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PATENTS IN THE SERVICE INDUSTRIES
Final Report

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Executive Summary

Background and Objectives of the Study

It is well known that in the advanced economies of the OECD services account for roughly two-thirds of employment and over 50% of GDP, a share that is growing. Nevertheless, services have received relatively little attention from analysts of innovation for a long time, since they appeared to be much less innovative compared to the manufacturing sector. Another reason for this negligence are also the difficulties concerning the definition and identification of R&D in service companies. Innovation activities in the service sector are more broadly understood and not concentrated just on R&D. They comprise the introduction of new services without any technical equipment as well as the development of new technical products or processes. Many service firms extensively use technical equipment and contribute, through their new demands, to technical innovations by their suppliers. At the same time, many service firms are very innovative without any visible link to technology. So relevant parts of innovations of the service industry refer to the introduction of new services, such as new concepts of insurance or a new method of teaching, and cannot be described in terms of technology.

Like in the manufacturing sector, the protection of innovations in service industries is important, in order to achieve a sufficient return on investment for innovative activities. Possible mechanisms of protection are secrecy, market lead and the long-term commitment of personnel, but also intellectual property rights (IPR). However, patents can only be applied for innovative technical solutions. Since a central driving force for innovations in the service sector are the recent developments in the information and communication technologies (ICT), there is clearly the possibility of a growth of patenting here. There are other IPR as well, e.g. trademarks, copyrights. Thus it is sensible to extend the analysis of IPR and protection strategies in general beyond patents, in order to get more valid results on the relative importance and effects of intellectual property protection.

The **objective of the study** is to analyse **the use and importance of formal IPR**, especially **patents**, and informal protection strategies for **service companies** on the basis of an in-depth understanding of the "innovation process" in the different service sectors. In order to reach this main objective, **three tasks** had to be accomplished. **Firstly**, the existing **literature** on innovation in services had to be screened in order to build a solid base for the empirical analyses. **Secondly**, in order to obtain quantitative results about patent activities of service companies **patent databases** have been searched for patent applications by European service companies. **Thirdly**, a **sample of service companies** was **analysed in-depth** in order to obtain **insights into the strategies of generating and protecting innovations** in services.

Key findings

Empirical Evidence about Patenting Activities of European Service Companies

Both the propensity to patent and the quantitative volume of patent applications are significantly lower in the service sector compared to the manufacturing sector. The propensity to patent of a service company is one third of the likelihood of a manufacturing company. According to the second **Community Innovation Survey**, just **around 7% of service companies have applied for patents**, compared to **25% in the manufacturing sector**. Recent results of the third Community Innovation Survey in Germany confirm these rather small shares. Furthermore, **among the top 100 applicants at the European Patent Office not even five are "pure" service companies**.

Moreover, those service companies that apply for patents have rather small numbers of patent applications. An analysis of the **top applicants who were responsible for the major share of all applications in 1998-2000 showed that "pure" service companies** accounted for just above **3%** or around **1,800 patent applications**. Companies, including research institutes, providing **R&D and business related services** are responsible for two thirds of these applications. Besides this sector, only **telecommunication companies** have applied for a significant number of patents.

Using the same approach one can also analyse services patents in specific sectors and technologies. The table below shows that neither chemistry nor mechanical engineering, including vehicles construction, are technologies on which service companies focus, with the exception of the R&D oriented service companies. In the broad field of **electro-technology** and a **residual category covering all other technologies**, the share of patent applications by service companies is around **4%**. If one has a closer look at **telecommunication and information technology**, it turns out that more than **5%** in the former and almost **7%** in the latter of the applications are submitted by service companies. **Telecommunication companies** have applied for **almost 5% of the patents in telecommunication technology**.

Summarising the results of this quantitative approach to receive a comprehensive picture on the quantitative importance of patent applications submitted by service companies, we find that **only few service companies apply for patents at all**. In addition, **their number of patent applications is very low**. The result is the **small share of 3% of all patent applications**. The very few service companies active in patenting come especially from **R&D or telecommunication services**. Whereas the **R&D services cover a broad range of technology fields**, **telecommunication and IT companies** are focussed in their patent activities around **electro-technology** and especially **telecommunication technology**.

Estimated Shares of Patent Applications in the years 1998-2000 by Service Sectors in Five Main Technologies						
Service sectors	Technologies					Sum
	Chemistry	Mechanical engineering	Electro- technology	Vehicles construction	Others	
Wholesale and retail trade						
Transport			<0.1%		≅1%	<0.1%
Post and telecommu- nications			≅2.5%		<1%	≅0.75%
Financial intermedia- tion			<0.1%			<0.1%
Computer and related activities			<1%		<1%	<1%
R&D and other busi- ness activi- ties	3%	2%	1%	<1%	3%	2%
Sum	3%	2%	4%	<1%	4%	3%
Total appli- cations	5,367	13,737	14,645	4,107	18,495	56,351

Note: The table should be read as follows: Approximately 2.5% of the patent applications in the field of electro-technology were submitted by post and telecommunication companies.

Results of the Case Studies

In order to examine the actual situation in-depth, a sample of service companies was analysed in the year 2001. This approach is able to generate more **qualitative insights** into why these organisations protect their knowledge and what they are protecting. The objective of the case studies was to investigate the basic characteristics of innovation in services and, in particular, of the strategies and specific means used by service firms to "protect" their knowledge assets, their investments in innovation, and the new services introduced into the market.

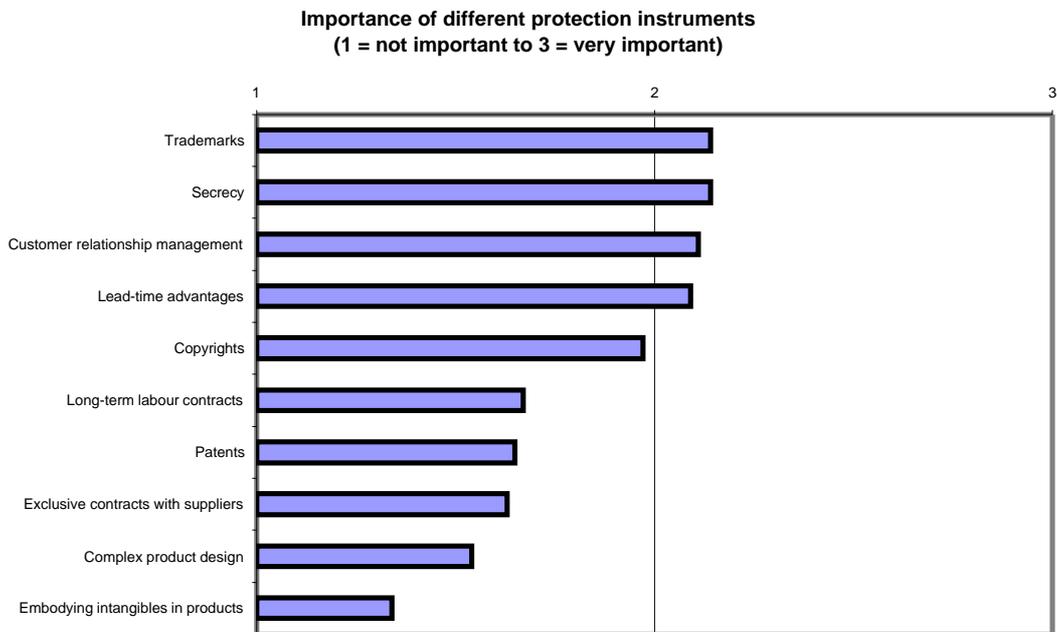
In total, case studies of **65 service companies** located in **more than 10 different Member States** were performed. The sample covers all service sectors, but has a **focus on innovative and technology-intensive services**, like software development, R&D and other business services, which may therefore need protection of their intellectual property. Finally, the sample consists equally of very large, medium, and small companies. It appeared that each service company has a very specific attitude both to innovation and to IP protection strategies.

The resources which the sample devotes to the innovation process are significant and on average more than a quarter of the workforce is committed to innovative activities. The **most important innovation activity** is the **acquisition of software and related technology**. External sourcing is therefore more important than internal research and experimental development. Besides the technological dimension, the provision of services relies highly on the input human factor. Consequently, the training of the staff, which is directly linked to technological innovations, is of secondary priority for the service companies examined.

Due to these characteristics of the innovative process, **the role of IPR for the innovation process is obviously only of minor importance** among the set of innovation strategies. Both the licensing of IPR, like patents, trademarks and copyrights, and screening the information contained in patent documents are of low importance for most of the companies. The relatively low importance of both the IPR as formal protection instruments, with the exception of trademarks, and the informal means can be explained by the **limited overall assessment of IPR activities** in relation to the other business assets of the companies, like product quality, client orientation, client service, price, adequate supply of products and services and a high level of technology.

In order to understand better the assessment of the effectiveness of different protection strategies, it is important first to clarify what assets the companies try to protect from competitors, customers and other actors in the market. Most important is defending **internal process knowledge**, which is crucial for providing services. Since the provision of many services relies on ICT, software is the next asset necessary to be protected. The high share of small companies protecting software is caused by the dominating role of software companies in the category of small companies. For the majority of all companies, it is important to safeguard the unique skills of their staff.

As the following Figure shows, **all formal and informal protection instruments are of medium importance**, which reflects the limited importance of protection strategies in general for some companies. **Patents are the least important IPR** for the interviewed service companies, although a significant share of them expects a much higher importance of this instrument in the future. For four instruments the importance is assessed clearly as above average, only one of which is a formal instrument (**trademarks**), three are informal protection means (**secrecy, customer relationship management and gaining lead-time advantages**). However, it becomes evident that service companies with own R&D activities are both more likely to use patents and more active in patenting compared to companies with little or no own R&D effort.



