s to allow certain types of computer software to be protected by patent clauses. Thus, the US permitted patenting of certain algorithms that were previously thought to be outside the scope of patent law (although some countries do not allow computer programs per se to be patented; World Intellectual Property Organization 1987, 22-23). This change, may partly explain in large part why patent activity has increased by service industries (reflected also in their increased amounts of R&D expenditure).[ii]

Teece (1987) noted that patents are the written articulation of certain codified aspects of the technical know-how of the firm, and copyright could also be perceived in this sense. However, because copyright does not require registration its *value* or even *existence* has not been validated by the outside world and remains contestable. Indeed

copyright law has essentially been built up around case law. Much of the inherent differences between patent and copyright systems relate to differences in the economic and technical nature of intangibles and information compared with physical artefacts. Thus for physical products, simple storage of that product does not constitute copying infringement; however, in the UK storage of computer program can in certain instances be seen as *reproduction* of that program and therefore to infringe the law.

This in turn helps in part to explain why IPR strategies for innovative service firms (which in turn can be linked to the wider development of the strategic assets or core competencies of such firms; Winter 1987; Prahalad and Hamel 1990) are different and more complex than for manufacturing companies. This for a number of reasons:

- IPR protection in most service innovation contexts (intangibles) is much weaker than for manufacturing innovation (as represented by artefacts and physical systems).

- Although the copyright system compared to the patent system historically goes back a long way (in terms of published works), within the context of innovative activity its history is much more recent, less developed and, most importantly here, less well defined.

- Whereas manufacturing firms usually face a simple IPR decision of whether to patent or not to patent, for service firms the issue is to decide which is the most appropriate system is the best for protection (patent, copyright or even trademark protection) or indeed which combination of IPR protection is the best.

- Intellectual property right protection in service fields is much weaker than for manufacturing industry.

- IPR in services is not only weaker, but is also much harder to monitor and enforce than for manufacturing systems.

The above leads to the conclusions that IPR strategies within innovating service firms will be substantially different and more complex than for innovating manufacturing firms, or (more provocatively) non-existent (see below). Certainly it is more recent and less well-developed. In the US even partially effective cover for software programs came with the 1976 Copyright Act and only became fully effective with an amendment in 1980 to make explicit the applicability of copyright to computer programs (Braunstein 1989, 12). Similarly in the UK (although copyright law had been flexible in its approach) the first specifically targeted piece of legislation which dealt with computer software under the Copyright (Computer Software) Amendment Act of 1985 (soon followed by the Copyright, Designs and Patent Act 1988). It may be argued that innovative service companies have grown up with a culture that has not protected innovation (and where moreover copying is virtually costless; Sieghart 1982).

There are a number of strategies which innovative service firms are more likely to employ than their manufacturing counterparts because of the intangible nature of their innovations and because of this the arguably weaker protection offered by the copyright system. These are:

- Secrecy*:* Thus some argue that the best IPR strategy for an innovative service firm is secrecy, or what Taylor and Silberston (1973, 296) have termed 'secret know-how.' How far secrecy can be sustained is questionable and it has also wider implications, such restricting collaboration or know-how trading. It also leads to the interesting question of why an increasing number of service firms are openly seeking IPR protection for their innovations, if the best policy is to keep quiet.

- 'Ensemble' Protection*:* Service firms may consider protecting their innovations through an ensemble of IPR methods, including copyright, patenting and trademark legislation. By contrast, other service companies view certain types of IPR with scepticism (often based on past experience) and do not use them in their strategic repertoire for intellectual asset protection.

- Short Innovation Cycles*:* By actually seeking to create ever shorter innovation cycles a firm can reduce the risk of copying and imitation by reducing 'lead times' so much that by the time a potential competitor does seek to copy or imitate the innovation it is too late. Significant barriers to imitation are created by such action. Innovation cycles in the software industry are often already less than six months. However, short lead times impose considerable costs to the firm and more especially means that innovation costs have to be amortised over very short periods.