This Figure represents the current situation. Nevertheless, many companies indicate that especially their IPR activities and their IPR portfolio will gain more importance in the near future. In addition, **for companies which like to protect their IT hardware and software, the importance of patents as a protection tool is significantly higher** than in companies with no interest in protecting their hard- or software.

Concentrating just on patents, the share of companies which uses this protection instrument is about half of the total sample and the majority of the sample assesses patents of low importance. Furthermore, **only one quarter of the companies using patents follow an explicit patent strategy**, discusses about patents and patent strategies regularly and contributes a high importance to patents for knowledge protection. Most **important reason** for patenting is the traditional motive to **prevent competitors from copying their own innovations**, which is closely related to securing the exclusive use of valuable knowledge. The more strategic motives of patenting, like to improve the position in negotiations with other companies or to block competitors' patenting activities, are of secondary importance.

In order to gain more insights into the low usage of patents by service companies, it is helpful to have a look at the reasons which prevent companies from patenting. The **general perception** of almost half of the interviewed service companies is that their **new products and services including their tacit knowledge are not eligible for patenting**. More than one quarter of the companies doubt the effectiveness of patents in preventing imitation and a fifth of the respondents claim that patent protection is irrelevant, since the technological cycles are becoming shorter. The cost and time argument is also of minor importance for not using patents.

Sector Studies

Due to the heterogeneity of the service area, the company cases are clustered into seven sectors and analysed separately. Some interesting sector idiosyncrasies come to the fore:

- **The wholesale and retail companies** have in most cases no internal research and development or innovation activities. Consequently, there are no physical objects to be protected by IPR, especially patents. On the contrary, these companies are confronted with the patent-protected products of manufacturers. In contrast to the more defensive behaviour concerning patents, their trademark strategies are much more pro-active.
- **The transport sector** is increasingly confronted with patent issues, since de-regulation and globalisation leads to more intensive competition, in which patents play a crucial role, due to the intensive use of technology in transport services.
- **The communication and media sector** faces increased intensity in competition. This has both been in relation to ‘new services (product innovations)’, rapid evolutions of process technologies (ICT), and the emergence of new market needs (market-driven evolution). IPR have only recently – and still to a limited degree – become effectively co-ordinated into the primary strategies of the communication and media firms.
- The main asset in the **banking and the insurance sector** is a trusting relationship to both the commercial and the private clients, although the trend towards online-banking has meanwhile increased the role of technology in the customer relationships. Obviously, the awareness of the need to protect the supporting technologies is not yet well developed.
- **Business services** include a rather heterogeneous mix of sectors and models of innovation. IPR could potentially play a role among all the so-called knowledge-intensive business services which generate knowledge themselves or those which disseminate such knowledge by providing customised applications and consultancy to a wide range of users. The knowledge content of these services is however very diverse and only in few cases can the existing formalised means of protection be used or are effective. R&D service providers have usually a strong technological base and their innovative output is usually patentable. In the case of engineering services, the increasing use of ICTs in the project design phases and for the final delivery of such products to clients makes the IPR issue potentially a critical one. A different case is represented by the broad category of consultancy services. Here formal protection tools cannot be used for a variety of reasons: because of the specific nature of the knowledge base of these industries, for the high customisation of the solutions proposed to clients and the intensive knowledge-sharing between service providers and clients.

- The **software sector** as a whole is very innovative, both in terms of resources spent for R&D and concerning its output of innovative products and services. The increased competition has crucial consequences, both for the innovation activities and the IPR strategies of the companies. First, the software companies are forced to be even more innovative in terms of new products and services, but also in terms of quality and price. Second, the threat of product imitation by competitors increases. These two effects together lead to an increased importance to protect the innovative assets produced by formal copyright protection, trademark registration and informal means. In addition, the sector experiences an implicit change of the IPR regime towards software patenting, which is perceived ambivalently by the companies.
- Given the strong link to the manufacturing tradition of protection via patents, the **manufacturing companies** also providing services transfer these experiences and know-how to their service business. Consequently, they are the drivers behind the growing trend to file patents for software applications. Some of the manufacturing companies, especially the big ones, actually equate the issue of service patents with the issue of software patents and are strongly in favour of patents on software-related technologies.

Recent and Future Challenges for the IPR Regime in the Service Industries

The service sector is characterised by some **special features** and influenced by some **major trends**, which also have an impact on the importance and role of IPR. First of all, the **heterogeneity of the service sector** and the **wide range of innovation activities**, including frequent R&D collaborations, have to be mentioned. Furthermore, most service sectors are dominated by **SMEs**, for which an active use of IPR, like the application for patents, is less appropriate and passive IPR strategies, like dealing with others' IPR, more important. However, the numerous start-ups in the service sectors depend very often on venture capital. In this context IPR can serve as collateral. The **trend to deregulate and privatise** whole service sectors also has implications for IPR, since the former public regulated companies may protect their monopolistic position also by relying on protected knowledge assets. The **intensive use of ICT** threatens the protection of intellectual property by the ease of copying, especially information goods. But it is also able to increase the value of digital goods by lowering their distribution costs. The increased and more sophisticated use of ICT allows the **internationalisation of services**, which raises conflicts between differing national IPR regimes. Finally, the **skills of highly qualified personnel** are crucial assets for many service companies. Since the mobility of this type of employee is rather high, conflicts between service company and service employee regarding claims on intellectual property are likely.

Having these features and trends in service sectors in mind, the companies report the following experiences regarding the different IPR:

- **Trademarks** in general cause no significant problems. However, their effectiveness regarding the protection of innovations is also limited, which explains the rather low degree of conflicts and problems.
- **Copyright protection** is only relevant for some service sectors, like the media and software sector. These companies complain about the limited protection provided by copyrights and the costly and often impossible enforcement. Furthermore, these sectors are to a high degree internationalised in the sense that both the production of their services relies very often on input from services companies located in different countries and their distribution aims to reach customers world-wide. Due to differences between national copyright systems, companies increasingly suffer from these inconsistencies.
- **Patents** cause two kinds of problems. The first one is linked with their scope, the second one with their current implementation. For some service sectors patents are not at all relevant, since their new products, services, tacit and even codified knowledge is not patentable. Some companies take this situation for granted and have no ambitions to extend the scope of patents, since they question the effectiveness of patents for their business or they admit a low level of knowledge about patents in general. Other companies complain about the limited scope of patent protection. Companies which are more experienced regarding patents belong to the latter group, because they have their origin in the manufacturing sector or because they provide very hardware-related services.

Policy Considerations for the IPR Regime in the Service Industries

In order to solve the problem of heterogeneous national patent systems and differences in the applications, a harmonisation at least in the European Union should be reached by the **introduction of the European Community Patent**, as was already announced at the Lisbon Summit 2000. Furthermore, to solve patent conflicts within the European Union, the **introduction of a European Patent Court** is under discussion.

Whereas a harmonisation within Europe can be legitimised also by the completion of the internal market, a conformity between the US and the European patent system is ambivalent. Especially **regarding the introduction of software patents**, which means following the US example, there is **no agreement within the software sector**. In general, new forms of IPR better suited for services may generate additional incentives to innovate for the relevant service companies. However, the current IPR system already causes significant costs for its users. The more intangible and tacit the objects of protection are, the higher the costs for their application or registration will be and the more difficult their prosecution.

Therefore, it is more appropriate **to increase knowledge about the IPR regime among service companies**. Especially SMEs should be enabled to deal with own IPR and the claims of other companies adequately. **Possibilities for simplifications should be identified and realised** within the patent and trademark system. In the case of copyright, some companies suggest to introduce – at least – a voluntary registration, in order to increase the transparency of existing claims.

Finally, based on the literature review, the quantitative analysis, the case studies and CIS surveys, it can be clearly stated that **patents are an innovation indicator of only limited value for the service sector in general, but adequate for specific service sectors, like telecommunications**. Regarding **alternative indicators**, the **registration of trademarks** may be helpful, since the share of service companies registering trademarks is higher and not so heterogeneous as between service sectors. However, trademarks are often not directly linked to an innovation, but motivated by marketing reasons to increase the visibility of their services in the market or reflecting competitive strategies. Nevertheless, the registration of a trademark often has the function of supporting the introduction of a new service in the market.

1. Introduction

1.1 Background of the Study

It is well known that in the advanced economies of the OECD services account for roughly two-thirds of employment, a share that is growing, whereas that of manufacturing is in decline. In the European Union in 1997, 'market services' accounted for 45% of employment and over 50% of EU GDP, whilst 'non-market services' accounted for a further 21% of employment and 14% of EU GDP (Eurostat, 1999). Even in Germany, a country famous for its manufactured products, services account for a two thirds of GDP employment (OECD 2000).

Yet, despite their economic importance, services have received relatively little attention from analysts of innovation, particularly at the micro level, whilst at the macro level the growing importance of services is often related to an apparent productivity slowdown, and the 'productivity paradox'. To date, almost all of our understanding of innovation and the innovation process at the micro level has been derived from manufacturing, despite the economic importance of services.

This raises both simple and complex questions. Are service companies innovative? If so, how is it possible to identify innovative service sectors and companies and to quantify the output of their innovative activities? Because of difficulties concerning the definition of R&D in service companies, output indicators seem to be more appropriate.

Various surveys on innovations in the service industry have revealed that a broad range of different innovative activities are covered. Service innovations comprise the introduction of new services without any technical equipment as well as the development of new technical products or processes. In particular, consultation firms, engineering firms, architects etc. often directly generate technical innovations. Many service firms extensively use technical equipment and contribute, through their new demand, to technical innovations by their suppliers, or they suggest to their suppliers an improvement of their technical products. Some firms comprise production departments and service departments with interactive linkages. At the same time, many service firms are very innovative without any visible link to technology. So relevant parts of innovations of the service industry refer to the introduction of new services, such as new concepts of insurance, a new method of teaching, and new styles in cultural industries, and cannot be described in terms of technology.

Like in production industries, the protection of innovations in service industries is likely to be important in order to achieve a sufficient return on investment for inno-

vative activities. Possible mechanisms of protection are secrecy, market lead and the long-term commitment of personnel, but also intellectual property rights.

The majority of innovations in the manufacturing sector are protected by some kinds of intellectual property rights. The legal instruments of these items of human creativity are covered by the generic term "Intellectual Property" (IP). Intellectual Property Rights (IPR) ensure exclusive use in commerce and industry. Utility-model patents for inventions can be obtained as a means of ensuring the protection of technical inventions. The subject of such an intellectual property right could be, for example, a product or manufacturing process. Industrial design, on the other hand, protect the aesthetic qualities that are expressed in the particular shape or form of a certain product, device, or whatever. Transferring the well established patent system from the manufacturing sector to the service sectors may be a possible solution both for the protection and the indicator problem, raises on the other hand some problems.

First, patents can be only applied for innovative technical solutions, consequently in the international patent classification (IPC) there are no service categories. Therefore, only the service companies whose products have a technological base can protect their innovations using patents. Furthermore, since a central driving force for innovations in the service sector is the recent developments of information and communication technologies (ICT), patent activities tend to cluster and grow more rapidly in this field. Non-ICT patents are in fact rarely known in service firms.

Whereas technology-based service companies may be identified by analysing their patent applications, there exist many service companies which are either only technology users or which provide services with a low technology intensity. There is a variety of methods extensively used by those companies to protect intellectual property as well, e.g. trademarks, copyrights, secrecy or market lead. Thus it seems obvious and sensible to extend the analysis of IPR and protection strategies in general beyond patents in order to get more valid results on the relative importance and effects of intellectual property protection. To do this over a range of sectors and regions as efficiently and thoroughly as in the case of patents, one has to look for those mechanisms which enable systematic quantitative analysis. However, most of the protection mechanisms mentioned do not require registration of the property that is to be protected¹ which puts up severe obstacles for quantitative analysis.

¹ See Miles et al. (2000), who examine the IP strategies of service firms, finding less formal means such as contracts and employee law to be most wide-spread, though copyright and design rights are employed in some sectors.

1.2 Objectives of the Study

The main objective of the study is to obtain first an in-depth understanding of the "innovation process" in different service sectors including those covered by the Community Innovation Survey (CIS). This implies an in-depth analysis of the service process, the latest market trends, the process of technology adoption and the conditions to appropriate new knowledge in service companies. Second, based on these insights the use and importance of formal IPR, especially patents, and informal protection strategies for service companies have to be analysed.

In order to reach this main objective three tasks have to be accomplished. First, the existing literature on innovation in services has to be screened in order to build up a solid base for the empirical analyses. Secondly, a database of large European service companies that have applied for European patents has to be constructed to get an quantitative impression of the situation. Thirdly, a sample of service companies has to be analysed in-depth in order to obtain an insight into the strategies of generating, protecting innovations in service companies and the conditions to appropriate external knowledge and new technologies.

The outcome of the study should complement and deepen the insights of the CIS and other respective studies.² This would allow a comparison in order to support or to revise the result of the CIS analysis. Additionally, future challenges for the IPR regime in service sectors can be identified, which may request adjustments within the current regime or even radical changes.

1.3 Structure of the Report

In order to reach the above objectives, different research steps have been performed. Based on a review of the literature, presented in Chapter 2, a conceptual framework of knowledge regimes for services has been constructed in Chapter 3. Chapter 4 presents the results of the various empirical analyses, including an empirical test of the hypotheses derived from the model presented in Chapter 3. The various analyses allow in Chapter 5 to conclude with policy considerations regarding the IPR regime in the service industries.

² Compare Arundel and Kabla (1998).

2. Literature Review: Innovation and Protection in the Service Industries

Birgitte Andersen, Jeremy Howells, Ian Miles, Joanne Roberts

2.1 Introduction

2.1.1 The Services Field

Research on services has developed massively since the mid-sixties.³ In the immediate post-war period, manufacturing industry was still considered the wellspring of economic growth, and the source of innovation. Services were categorised as the tertiary or residual sector, with little role here. While some services were seen as supporting the economy's social and logistical infrastructure, others were either producing luxuries (consumption of which grew as manufacturing industry's productivity growth gives us time, material goods, and money), or helping to limit social inequalities by providing mass health and education.

By the 1960s, the scale of service activities prompted the first systematic analyses of the "service economy", "producer services", and "post-industrial society".⁴ These accounts of service sector growth diverged widely. For many economists, services were laggardly, unmodernised activities, unable to participate in general productivity growth (because of such factors as their low quality labour and small-scale organisation). But for some "post-industrial" analysts, often sociologists and geographers, services were seen as superior products, growing demand for which reflected increasing consumer sophistication; the service labour force was seen as typically professional and/or socially skilled. Implicitly both accounts viewed most services as technological laggards – the negative interpretation being that their low productivity growth was a drag on the whole economy; a more positive interpretation being that they could absorb labour displaced as manufacturing industry automated.

In the 1980s and especially the 1990s, increasing numbers of researchers and policymakers have taken a fresh look at services' role in innovation and innovation systems.⁵ There have been two major thrusts to much of this work:

- Firstly, to stress that services are often innovative (they are heavy IT users, for example, and CIS (= Community Innovation Survey) data show high levels of innovation); and

³ Bryson and Daniels (1998) provide a wide-ranging compilation of this literature.

⁴ See Bell (1973), Fuchs (1968, 1969) and Greenfield (1966).

⁵ Gallouj (2002) provides an excellent overview about theoretical models of innovation in the service economy.

- secondly, to examine whether there are specific features of services that shape the services' innovation process in particular ways.

Let us briefly consider some of the key points to emerge from this second element.⁶ One feature that makes many services distinctive is the *intangibility* of the service product.⁷ Even if the service effects physical transformations (transporting or caring for people or artefacts), or is embodied in a physical medium (a report, a CD-ROM), the service product for which the client is paying is typically not a material thing in its own right. (Thus clients are not primarily paying for the physical paper or disc, but for its data or information content.) Intangibility is one characteristic of services that makes them *relatively* hard to store, transport, or trade across international boundaries (although this applies less to 'digitalised' services) – and to protect within existing intellectual property regimes.

One of the most evident features of much technological and organisational innovation in services at present involves efforts to overcome these features – *to render the intangible tangible, or at least visible* (the current efforts to account for intangible investments are an interesting, and not unrelated, parallel). Various strategies are apparent here, in particular:

- to add material components to the service;
- to enhance the demonstrability of intangible innovations.

Since information is at the heart of many intangible products, recent years have witnessed the application of new IT to relevant services: on the IPR (= Intellectual Property Rights) front this raises issues about the protection of IT innovations (where software has been much discussed as a problematic topic). In the 1980s a new line of analysis – the "reverse product cycle"⁸ – suggested that IT represents a change for services, leading to more of them becoming innovative. The argument goes that most services are becoming IT-using services, and that many IT-using services are moving from applying IT to their established practices, to undertaking much more dramatic innovation using the new technology. They move from process innovations aimed at enhancing efficiency, through a period of quality improvement, to product innovations. The pattern described could alternatively be characterised as an evolution from *back-office* process innovation, through innovation in the *delivery* of services to clients, to *product* innovation.⁹

⁶ The discussion that follows draws on that in Miles (1999).

⁷ In Chapter 3 this dimension of services is integrated in a conceptual model of different knowledge regimes relevant for service companies.

⁸ Barras (1986, 1990) is the most prominent representative of this theoretical approach.

⁹ For a detailed empirical critique of the reverse product cycle approach, see Uchupalanan (1998). This study provides a detailed analysis of the interplay between competition, strategy, innovation and regulation for a series of banking IT innovations.

A second feature that renders many services distinctive is their "*client-intensity*". Many services involve their clients as more than just consumers - in specifying and in producing the service. Together with intangibility, client-intensity contributes to the difficulty of demonstrating many service products in advance of use, the specific property rights that may pertain, and the importance of trust in the process. However, there are many different forms of client-intensity, and services relations to their clients vary from firm to firm, sector to sector.¹⁰

Many researchers have differentiated among services in terms of the sorts of interactions through which they engage with clients. Silvestrou et al. (1992, 73) define two extreme categories of service, differing along six dimensions. **Professional Service Providers**: these are organisations with relatively few transactions, highly customised, process-oriented, with relatively long contact time, with most value added in the front office where considerable judgement is applied in meeting customer needs. By contrast, **Mass Service Providers**: these are organisations where there are many customer transactions, involving limited contact time and little customisation. The offering is predominantly product-oriented with most value being added in the back office and little judgement applied by the front office staff (a third category, **Service Shops**, falls between the two above on the six dimensions).¹¹

Another, more elaborate grouping by de Jong (1994) distinguishes four groups of services. The first, **Infrastructure Services**, lacks a parallel in the Silvestrou approach: these are services like telecommunication and transport services, which make use of fixed network facilities for standardised problems. The other three groups are, first, **Value added Services**, which are highly specialised services that can be used by different types of businesses, for example accountancy and wholesale trade. Second, **Pre-specified Services** which make use of a standard approach or method in order to satisfy a general demand, for example repair, maintenance and cleaning services. Third, **Ad hoc Services** such as management, consultancy and engineering services that are called in for specific, one-off problems. De Jong's classification is related to the potential for pursuing 'economies of scope' and 'economies of scale'; which can be represented in terms of the degree of (or the possibilities for) standardisation or variety in the services offered. It is likely that innovation dynamics will differ across these types of services; perhaps with opposing tendencies toward standardisation and more flexibility. Although, with the application of well managed service technology, even highly customised services may benefit from the efficiency gains of standardisation through the mass production of service inputs. The strong heterogeneity of innovation activities within services has been highlighted by Evangelista using a large set of indicators provided by the Italian CIS2 survey (Evangelista 2000). He has proposed a sectoral taxonomy in which

¹⁰ For empirical analysis of this point, see Hipp et al. (2000).