- 'Firmware'*:* There was much discussion in the 1980s that IPR protection was so weak for computer software that firms sought to protect their software by embedding it in microchips, coining the phrase 'firmware' or more formally "embedded microelectronics software." There are variety of methods for incorporating the software (the 'microcode or 'microprograms') in the electronic circuit, but certainly a significant proportion of software is protected this way if only because all microprocessor systems must by definition incorporate their own control program (OECD 1985). Interestingly although such microcode may be harder to copy, in the United States such code still falls within the meaning of 'computer program' (Bainbridge 1996, 177).

Obviously even these strategies are not independent of each other. Secrecy combined with short innovation cycles may offer substantial protection to a service firm and may be a preferred strategy over more formal IPR methods. One advantage that service firms reliant on the copyright system over manufacturing companies reliant on the patent system, is that as they do not have to register the copyright (only activate it when they see it being transgressed) they do not alert potential competitors to what new technologies they are developing. This is unlike patents which offers the general public precise technical information about the product, process or molecule that has been registered.

5. IPRs as a Shaping System in Innovation and Vice Versa

IPRs, such as copyrights and patents, not only reflect innovativeness within services, they are also responsible for *shaping* it. As such, IPR systems can be powerful elements that shape wider sectoral systems of innovation. This can lead to important insights to the wider formation and structure of the innovation process across services. Thus patents and copyrights may not have been widely used in services because they formed poor IPR protection mechanisms and therefore have served over the long term to preserve the image that services were not innovative.

However in a way opposed to this and more fundamentally, because the IPR protection system in services is weak, inappropriate or unenforceable this could have produced a dampening effect on innovative activity in services because of lack of appropriability. An important research issue here is to analyse how the evolution of the IPR system in relation to services has influenced the innovation dynamics of services and vice versa, i.e. the issue of co-evolution.

In this respect, although the IPR system has in some senses flexibly evolved to generally suit the conditions of the different types of innovation formats, most notably between physical artefacts (largely covered by the patent system) and intangible, information based innovations (covered by copyright and trademark legislation), it also has, in certain respects, helped solidify change. Thus it has contributed to the establishment of institutional and legal boundaries and help define technological trajectories (see Dosi 1982), which have shaped the innovation processes between manufacturing and service based industries. It has provided a key element in the institutional governance structure surrounding and shaping service innovations since the 1960s and 1970s, i.e. sectoral endowments and properties (see Kitschelt 1991). This institutional governance structure is perhaps especially important in an area of new technology, such as computer software, laying out a path-dependent learning process for firms operating in these sectors.

However, it would be equally misleading to view the service sector being within just one such IPR institutional shaping framework (although there may be a loosely defined

IPR system that could be applied to the innovatory framework of services overall). Just as manufacturing industry varies in terms of its use and propensity to patent, so do service sectors in their use of the IPR system. Thus certain service sectors may have weak IPR regimes and low levels of innovative activity; other service sectors may have an increased propensity to use copyright rather than patent protection; other segments may use few IPR protection mechanisms or none at all, but may still have relatively high levels of innovative activity. Many of these issues can only be successfully understood by examining all aspects of the use of IPRs and by positing such analysis within the wider IPR service regime.

In this context Metcalfe's (1995, 41) has noted that the national unit may be too broad a category to allow a clear understanding of the complete dynamics of a technological system and instead focus should be on "a number of distinct technology-based systems each of which is geographically and institutionally localised within the nation but with links into the supporting national and international system." Certainly the issue of why national innovation systems are dominant over sectoral or technological sectors needs to be questioned (Howells 1994, 94). In seeking to highlight one aspect of this, the sectoral system of innovation, it is not intended to here suggest that national systems of innovation are no longer valid. As Kitschelt (1991, 455) has noted there have been a series of studies that have sought to investigate the intersection of both national and sectoral and governance regimes.