¹¹ Tether et al. (2001) analyse the standardisation of services differentiated by sector.

service industries are clustered according to the overall innovative performance of firms, the sources of innovation, the different knowledge bases underlying the innovation process and the different patterns of interaction through which service firms innovate.¹²

A French research tradition has introduced the neologism '**servuction**' to describe the supplier-client relations surrounding process, product and indeed consumption.¹³ The sorts of activities involved include, for example, innovations in marketing; transactions; input of information from clients for choice, design or customisation of the service; after-sales support; and so on. In some applications of this approach, innovation in servuction is contrasted with innovation in production. Many innovative activities involving interactions between supplier and client (and networks of clients) have been overlooked, under-emphasised, or misrepresented in conventional innovation studies, measurement approaches, and, perhaps, IPR analyses. Customisation raises particular challenges for innovation measurement: it is usually explicitly sidelined in terms of R&D and innovation indicators, but is a critical process in many services. Much service innovation is intrinsically entangled with customisation of a continually evolving product. And with the high degree of co-design and co-production of service products, it may be difficult to locate the innovation within service supplier or client. It is not unusual, for instance, for service firms to site their staff within client organisations for periods of time (similar problems are raised in collaborative R&D more generally).

Client-intensity is not restricted to services; manufacturing firms too, vary on this dimension. But it is a marked feature of many services, and is liable to shape their innovation patterns, and roles in innovation systems. Indeed, client relations emerge as a key source of competitive advantage for many service firms. Among large business service firms this has led to organisational innovations such as the introduction of global account executives whose task it is to ensure that multinational clients receive a seamless global service.¹⁴

A third distinctive feature of many services is that they have been typically operating in environments that are highly regulated – by government rules and often state ownership, and by professional qualifications and norms of action. Despite deregulation and privatisation in the 1970s and 1980s, services remain more heavily regulated than most areas of the economy.¹⁵ Nevertheless, levels of competition in the sector have increased significantly. Although some service sectors remain protected by national regulation, many others are now being subjected to the full forces of

¹² See Quinn and Paquette (1990).

¹³ See Eiglier and Langeard (1987).

¹⁴ About multinational business service firms, compare Roberts (1998).

¹⁵ For accounting services, see White (1999).

global competition, as growing numbers of service enterprises develop their international trade and investment activities. Such competition is set to intensify with the liberalisation of service markets, which is likely to result from the current round of World Trade Organisation (WTO) negotiations. The rise in competition is undoubtedly stimulating innovative activity, though the organisation of innovation in the sector may be influenced by the attitude of many services to competition and to IPR protection in the past, and there may be continuing effects from this.

Finally, the service sector does not tend to organise its innovative activities in the R&D management, research centre styles employed by many manufacturing firms.¹⁶ Instead, it is much more common for innovation to be handled through ad hoc product or project development teams, and/or software engineering departments. Though there is a general trend for services to become more like other sectors in terms of innovative capacity and effort, their history may have generated a legacy that is hard for these sectors to overcome. And, indeed, it could be that the particular features of services and/or services innovations mean that it would not be appropriate for them to adopt the sorts of innovation management structures that are typical of manufacturing sectors. As elsewhere, it is probably premature to assume that the models established in one sector are automatically optimal for others – even if the former sector has the longest tradition of practice in the area concerned.

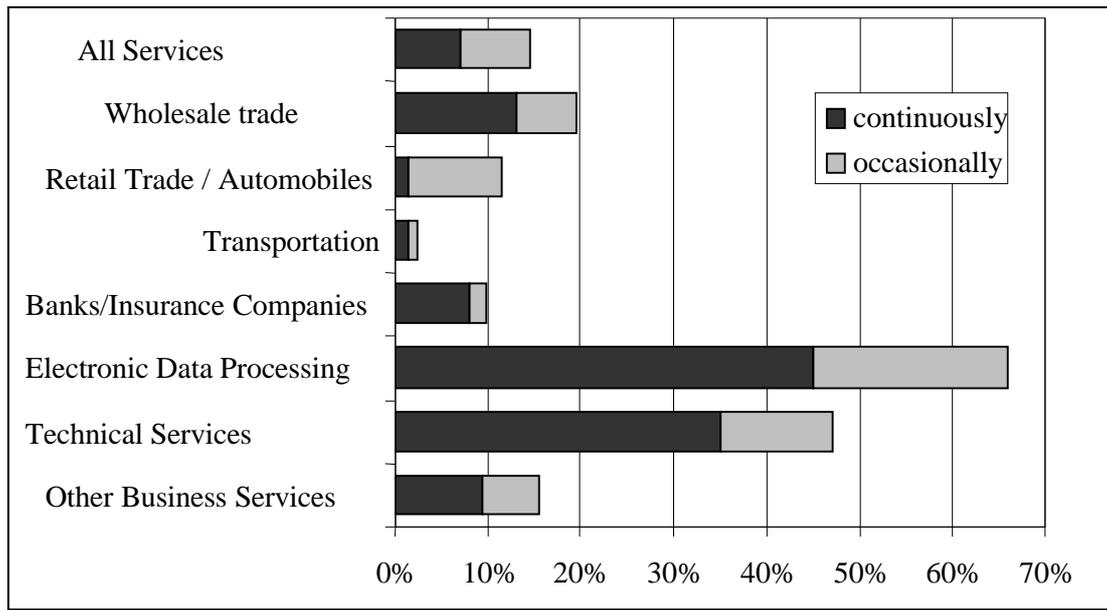
One source of survey evidence concerning services' innovation, and use of R&D, comes from a major German survey. Using these data, Hipp (2000) also shows that German services firms generally do not conduct formal R&D. However, there are exceptional firms, and some subsectors are more prone to R&D than others. An industry-specific presentation shows clear differences in R&D behaviour (see Figure 2.1-1). Transportation, banks and insurance companies, and retail trade have little involvement with formal R&D: this may mean that they contribute little to technological change, or that their contributions are more on the "softer" side of technology – thus software development is often (incorrectly, according to the formal Frascati criteria) *not* perceived as R&D. On the other hand, the more technology-oriented industries like technical services and large electronic data processing companies are much more active in research and development. With regard to their R&D activities they correspond much more closely to the manufacturing sector.

Of course, many manufacturing firms do not have formal R&D divisions. This is, especially true for small firms, (and has also been the case historically for many sectors of manufacturing, who are "supplier-driven"). Expenditures on R&D and innovation in such circumstances are less likely to be formally registered; and patents or other *formal* instruments of IPR protection are not undertaken. Blackburn and Kitching (1998) argue that this explains many SMEs' perception and management of IPR. The relevance to the present discussion is that many services are

¹⁶ Cf. Sundbo (1998) about the organisation of innovation in services.

SMEs – the sector is more skewed that way than is manufacturing – and possibly that even large service firms share many of the attitudes characteristic of SMEs in services and other sectors.

Figure 2.1-1: German service innovators conducting R&D differentiated by industries in 1996 (shares in per cent)



Source: Mannheimer Innovationspanel – Dienstleistungen, Erhebung 1997, ZEW and FhG-ISI

Thus, statistics on R&D or on *formal* IPR protection do not adequately portray the innovativeness of services firms.¹⁷ As Hipp (2000) concluded in her survey on German firms, services firms contribute to innovation and technological change, and *vice versa*, and as Blackburn and Kitching (1998) concluded, an adequate study of the management of intellectual property in SMEs must explore both *formal* and *informal* methods of protection and the rationales for the various approaches. This is mainly due to business owners of services (resembling SMEs) often being reluctant to adopt *formal* rights, such as patents or registered trademarks, primarily because they entail money and time costs in becoming aware of, acquiring and enforcing as well as because of the informal way in which the service innovation is conducted.

Despite the distinctive features of services outlined here, it is important to recognise that the service sector is evolving rapidly. New activities are emerging, especially

¹⁷ Young (1996) discusses the major problems of comparison between countries and over time of the data on R&D performed in the services industries.

connected to interactive media technologies and the Internet, while some traditional services are becoming obsolete. There are then likely to be wide divergences between the attitudes of different services to innovation and IPR. Furthermore, the blurring of activities between manufacturing and services, with some services moving into the production of tangible outputs and manufacturing firms becoming more service-oriented, is likely to add to the complexity and variety of innovative and IPR activity within the service sector.

2.1.2 Types of Intellectual Property

The exploitation of knowledge embodied in product and process innovations, new ideas, or related to intangible assets and symbolic material, is in most mature economies protected through the use of IPR. IPR instruments differ considerably in history and precise intent, and in mode of operation. The main IPR measures used in studies of innovation, for example, patents, are designed to protect the inventor from exploitation of his or her knowledge embodied in mainly industrial, product and process inventions. While the scope of patent protection has been considerably increased in recent years, there are still many classes of innovation which are not easily covered by patents, if at all. Another IPR instrument is copyright, which provides rights to the creators of certain kinds of mainly symbolic material, enabling them to control the various ways in which their material may be exploited. Among the several other instruments which are in use, we should mention in particular trademarks, which relate 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.

It should be noted here that the study of IPR covers a diverse range of subjects, disciplines, instruments and legal regimes. As such it includes 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.

It is important to recognise that an individual or organisation's "intellectual capital" may be protected by other means than through such IPR instruments – through commercial secrecy, contractual agreements, and physical protection of assets, for example.

The United States (US) IPR system, probably the world's most developed IPR system, supplies the definitions of IPR instruments presented as background in Table 2.1-1.

Table 2.1-1: A classification of intellectual property rights: The US context

IPR	Nature of Protection
"What are patents, trademarks, copyrights, and trade secrets?"	"Patents, trademarks, copyrights, and trade secrets are sometimes referred to as "intellectual property"-referring to products that come from the creative mind. Intellectual property is imagination made real."
Patents ...	Provide exclusive rights to make, use, import, sell and offer for sale a product and process invention for up to 20 years.
Utility patents ...	Protect useful processes, machines, articles of manufacture, and compositions of matter. Examples: fibre optics, computer hardware, medications.
Design patents ...	Guard the unauthorised use of new, original, and ornamental designs for articles of manufacture. The look of an athletic shoe, a bicycle helmet, and the Star Wars characters are all protected by design patents.
Plant patents ...	Are the way we protect invented or discovered, asexually reproduced plant varieties. Hybrid tea roses, Silver Queen corn, Better Boy tomatoes are all types of plant patents.
Trademarks ...	Protect words, names, symbols, sounds, or colours that distinguish goods and services. Trademarks, unlike patents, can be renewed forever as long as they are being used in business. The shape of a Coca-Cola bottle is a familiar trademark.
Copyrights ...	Protect works of authorship, such as writings, music, and works of art that have been tangibly expressed. The Library of Congress registers copyrights which last for the life of the author plus 70 years.
Trade Secrets ...	Are information that companies keep secret to give them an advantage over their competitors. The formula for Coca-Cola is the most famous trade secret.

Source: Andersen and Howells (2000).

At the outset, we should distinguish between different types of intellectual property that may be protected. It is also useful to consider the nature of the knowledge embodied in different types of intellectual property because this will influence the value and relevance of formal mechanisms of protection. For instance, when intellectual property is embodied in codified knowledge, which is easily replicated and distributed at very low or zero marginal cost, the establishment of IPR will be more

important than when intellectual property is based on tacit knowledge, which is not easily replicated.

A useful classification which provides an analytical framework for the above distinctions is outlined below:

- "Working knowledge" – the everyday knowledge utilised by employees in order to carry out the more or less routine activities of the firm. This may involve a high degree of firm-specific knowledge of what constitutes local best practice. Much of this knowledge will be tacit and held in the heads of employees who will have accumulated it through a process of learning by doing.
- "Client and market knowledge" – information accumulated by employees (and possibly captured in databases – concerning the key personnel and preferences of clients and suppliers, and similar sorts of knowledge that provide important sources of competitive advantage; these may be key complementary assets). The ability to work within and mobilise networks is a related form of intellectual capital. Clearly, these types of knowledge combine elements that are codified and tacit. While IPR may protect databases, they have little relevance for the protection of knowledge of networks. Such knowledge is often dependent on social interaction and it is not easily replicated. However, continual investment is necessary to maintain the quality of IP based on this type of knowledge.
- Intellectual property that takes the form of marketable products or outputs of the firm's operations, such as publications in various media, or the ability to present similar forms of material in face-to-face or other settings. This particularly applies to artistic and cultural products, but also includes some elements of, for example, technical designs and consultancy reports to which "aesthetic and cultural innovations" can give particular value. Where intellectual property takes the form of products, the knowledge embodied within them is codified, whereas the ability to present material face-to-face incorporates tacit knowledge.
- Knowledge, both codified and tacit, of practical innovations in products or processes, involving improved technical ways of accomplishing particular ends for the user of the innovation.
- More symbolic forms of intellectual property, which embody codified knowledge, include, for example, brands, trademarks, and other types of label that can be used to signify the reputation of the firm in question. A related form of intellectual property is the credentials which typically are bestowed by a sponsoring body whose IP they are – such as adherence to a particular standard – but which give reputational status to those awarded them.

The characteristics of different types of IP and the types of knowledge on which they depend have implications for the relevance of various forms of IPR. In particular, where IP depends on tacit knowledge, which is hard to replicate, IPR are less significant. A firm's efforts to protect such IP are likely to be focussed on re-

taining key members of staff or maintaining networks both internal and external to the firm. Hence, in such instances, employment contracts, and social bonds may prove to be of more relevance when compared to traditional mechanisms for the protection of IP. An appreciation of the nature of the knowledge used in the production and delivery of various services is vital if a full understanding of the use of IPR in the services sector is to be gained.

Intellectual property may be a direct source of "rent", in that charges can be levied for the use of the property. Or it can be a source of value to its owner in that leverage of the IP may give the owner a competitive advantage. In some cases it may be both; a firm may extract rent from letting others use its patents, and use the underlying technologies itself to commercial advantage. The types of IPR that are available, the motives for using them, and the strategies that follow from this, will be related to these different types of intellectual capital. The strategies in question will also be related to such factors as the local IPR regime, the resources and experience of the firm in question, the market environment, and so on.

2.2 Intellectual Property Rights and Services

2.2.1 Introduction

The background for this report is the emergence of a knowledge-based service economy as well as the micro-electronic revolution. In this respect, the report reviews how IPR can change in form, function and impact and how it plays a more direct role in services competition. A major purpose of the review, therefore, is to gain insights into the IPR mechanisms and strategies used to secure competitive advantage among services firms. It also seeks to contribute to the theoretical and empirical understanding of the dynamics of IPR systems more generally in the knowledge-based economy.

Just as innovation studies have tended overwhelmingly to focus on the manufacturing sector, so research linking together innovation and the IPR system has been almost exclusively centred on patenting. Part of the reason for this seems to lie in the increasingly less tenable view that manufacturing industries are the source of all technological innovation (on this basis, services are merely more or less passive users of technologies, at best contributing artistic flourishes to them, or making cultural innovations with them). But as we have seen, the patent system was developed mainly for manufacturing industry, to provide fairly strong and clear protection for innovations that are physical artefacts. Patents form a source of data that is relatively easy to relate to technological innovation, and much has been published on the propensity and benefits to patent among manufacturing firms.

In contrast, many of the more intangible innovations associated with services cannot be adequately protected under patent law. As we will see, it is a mistake to claim that services never use patenting: but services have been far less prominent in patent records than are manufacturing firms.

Often, when services seek formal means of protection of their innovations, (at least, for products rather than processes) they either register a trademark or, depending on the content of protection, they turn to copyright system rather than to patents. As some statistical evidence will show (see below), trademarks are of high and increasing importance for service companies, especially in globalised economies. Trademarks very often are regarded as major assets, not only to protect companies from being imitated, but also to increase the world-wide diffusion and recognition of established and new products.¹⁸ Therefore, the trademark system has gained increased attention lately. By the same token, the copyright system is currently the centre of renewed attention, since it may require structural change to meet the challenges of the "information economy", where new IT is enabling almost costless

¹⁸ For the overall importance of trademarks see, for example Aaker (1991). For a recent empirical study on the overall value of trademarks see PWC Deutsche Revision (1999).

copying and rapid global distribution of information products. But the copyright system fails to give us much grasp of technological innovation processes: a new cartoon character, popular song or training video is as much subject to copyright as is a new version of a software package or a new telematic service. The patent system has a dual mission: rewarding technological advance and distribution of relevant knowledge. In contrast, copyrights centre on protecting creativity for subsequent appropriation, rather than diffusing knowledge.

It is thus important to examine the strategies of and scope for services to use patenting more than they do, and the possibilities of utilising patents data to assess at least some forms of services innovation. This report is limited because rather little on this theme has been established in previous studies. Hence, a major function is to highlight a state-of-the-art picture. The role of IPR in services innovation and appropriation for the new economy proves to be a significant field of research, raising numerous important questions concerning economic theory, business management and policy practices.

2.2.2 Innovation, Imitation and Intangibility

Recent studies using the Community Innovation Survey (CIS) across a range of European countries confirm that services companies are indeed frequently innovative actors. However, the design of the survey focuses on "technological innovation". This suggests that responses are likely to be biased towards technological rather than non-technological innovations, which may understate the true extent of innovation within many service sectors.

Table 2.2-1: Significant innovations in the Danish financial services industry in the 1980s

	Organ- isational	Process	Product	Market	All types
Non-technological	94%	16%	47%	70%	54%
Not technological but dependent on technology	6%	23%	42%	30%	30%
Technological	0%	62%	11%	0%	16%

Source: Sundbo (1997)

For example, Table 2.2-1 from Danish survey work into financial services, shows that technology was only central to process innovations, and across all categories was dominated by non-technological innovation.

It is widely assumed that services are particularly prone to imitation. The notion is that innovations in their products can typically be rapidly apprehended and copied by competitors. Classic examples would extend beyond cultural innovations (such as new musical styles or even specific line-ups – the boy and girl bands of the 1990s being a case in point), to innovations in such things as meals in restaurants or home delivery services (the new pizza topping), or environmental audits (e.g. the specific indicators developed for firms or cities to assess their performance). Service industry marketing and management literature seem to take the likelihood of copying for granted. In the services innovation field, Danish case studies led Sundbo to conclude that, across a fairly wide range of firms and services, imitation was seen as a major deterrent to "do new things" (this latter formulation was employed because the term "innovation" was not really recognised in this sample; Sundbo 1993a; 1993b).