However, the situation is more complex than this, since all systems or regimes are dynamic and undergoing differential rates of change and direction. Within the context of patenting there has been a strong shift towards international harmonisation of patenting systems, although full global harmonisation of patenting systems is still a long way off (Carey 1994), whilst effective pan-national implementation of international standards even further away (Government Accounting Office 1993). Nonetheless, since the 1990s the three main trading and regulatory regimes in terms of pharmaceutical patenting had already sought to move towards global harmonisation of systems, after the lead taken by the US, the conciliatory follow-up by Japan and the subsequent competitive catch-up by Europe (Howells and Neary 1995, 165). The 'triadisation' of the patent system has been highlighted by Cameron (1997) developing

the US Government Accounting Office review of patenting systems. However, the copyright system remains very much more idiosyncratic and nationally focused. National variations in copyright legislation are still very significant and even, in some cases, are still *diverging* rather than converging (for example, in relation to computer software). The IPR regime which many innovating service companies are having to operate are more nationally restricted and determined. This obviously is in part a reflection of the laggard nature of the service sector in terms of political power and policy involvement, where service trade issues and property protection have always been the last on the agenda and the last to be tackled. However, it has provided a further limiting factor on service innovation where firms find the protection of their inventions more partial and geographically more limited. A global copyright regime is still a long way off and therefore a more internationally based service innovation system, where firms can successfully generate, exploit and defend their service innovations across the world, still further off.

6 IPR Indicators in Services and the Role of Copyright

During the last few decades there has been a growing interest in searching for technology indicators. This is due to the growing recognition of the importance of technology and technical change in the competitiveness and growth of firms and countries. Whereas search for technological indicators in relation to IPR so far mainly has been in relation to the producing or manufacturing economy, this section aims to move the search into the area of the innovating service sector.

6.1 The Nature of IPRs

As an introduction to discussing IPR indicators, it is relevant to introduce the nature of the different IPR measures. The definitions of the US Patent and Trademark Office as well as the US Library of Congress has been used (Table 2). As such, Table 2 illustrates three forms of intellectual property (patents, copyrights and trademarks) with different lifespans. However, although the nature of the three types of intellectual

property rights seems very different, a combination of them is often used. Thus once a patent has been granted with respect to an invention, other rights might be appropriate, such as a trademark if a name is applied to a product. Also in telecommunication some aspects of some software may be protected by the patent law while other aspects can only be protected by the copyright law. Finally, in the first stage of an invention copyright may be the only means of protection. This is because, for example under the UK Copyright, Design and Patent Act 1988 (Section 5), documents submitted in a patent application are open to public inspection and may be copied if not protected by the copyright law (Bainbridge 1992, 18). However, even before this, until the patent application is published the idea of the invention is protected by the law of confidence. Thus, each invention often goes through different stages of protection.

Table 2

A Classification of Intellectual Property Rights:
The U.S. Context

	Nature of IPR Protection*	**IPR Term of Protection**
Patents	"The right conferred by the patent grant is, in the language of the statute and of the grant itself, "the right to exclude others from making, using, or selling" the invention. What is granted is not the right to make, use, or sell, but the right to exclude others from making, using, or selling the invention."	"The term of the patent is 20 years from the date on which the application for the patent was filed in the United States … subject to the payment of maintenance fees."
Copy rights	"A copyright protects the writings of an author against copying. Literary, dramatic, musical and artistic works are included within the protection of the copyright law, which in some instances also confers performing and recording rights. The copyright goes to the form of expression rather than to the subject matter of the writing. A description of a machine could be copyrighted as a writing, but this would only prevent others from copying the description;	"New copy right law: A work that is created (fixed in tangible form for the first time) on or after January 1, 1978, is automatically protected from the moment of its creation, and is ordinarily given a term enduring for the author's life, plus an additional 50 years after the author's death. In the case of "a joint work prepared by two or more authors who did not work for hire," the term lasts for 50

	it would not prevent others from writing a description of their own or from making and using the machine. “	years after the last surviving author's death. For works made for hire, and for anonymous and pseudonymous works (unless the author's identity is revealed in Copyright Office records), the duration of copyright will be 75 years from publication or 100 years from creation, whichever is shorter.”
Trade-marks	“A trademark relates to any word, name, symbol or device which is used in trade with goods to indicate the source or origin of the goods and to distinguish them from the goods of others. Trademark rights may be used to prevent others from using a confusingly similar mark but not to prevent others from making the same goods or from selling them under a non-confusing mark. Similar rights may be acquired in marks used in the sale or advertising of services (service marks).”	“Unlike copyrights or patents, trademark rights can last indefinitely if the owner continues to use the mark to identify its goods or services. The term of a federal trademark registration is 10 years, with 10-year renewal terms.”