There is an implicit notion here that intangibles are easier to imitate than more tangible innovations – perhaps because of the difficulty in claiming exclusive ownership of the idea, but more probably because the new product's principles are so easily comprehended and reconstituted. Unlike the mysterious operation of a new piece of technology, here are innovations that involve (at least in the examples above) relatively simple recombination of existing elements, addition of new but hardly challenging elements, or adoption of readily explicable procedures. Are these typical of services innovation?

In the examples presented above, the main challenge to the imitator is one of developing and deploying the necessary skills: and in some cases (such as the pizza topping), there is very little need to apply specialised knowledge or to invest more than minimally in training – let alone new equipment - to produce the service. The innovation has very little technical content, in effect (historically technical content was associated with tangible, material artefacts).

But the threat of imitation is also raised in the context of much more technology-intensive services. It has been particularly prominent in the case of IT services, and in some industries supplying services through new IT media such as the World Wide Web. In such cases, imitation of design features has been a contentious issue, with "look and feel" copyright cases in the USA attracting a great deal of interest. More recently, there has been controversy around the application of new US patent rules – covering "business processes" to include innovations supporting e-commerce. Critics have argued that allowing the patenting of such basic ideas as the virtual shopping basket, or the aggregation of consumer purchase demands, could prevent the rapid development of e-commerce.

Service product innovations may be tangible. A familiar example in the literature on services is the fillings one receives at the dental surgery. Another case is the "hush-kitting" of aircraft, a commercial service enabling clients to extend the hours in

which freight aircraft can use airports, given noise regulations. So the service product innovations of physical services can quite often be intangible ones. Service process innovations are, however, much more likely to involve highly tangible technology. Consider the computer and telecommunications systems in banks, the vehicle fleets and warehouses of supermarkets, the infrastructure of airports and hotels, and so on. Process innovations in services may well involve such technologies, especially information technology, which is a pervasive technology in services innovation (for evidence from German survey data, see Licht et al. 1997). Not surprisingly, then, large and IT-intensive service firms do often patent their innovations (examples in the UK include BT and Reuters).

In this context, we should make it clear that this report will not be focusing, in the main, on the issue of *copying*, in the sense of the unauthorised reproduction of information content. This is an important issue, and one to which copyright regulations are particularly germane. New IT makes it easy to reproduce and distribute electronically encoded products such as "content" and "dataware" (recorded music, private e-mails – and even an unauthorised German-language translation of the fourth *Harry Potter* book¹⁹). Other important electronically encoded products are "codes" and "software" (widespread piracy of computer software is reported by most large producers, both on the part of commercial pirates – "burning" illicit CD-ROMS in bulk in poorly regulated countries – and on the part of users – e.g. large user companies attempting to cut costs by purchasing only a few discs or licenses compared to the number of their staff actually deploying the software). Such copying may deter innovation, by reducing the market for one's official product. Copiers and their clients may be appropriating, or eroding, the value associated with one's product. However, at the risk of simplification, we can say that they are only doing so by a form of theft, even if this theft does not deprive anyone else of the actual product – even if its commercial value is being reduced.²⁰ Imitation involves more than copying, though it may come fairly close in some cases. For example, the reverse engineering of rules and procedures may lead to the generation of a piece of software with no lines of code in common with the original, but where every step and nuance has been faithfully followed or reworked in a different computer lan-

19 Tired of waiting for the official publication, fans of the series released their own version on the Internet. Action by the publisher to prevent this merely led to a number of "mirror sites" offering access to the content. This problem of returning the genie to the bottle has been encountered in a whole series of circumstances where commercial interests or public bodies have sought to restrict access to material.

20 Simplifications abound here. It is quite plausible that in some commonplace circumstances, illicit copying actually helps extend the market for the bona-fide product. An employee making unauthorised "own time" use of an illicit copy of software may become sufficiently convinced of its utility to persuade the company to invest in a site license; a music fan enjoying an MP3 track downloaded from Napster may wish to purchase the CD containing that track and others, together with sleeve notes and the advantage of portability across equipment. Producers, of course, would like to retain control over such demonstration processes, but this does not mean that the outcomes are necessarily negative.

guage, or by means of deploying other standard methods of achieving the same results. While such instances involve considerably more work than just running off a copy of the original code, they are much more akin to copying than the sort of imitation that aims simply to achieve similar end results, without doing more than guessing the ways in which these results might have been achieved.

As the above discussion will have suggested, the questions of copying and imitation are extremely "hot" ones in those services whose functions are most closely connected with information processing. Computer services, multimedia services, and services associated with cultural industrials (including publishing and broadcasting) are all heavily involved in debates and court actions here. And, as we shall see, there is some evidence that these are services whose managers, at least, are aware of an impact upon their innovative efforts from this climate. However, this strongly perceived impact does not seem to be marked across all services. Or even most services, despite the received wisdom on this topic.

Two large-scale surveys of services innovation provide empirical evidence on this theme.²¹ In a German study, there is opportunity to directly compare services and manufacturing in terms of perceived barriers to innovation, (Licht et al. 1997, 75-78). "Ease of Imitation" is among those barriers listed. Strikingly, the service firms in this survey on average saw ease of imitation as a barrier less often than manufacturing firms. Around 35% of service firms cited this barrier, as opposed to around 45% of manufacturing firms. There were no obvious differences between large and small firms in respect of this problem.

This is a survey which points in the direction indicated above, suggesting that IT services might be more conscious of problems here. The software sector was found to be more like manufacturing in respect of ease of imitation.²² Over 40% of the software firms sampled do see this as a barrier (software appears to be closer to manufacturing than do most other services in several other respects, too).

An Italian survey points in a similar direction, with respect to services in general **not** being more strongly concerned with innovation than manufacturing. In this survey, direct comparisons are limited on this theme, since the questions varied slightly between the service and manufacturing questionnaires (Sirilli and Evangelista 1998). The manufacturing firms were presented with a list of fifteen factors which might hamper innovation. Among these, "risk of imitation by competitors" ranked fifth. Service firms were asked about how important various factors were as barri-

21 It is likely that a further swathe of evidence will be forthcoming from the recent round of CIS surveys.

22 We wonder whether in these surveys respondents are differentiating between imitation and copying. There is little reason to think that they will be motivated to do so.

ers. The risk of imitation received fewest endorsements as being "very important", with just 2.2% of the sample citing it.²³

The two large-scale surveys of firms in major European economies have thus explicitly addressed the issue of whether service firms feel that innovation is deterred by the ease of imitation in their activities. The results suggest that the conventional wisdom – that services feel the threat of imitation most acutely – is not as self-evident as would be expected. Is the issue that services' innovations are no more – even less – vulnerable to imitation than (purportedly) more tangible manufacturing innovations? There does not seem to be clear evidence reported in the survey studies concerning the link between the threat of imitation and actual reported innovation rates – a theme deserving closer analysis – but the general evidence concerning levels of innovation in services and manufacturing does not strongly suggest that the services are being widely deterred from innovating.²⁴ Other lines of explanation may lie in different approaches and strategies to IP across different firms and sectors.

2.2.3 Services and Intellectual Property: Patterns and Trends

The fact that some services do engage in patenting, and in protection of their IP through copyrights and other mechanisms, indicates that at least some of the firms here do see such mechanisms as relevant for dealing with imitation and copying. Unpublished results based upon the Confederation of British Industry (CBI) Innovation Survey in the UK (the 1999 version of the annual survey – data analysis supplied to us by Mark Tomlinson) provide one interesting source of cross-sectoral comparisons.²⁵ In this analysis, three IPR instruments – patents, trademarks and copyrights, were contrasted among a sample of innovative firms (not a representative sample of the UK economy). The results are highly aggregated, but very interesting: see Table 2.2-2.

The tendency for Services (S) to patent less often than Non-Services (NS) (but not to be completely absent from the patenting scene) is apparent. Only 20% of service firms are here reported as patenting, against almost half of the non-services. But 6% are highly involved in patenting. Services seem to be less inclined to see patents as

23 Both the German and Italian surveys found high variation across different service branches in terms of rates of innovation; and confirmed the familiar result that larger firms and establishments are more likely to report innovations than smaller ones.

24 We should add, however that (a) there may be differences in the level of innovation which the simple survey instruments do not capture; and, (b) that the high rates of innovation reported in software may be suggestive of the possibility that the most innovative sectors feel the threat of imitation most strongly.

25 For published accounts of this survey and the analyses of innovation trends from it – demonstrating the high levels of innovation in KIBS, for example, see Coombs and Tomlinson (1998).

becoming more important. There is little difference between the two sectors in the taking out of trademarks. And in the case of copyrighting, rather more services report not making use of new copyrights, which comes as something of a surprise, since this would be expected to be an alternative means of protecting innovations. However, we must note (a) there is no mandatory requirement to register copyrights and (b) copyrights are, as noted earlier, not necessarily about technical innovations.