Source: compiled and revised from U.S. Patent and Trademark Office and the U.S. Library of Congress sources, namely:

http://www.uspto.gov/web/offices/pac/doc/general/what_is_a_patent.html;

http://lcweb.loc.gov/copyright/circs/circ01.html#wwp; and

http://www.uspto.gov/web/offices/tac/doc/basic/basic_facts.html.

6.2 Appropriate IPR Indicators for Innovation in Services

When promoting an understanding of the rate an direction and pattern of technological change and the evolution of corporate innovations emphasis has often been on patent data. So far, patent statistics have shown promise and some success in analysing: international patterns of innovative activities and their effects on trade and production; patterns of innovative activities amongst firms, and their effects upon their technological strength or competence as well as performance and industrial structure; rates and directions of innovative activities in different technical fields and industrial sectors; and links between science and technology (see, for example, Pavitt 1984;

1988; Archibugi 1992; Narin, Noma and Perry 1987; Reekie 1973; Engelsman and van Raan 1992).[iii] This focus on patents no doubt reflects the fact that the patent system is the most developed IPR regime (associated with the rise of corporate capitalism, noted above), which was based on production and manufacturing protected by patent rights.

Whereas patent data are probably the most long running detailed historical record of technological activities, and are therefore very suitable to use as indicators in historical studies and approaches, the extended opportunities for the use of copyrights is much more recent due to the more recent technological trajectories of 'copyrightable' inventions within services. Hence, although it is still believed that patent data, especially in a historical perspective, are among the most comprehensive tested and used technological indicators, it has to be recognised that they do not throw a great deal of light on the evolution of new sectors within services, such as software and multimedia services.

Owing to the greater recognition of the importance of the service sector, which is poorly protected by patent rights, we now also have to address the merits of the use of copyright as innovation indicators. The expected increased use of service IPRs certainly provides some scope for the use of copyright data as technology indicators, and this will be addressed below. The suitability of other IPR-measures in relation to services, such as patents, will of course also be explored. This, in turn, is dependent on the establishment and development of a database on copyrights and patents in order to empirically test and critically evaluate the suitability of using copyrights and patents as indicators for measuring innovation in services.

6.3 Possibilities and Problems of Using Copyright as an Innovation Indicator

It is, of course, accepted that IPR data can be used and misused or abused as any other data source used in statistical studies, and that IPR data is not appropriate for all kinds of research. Possibilities and problems of patent statistics have also been discussed in many indicator studies, especially in studies by Pavitt (1984, 1988), Griliches (1990) and Archibugi (1992). Although this paper does not aim to contribute to the overall survey literature, it ought to be mentioned that use of copyright data is of course expected to share

many of the same possibilities and problems as patent statistics, plus some different ones, as will be presented below.

i) From Creativity and Invention to Innovation

Patent data has been shown as an acceptable indicator for inventions and innovations within manufacturing by a variety of studies. Thus, Mansfield (1986) revealed that firms in his study applied for a patent in relation to about 66% to 87% of their patentable inventions; whilst research by Scherer (1959), Sanders (1964), Napolitano and Sirilli (1990) has indicated that between 40% to 60% of total patent applications actually progress to innovations. On this basis, the extent to which copyrights can be used as indicators in technology and innovation studies within services is critically dependant on how much firms apply for a copyright of their 'copyrightable' inventions, as well as to what extent the 'copyrightable' inventions are actually developed into further innovations. Hence, just as a patent is only a direct measure of invention and under certain conditions an indirect measure for innovation, a copyright is only a direct measure of invention of new creativity (although it does not need to satisfy the same novelty conditions; see below), and is only under certain conditions part of a new innovative process.