Table 2.2-2: IP strategies in innovative UK companies: 1998

Number of items filed:	Patents*		Trademarks*		Copyrights*	
	S	NS	S	NS	S	NS
<i>None</i>	80	55	64	64	74	80
<i>1</i>	4	8	10	5	2	2
<i>2 – 5</i>	8	24	16	24	12	9
<i>6 – 10</i>	2	4	6	2	9	2
<i>10+</i>	6	8	4	5	4	6
More important than last year?	15	23	17	13	15	7

* Proportions of companies in Services (S) and Non-Services (NS)

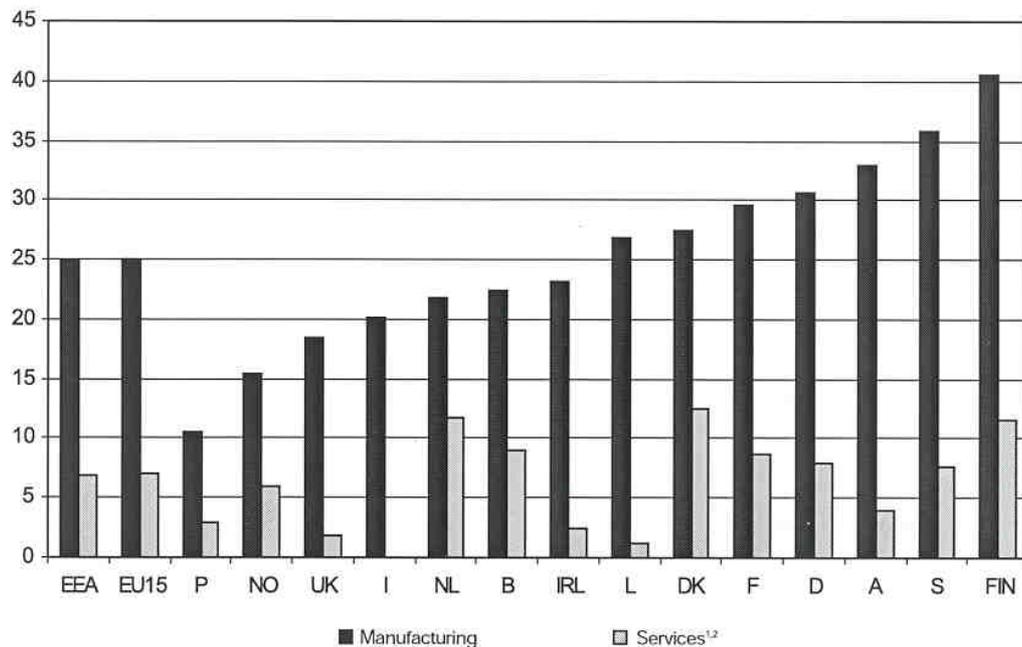
Tomlinson also reports that all sorts of IPR strategy are more likely to be pursued, and pursued more intensively, by larger firms. Regression analysis suggests further that the types of strategy used to obtain knowledge are related to IPR strategies, as follows:

- The likelihood of patenting is greater for firms who use other companies and public research institutions as collaborators. Financing innovation through alliances and joint ventures also increase the likelihood of patenting (these seem to be strongly associated with government and EU research support).
- Linkages with higher education, in contrast, are important for both patenting and copyrights.
- Trademarks and copyrights are more likely for firms that make use of consultants and professional links as sources of knowledge for innovation. The sorts of alliance noted in the first bullet point have little relation to these IP strategies.

A more representative sample of firms is provided in the Second Community Innovation Survey, but the results are restricted to the use of patents. It turns out that

only 7% of the innovating service companies have applied for at least one patent.²⁶ In the manufacturing sector the share of innovators with patent applications is one quarter and therefore more than three times as high as in the service sector. Danish, Dutch and Finnish innovators rank as the first three countries with shares over 10%, while in the United Kingdom less than 4% of service firms have applied for patents (Figure 2.2-1).

Figure 2.2-1: Number of innovators having applied for at least one patent as a share of innovators by country, 1996



1: Spain and Italy are not included in the service sector

2: Wholesale sector is not included

Source : CIS2, Eurostat / Enterprise DG

Source: Eurostat 2000, p. 39

Furthermore, we can report more detailed results of an analysis of the UK survey.²⁷ Amongst the service sectors in the UK, this proportion was highest for technical services (15%), and lowest for financial services (2%). These results confirm the widespread view that patents are of little relevance to (technological) innovation activities within services. And indeed, the CIS confirms that patenting is far more common in manufacturing than services. Nevertheless, only a quarter of all innovating manufacturers in the UK sample had applied for patents between 1994 and

²⁶ Compare Eurostat (2000), p. 39. Recent results of the Third Community Innovation Survey show no significant changes regarding Germany. See also Section 4.3.2.

²⁷ Cf. Tether et al. (1999).

1996. This proportion too, varied widely between sectors, being lowest (at 5%) amongst publishing firms, and highest (at 38%) amongst chemicals firms.

Additionally, an analysis of the sources of information used by the firms for their innovative activities, amongst which patents are included, showed that patents are an important source of information only to a minority of innovators in both services and manufacturing. The IP questions in these surveys were a minor part of the study. There have been a number of studies in recent years focusing more substantially on IP issues. In the UK, a research programme entitled the 'Intellectual Property Initiative' generated a number of relevant studies, including one that focused on KIBS.

Miles et al. (2000) describe results from this survey of a small sample of firms (150 firms in total). Despite this limitation, it highlighted the diversity of protection methods across different sorts of KIBS, and the importance of contractual and "informal" mechanisms. The three KIBS studied were accountancy (ACC), architecture (ARC) and environmental engineering (EE), chosen because of their different relations to technology. EE is undoubtedly in large part a KIBS supplying technological knowledge; ACC is mainly concerned with processing and organising organisational data in standard administrative categories (extensively employing IT in this process nowadays, but still with very limited scope to innovate in the types of product generated); and ARC combines knowledge of materials and building regulations with creative flair and aesthetic sensibility. The study examined their core products, not supplementary services such as management consultancy which they might offer. Fifty firms from each KIBS sector were asked about the mechanisms they used to protect the knowledge inputs/core competencies embodied in their *key* business activities.²⁸ Striking differences are apparent among sectors.

Among these three KIBS, only EE used patents at all - over a third of the respondents in this sector report using patents at least sometimes for protecting their knowledge, and two-thirds of those with more than 50 employees do so (Table 2.2-3). Even for EE, patenting was much less important as a tool for protecting valued knowledge than certain others. Thus, even EE reported more recourse to copyright than to patenting. ARC almost universally use the copyright mechanism, while ACC use copyright much less frequently. The core service of both ARC and ACC is generally embodied in a document, but in the case of the former this includes creative inputs which may be appropriated by others to undertake competitive bids or to use in other circumstances, while the reports produced by ACC services for their

²⁸ A list of eleven mechanisms was provided: Copyright, Design rights, Patents, Trademark or Company name, Agreements with partners/collaborating companies, Agreements with suppliers or end-users, Working with trusted partners, Internal Working Practices, Maintaining a lead-time advantage over other competitors, Embodying knowledge in equipment, software etc., Membership of professional associations.

clients are highly client-specific – copying them is unlikely to be a competitive tool among ACC firms, though there can be important confidentiality issues involved.

Table 2.2-3: Use of methods to protect knowledge

Level of use of method	IPR method*			
	Copyright	Design rights	Patents	Trademark/ company name
		<i>Accountants, 1-14 employees</i>		
<i>Sometimes</i>	10.0	0.0	0.0	30.0
<i>Never</i>	90.0	100.0	100.0	70.0
		<i>Accountants, 15 + employees</i>		
<i>Always</i>	0.0	0.0	0.0	12.8
<i>Sometimes</i>	5.1	0.0	0.0	20.5
<i>Never</i>	94.9	100.0	100.0	66.7
		<i>Architects, 1-14 employees</i>		
<i>Always</i>	65.4	30.8	0.0	26.9
<i>Sometimes</i>	26.9	34.6	0.0	19.2
<i>Never</i>	7.7	34.6	100.0	53.8
		<i>Architects, 15 + employees</i>		
<i>Always</i>	68.0	40.0	0.0	36.0
<i>Sometimes</i>	28.0	36.0	0.0	8.0
<i>Never</i>	4.0	24.0	100.0	56.0
		Env. Engineers	<i>1-14 employees</i>	
<i>Always</i>	7.1	0.0	7.1	14.3
<i>Sometimes</i>	21.4	14.3	42.9	28.6
<i>Never</i>	71.4	85.7	50.0	57.1
		<i>Env. Engineers</i>	<i>15 + employees</i>	
<i>Always</i>	21.9	12.5	6.3	25.0
<i>Sometimes</i>	34.4	43.8	28.1	50.0
<i>Never</i>	43.8	43.8	65.6	25.0

continued

Source: Miles, Andersen, Boden, Howell (2000)

Table 2.2-3: Use of Methods to Protect Knowledge (Continued)

Level of use of method	IPR method ²⁹						
	Agree-ments with partners	Agree-ments with suppliers/end user	Work with trusted partners	Internal working practices	Lead-time advantage	Embody-ing knowl-edge in products	Member-ship of prof. assocns.
			ACC	<i>1-14</i>	<i>Employees</i>		
<i>always</i>	11.1	0.0	44.4	20.0	10.0	30.0	30.0
<i>sometimes</i>	33.3	33.3	11.1	70.0	40.0	40.0	70.0
<i>never</i>	55.6	66.7	44.4	10.0	50.0	30.0	0.0
			ACC	<i>15+</i>	<i>Employees</i>		
<i>always</i>	12.8	2.6	33.3	48.7	10.3	23.1	64.1
<i>sometimes</i>	38.5	48.7	53.8	46.2	46.2	48.7	33.3
<i>never</i>	48.7	48.7	12.8	5.1	43.6	28.2	2.6
			ARC	<i>1-14</i>	<i>Employees</i>		
<i>always</i>	3.8	3.8	19.2	11.5	3.8	19.2	61.5
<i>sometimes</i>	57.7	30.8	53.8	50.0	23.1	26.9	23.1
<i>never</i>	38.5	65.4	26.9	38.5	73.1	53.8	15.4
			ARC	<i>15+</i>	<i>Employees</i>		
<i>always</i>	16.0	4.0	16.0	44.0	4.0	20.0	56.0
<i>sometimes</i>	52.0	56.0	64.0	28.0	52.0	40.0	20.0
<i>never</i>	32.0	40.0	20.0	28.0	44.0	40.0	24.0
			EE	<i>1-14</i>	<i>Employees</i>		
<i>always</i>	35.7	7.1	35.7	35.7	28.6	28.6	7.1
<i>sometimes</i>	42.9	64.3	42.9	14.3	35.7	35.7	7.1
<i>never</i>	21.4	28.6	21.4	50.0	35.7	35.7	85.7
			EE	<i>15+</i>	<i>Employees</i>		
<i>always</i>	21.9	25.0	28.1	28.1	18.8	18.8	15.6
<i>sometimes</i>	68.8	65.6	65.6	50.0	53.1	59.4	53.1
<i>never</i>	9.4	9.4	6.3	21.9	28.1	21.9	31.3

29 In response to the question: "Which of the following mechanisms are used to protect the knowledge inputs/core competencies embodied in your key business activities?" (percentage of each size group responding to items).