ii) Novelty Conditions

Whereas a patent has to reflect a novelty (i.e. a movement of the technological frontier) and is therefore an appropriate indicator when measuring the rate and direction of technological change, such novelty restrictions are not imposed on copyrights. However, it is still to be expected that within certain fields such as telecommunication and software you would normally only ask for a copyright where there is novelty. Although in many other disciplines within services (such as written works, performing and visual arts) the degree of novelty is not an important issue, the rate of change, as well as the structural dimensions of these changes, still reflects some institutional and cultural aspects of the frontier of the changing society.

iii) Different Propensity to Use IPRs

In addition, similar problems concerning different propensity to patent across sectors, firms, industries and countries as well as over time also apply to the use of copyrights as indicators, and the problems here may be even more pronounced. First of all, as most countries have not developed a classification scheme of types of copyrights, the data cannot be broken down into sectors, which is a vital problem when investigating structural changes in patterns of specialisation. Only the US Copyright Office has broken down the copyright registration into twenty broad categories across four broad groups as presented in Table 3. However, these categories are still too broad for any meaningful analysis of structural changes. As copyrights in this scheme also covers sectors of very different nature (from poetry to computer programming; Table 3) any inter-sectoral comparison is not very meaningful in the first place.

Table 3

U.S. Copyright Registration

Copyright Registration Scheme: 20 Registration Classes Sorted by 4 Broad Groups*	
Written Works (Fiction, Non-Fiction, Poetry, Prose, etc.):	• Registration of Books, Manuscripts, and Speeches • Registration of Poetry • Registration of Serials (such as Periodicals, Newspapers and Annuals)
Performing Arts (Lyrics, Music, Plays, Videos, etc.):	• Dramatic Works: Scripts, Pantomimes & Choreography • Motion Pictures including Video Tapes • Registration of Music • Musical Compositions • Musical Compositions and Sound Recordings
Visual Arts (Comic Strips, Drawings, Photographs, Sculpture, etc.):	• Registration of Visual Arts • Visual Arts • Visual Arts Deposit • Cartoons and Comic Strips • Registration of Photographs
Other Works:	• Architectural Works • Computer Programs • Games • Mask Works (Semiconductor Chips) • Multimedia Works • Recipes • Sound Recordings

Source: complied from http://lcweb.loc.gov/copyright/reg.html

Nonetheless analysis of copyright data may still be useful, albeit in a more limited and restricted way. Thus it may still be valid to investigate the changing opportunities and stock of technological capability on an intra-sectoral level. The focus of further analysis will be on those sectors covered under 'Other Works' listed in Table 3, which it is argued here represent the most interesting and dynamic innovative sectors within services and which

have close parallels to those sectors that have been defined as 'technical Knowledge Intensive Business Services' (t-KIBS) as outlined by Miles et al. (1995).

When investigating the changing intra-sectoral opportunities in copyright, changes in propensity to copyright over time of course has to be investigated and adjusted for. Thus major expected changes in propensity to copyright over time (for example, the development of the information technology infrastructure is recent phenomenon) is certainly likely to make an analysis of long term patterns in 'copyrightable' innovations less meaningful, in comparison to that which has been possible with patent studies (see, for example, Andersen 1997; 1998). However, this does of course not rule out shorter term analysis of 'copyrightable' innovations within services.

iv) Criteria for 'IPRability'

Examples of how different systems approach the issue of what is patentable has been covered by a number of studies. Thus, Cheung (1986, 6) has noted: " .... the troublesome question of what ideas should be granted patent protection must be faced. In one extreme, there is nothing new under the sun. In the other extreme, every different combination of ideas or every different application of an idea constitutes a new idea. In specifying the criteria of patentability, the designers of any patent system must select a position somewhere on the spectrum marked by these extremes." The same type of question of course applies to the issue of copyrights and trademarks. What is 'copyrightable' and 'trademarkable'?

The criteria for 'IPRability' differs across countries, and this hampers a direct comparison of the propensity to patent, propensity to copyright and propensity to trademark across different national systems. Archibugi (1992), for example, has mentioned how it appears there are more 'new under the suns' in Japan than in the US (to put it in Cheung's phrase) as more is patentable in Japan. This, in quantitative terms, rises Japan's propensity to patent and thus has to be adjusted for when undertaking cross-country comparisons.[iv]

6.4 Towards a Copyright Data Base

When examining technological change and the evolution of the innovative services in a global context, another potentially difficulty is that, there is a difference amongst countries in the economic costs and benefits associated with IPR protection. This reflects the costs, time and rigour of the IPR examination, enforcement, and administration procedures, together with the expected market size which will yield monopoly profits. As has been highlighted in this study, countries also differ in their classification and registration schemes as well as their underlying IPR system values and objectives. Thus, whereas the patent systems have converged over time, the copyright and trademark systems have stayed largely nationally specific, so the propensity to copyright and trademark might be very nationally determined. Any cross-country comparison may therefore be even more problematic than that of patents due to the much wider differences in the propensity to copyright across countries. However, the degree to which the propensity to copyright will vary across countries (after having adjusted for different criteria of 'IPRability') is also likely to depend on the sector being considered.[v]

With respect to patents, it has often been argued that US patent data provide the most useful basis for international comparisons, given the common screening procedures imposed by the US Patent and Trademark Office (Soete 1987; Pavitt 1988). Moreover, as the US historically has been a progressive economy with the world's largest single market during the last century of technological development, and the country that welcomed and encouraged new ideas and innovation, successful inventions (home or abroad) were likely to be patented there. The same is to be expected to apply to copyrights and trademarks in recent times, due to the rise of the information paradigm within the service sector and globalisation of capitalism. From here it follows that the US serves as the best representative country concerning identifying technological development and the rise of modern capitalism using IPR measures.

Another reason for using US copyright data is that this is probably the most developed copyright system worldwide, and the only one with an adequate classification scheme. Thus, although the US copyright system is still poor-defined and broad-based, it at least

includes significantly distinct innovative sectors, such as computer programs, mask works (semiconductor chips) and multimedia works, which can be clearly distinguished from other types of copyright categories. For all the reasons listed above, therefore, when trying to develop copyright as an innovation variable as a research tool as well as establishing an initial database on copyrights (and in the longer term other IPR mechanisms), US copyright data (as with US patent data) provides the most useful indicator for identifying technological change and the evolutionary dynamics of services in a global context.

6.5 Integrated Research

All the problems and possibilities mentioned above must be taken into account when addressing the joint issues of technological capability and opportunities at the copyright sector level within services and the 'copyrightable' capability at firm, industry and country level. As indicated above, when introducing copyright data as an technology variable into innovation research, much can be learned and applied from existing literature covering the appropriate use of patent statistics. Great care should be paid to the limitations of using copyright data as a technological indicator. Copyright statistics ought to be seen and used as only one technology indicator, amongst a range of indicators including R&D data, bibliometrics, patents and productivity statistics. Integrating copyright databases with other IPR statistics, such as patents, also provides a better picture of the innovative application of copyrights, given that IPRs are often employed in an interrelated and combinational way by firms (Section 4).

7. Conclusion

Just as it has been argued that the full scope of the patent system took off with the rise of corporate capitalism during the Industrial Revolution based on changes in production and new industrial processes, there similarly appears to be an emerging in the late twentieth century in the interlinkage and coevolution of the innovation process within services and the IPR that has grown up to serve it, including here the copyright

system. It has been presented here that the IPR system represents an important institutional, legal and technical framework; one that deserves study in terms of broadening our understanding about the broader institutional framework in relation to the system of innovation as a whole (Lundvall 1998).

However, the IPR system is also an extremely complex system in its own right. On the one hand, it has strong moral and ethical rationales which include human rights, business and consumer ethics. On the other hand, it also has strong economic rationales, which include incentives to creativity and increased competition (providing scope for a better investment environment) and the more formal organisation of science and technology at the national level. This latter rationale provides scope for a more transparent stock of knowledge that the full society can benefit from, as well as a more collective information system covering technology and industry structures thereby allowing a better science policy advice forum. However, in order to understand the full value of the system a closer empirical investigation needs to be undertaken, in order to answer the question: "Are there any costs of such a system?"

By viewing the government institution or agency under which the system is administrated, it has also been found that the priority of the different rationales differ across different national systems of innovation. This institutional, legal and technical framework is critical in the formation of sectoral systems of innovation and especially in delimiting very different innovation characteristics and dynamics as between manufacturing and service industries. However, this is not to suggest that there are not important (and indeed more valid) sectoral systems of innovation within the service economy. Rather the service/manufacturing sectoral dichotomy delimits some general differences in the two macro systems of innovation, particularly in relation to IPR, but within the service dimension there are more specific sectoral innovation regimes. Here the work on service innovation indicators using IPR variables, most notably copyright, will be invaluable in defining more clearly these sectoral systems of innovation in relation to services.

As has been highlighted here, the protection of IPR afforded to service innovations has been much weaker and more recent than for manufacturing. In part, this may reflect

the problematic nature of trying to protect intangible knowledge and information products. Or it may be that the weak IPR system covering service activity is simply a reflection of the fact that service industries are less innovative and therefore less pressure was put on the legislators do anything about it? Further, regardless of why there has been such a weak IPR system in relation to services, has this weak protection system held back innovative activity within services?

These are all important questions to answer, but certainly things are changing. Ever since the mid 1970s there has been strong commercial pressure to do something about IPR protection for computer software and services (Bainbridge 1996). This in turn has led to a momentum for improved and more transparent copyright protection. The IPR system in relation to services did yield to new technologies and the commercial pressures that built up behind them. Moreover on a series of indicators, such as R&D expenditure and even patents, service industries do appear to becoming much more innovative. Can this partly be explained that service innovators are now better rewarded for their labours because of better IPR protection, or is it just part of a wider realignment within modern industrial economies towards intangible effort and knowledge production?

Lastly, although it has been stressed throughout this paper that attention should be paid to the problems and limitations of using IPR mechanisms as indicators of innovative activity, especially in relation to copyright data, there is undoubtedly a major need for new measurement tools and methods to analyse service innovations (such as for software technology; see Patel and Pavitt 1995, 45). Indeed all the questions raised above, have strongly highlighted the need to develop, test and evaluate the use of new indicators, such as copyrights, patents and as well as other IPR mechanisms, for measuring innovation in services. This, in turn, requires the establishment and development of suitable databases, for example, covering copyright and patents in relation to service activities. In this search for new innovation metrics, this paper has outlined possible new opportunities in the use of copyright as a technological indicator within services, and especially new t-KIBS sectors. However, much needs to be done before the use of copyright and other IPR mechanisms can be judged useful and valid within the wider scope of innovation related research.

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Footnotes:

[i] It could be argued that this delay in affording protection to computer software was because at least some of the software in the 1950s and 1960s was protected via embedding or 'hardwiring' into the computer itself, although much of the 'firmware' type of software (Section 4) only became more widespread with the more widespread diffusion of effective microprocessor systems in the 1970s.

[ii] Another factor has been the increased outsourcing and externalisation of R&D activities formerly undertaken 'in-house' within manufacturing firms and now provided externally by specialist research and technology service companies (see Howells 1997).

[iii] Earlier work in this field includes the work of Schmookler (1950; 1953; 1962; 1966), Scherer (1959; 1983) and Kuznets (1930; 1962).

[iv] The issue of what is trademarkable in the UK has been recently illustrated by the debate which arose over whether, after Lady Diana's death, the words "Diana the Princess of Wales" should have trademark status.

[v] Thus it might be expected that within telecommunication services cross-country variation will be less significant due to the very internationalised nature of this sector.