ARC have a strong emphasis on copyright, and place this instrument at the top of the list. This is unusual prominence for an IPR method. For ARC, it is closely followed by membership of professional associations (partly an entry barrier, partly a system of accreditation, partly a means of sharing knowledge resources and contacts). This is an important approach for ACC too, coming top for the larger establishments. In contrast, EE, which has not yet forged a strong professional identity, has little recourse to this tool (though some professional associations in related fields may be helpful, perhaps especially for individual service professionals).

Direct social relationships with staff, partners, suppliers and clients are particularly important in protecting knowledge (consider the data concerning means of protection that are "always" used). These may be informal relationships, or formally governed by employee law or by contractual arrangements between collaborating or trading firms. Working with trusted partners is most commonly cited as "always" being used by smaller ACC establishments, and is also among the most often cited approaches by EE firms. Indeed, trust may well be necessary not only for the protection of knowledge, but also for its successful transfer between the producer and consumer.³⁰ Internal working practices are, not surprisingly, a concern for larger KIBS of all types – the threat of losing knowledge embodied in key members of staff becomes increasingly important (and increasingly deliberately managed) in larger bodies – though it is among the most common methods of smaller EE firms too.

In general, those approaches which are most often cited as being "always" used are least often cited as being "never" used. But one interesting feature does emerge from the cases where this is not so. In particular, it seems that EE firms are quite divided about the methods that are "never" employed. This suggests that this KIBS sector may be more internally diverse, in the types of product supplied, than the others considered here. Reflection suggests that this is correct, with the services provided ranging from paper-based reports through software to actual physical operations.

2.2.4 Protecting Intellectual Property: IPR Compared to Other Forms of Protection Strategy

Whereas for many manufacturing firms - notably pharmaceuticals - patenting is a standard mode of IP protection, for some manufacturing and especially for most service firms the issue is not simply one of *whether* to patent or not in order to protect innovations and the knowledge behind them. Since - as we have seen – especially service firms are much less prone to using patents, for them the issue is rather *which* is the *most appropriate* system for protection of their knowledge - patent,

³⁰ Cf. Roberts (2000).

copyright, design right, or even trademark protection – or methods that step outside of the IPR system (see below). In some cases, they may need to determine which *combination* of IPR protection is most appropriate. In most cases the decisions will be made with highly imperfect knowledge and limited resources to invest in acquiring the relevant information.

The IPR strategies for innovative service firms can be linked to the wider development of the strategic assets or core competencies (Winter 1987; Prahalad and Hamel 1990) of such firms. Andersen and Howells (2000) argue that IPR strategies for service firms are different, and more complex, than for manufacturing companies, 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).
- IPR in services is not only weaker, but is also much harder to monitor and enforce than for manufacturing systems.³¹
- Although the copyright system historically goes back a long way (in terms of published works), as applied to innovative activity its history is much more recent, less developed and, most importantly here, less well defined than for the patent system. In the US, even partially effective cover for software programmes 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 was the Copyright (Computer Software) Amendment Act of 1985 (soon followed by the Copyright, Designs and Patent Act 1988).

This complex system may be met by a complex response on the part of innovating service firms – a use of multiple IPR instruments - or the challenges may be so daunting as to make real strategic activity more or less non-existent. It may be argued that innovative service companies have grown up with a regime that has not protected their creations and innovations properly. Innovative service firms are arguably more likely to be driven to strategies other than the use of formal IP mechanisms and instruments to protect IP and their core knowledge. These informal protection mechanisms include (see Howells 1997):

- *Secrecy*. (cf. Taylor and Silberston, 1973, 296 on this and ‘secret know-how’). Key knowledge can simply be kept confidential: a major element of this strategy

³¹ Andersen et al. (2000) address this issue with respect to the generation and capture of rent from IPR in the music industry and for the electronic age in general (Andersen 2003). See also Howells (2000a) for computer software.

involves preventing *employees* from giving away valued knowledge. For example, one large accountancy/consultancy firm pursues a sophisticated policy of restricting the information to which employees involved in major projects have access, so as to ensure that none can walk off with the set of capabilities required to offer a competitive challenge to the firm. In some sorts of firm, the issue arises concerning the leakage of secrets to and from collaborators, suppliers and clients, and more or less formal means may be put in place to govern the use of such knowledge. Overemphasis on secrecy may result in limiting the amount of collaboration the firm can engage in, and restricting its "know-how" trading. How far and how long secrecy can be sustained is questionable. When the existence of secret knowledge is suspected by competitors, it is liable to be the focus of their own research efforts, using clues gleaned from product offerings, recruitment practices, and so on, as well as from attention to industry gossip and perhaps poaching of staff. One advantage that service firms reliant on the copyright system have 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) and thus 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.

- *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. However, short lead times impose considerable costs on the firm and more especially means that innovation costs have to be amortised over very short periods. Nevertheless, this strategy is widely used in IT services – for example the telematics firms studied by Thomas and Miles (1989). A perhaps extreme example is the software industry, where innovation cycles are often less than six months.
- *Making intangible products more tangible.* This is a strategy employed by many services, and not just for IP protection. Adding tangible elements to intangible services can help increase the demonstrability of the service, or build client loyalty. But it is also relevant to IP. The view that IP protection was weak for software led, in the 1980s to many firms protecting their software by embedding it in microchips, coining the phrase 'firmware' or more formally "embedded microelectronics software." There are a 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) – it is not tangible enough! In the software field, the

threat of piracy, and of copying by users (running off many copies of a program to disseminate within an organisation) has been a major driver for such strategies, and for efforts to intensify policing of copyright law. One other approach, that relates to the "lock-in" discussion below, is to bundle the software package with something else that is hard-to-reproduce. Examples include: glossy user manuals; special discs or "dongles" that have to be available for the program to run; secret passwords and codes, regularly changed, for the use of licensed users only; and customer helplines that check user status before providing support.

- *"Lock-in"*. There is a range of strategies employed here. The service supplier may offer sets of related services that offer most value to the client who uses several of these from the same supplier. Lock-in may be through the use of specific standards and protocols, again in the case of software and IT services, which reduce user learning time and allow easy interoperability of products. International service providers may achieve client lock-in through the guarantee of a consistently high quality service in all their client's overseas locations. Other techniques include customer loyalty cards (as employed by organisations ranging from supermarkets to airlines) – which are also an instance of providing a tangible element to an intangible service.
- *Entry barriers*. Again these take various forms, but one which is visible in many professional services – and some personal services, such as complementary and alternative medicine – is to institute professional qualifications and accreditation systems. This may not prevent competition from other people in one's profession, but it can limit the scope for outsiders to move in. Further examples of barriers to entry include assets such as extensive international networks for multinational service providers and more generally the establishment and maintenance of reputation.

Moreover, the above strategies need not be independent of each other and we may consider a final approach adopted by firms, namely:

- *'Ensemble' Protection*. This could even be distinguished as a distinct strategy, in which firms protect their innovations through an ensemble of IPR methods, including copyright, patenting and trademark legislation, as well as less formal approaches. However, many companies view certain types of IPR with scepticism (often based on past experience) and exclude these from their strategic repertoire for intellectual asset protection. 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. Formal IPR methods, and the systems erected around them, thus interact with other modes of securing the rewards of innovativeness – and they may well also play a role in *shaping* sectoral systems of innovation. If the IPR protection system in services is weak, inappropriate or unenforceable this may have produced a dampening effect on innovative activity in services because of lack of appropriability – or in contrast led to even more innovation and shorter innovation cycles in order to stay ahead of the competition.

A rather different framework for considering IPR strategies was proposed, on the basis of their empirical study of SME innovations, by Blackburn and Kitching (1998) (see Table 2.2-4). They classify protection methods on a continuum varying in terms of the legal formality and complexity of the instruments used. At one extreme SMEs may "do nothing" in the way of consciously undertaking practices *specifically* aimed at avoiding the stealing or misuse of their intellectual property. Somewhat more deliberate strategies involve informal protection practices; active networking with organisations who aid protection of intellectual property; and contractual regulation. The acquisition of registrable intellectual property rights is thus at one extreme of a spectrum of practices. Blackburn and Kitching demonstrate that it is an end of the spectrum which few SMEs occupy.

A shift along the continuum to the right was found to occur under specific circumstances, where:

- high commercial benefits are anticipated from innovation/creativity;
- formal rights (are believed to) offer better protection than do informal methods;
- SMEs possess the resources needed to acquire formal rights. (Thus, larger firms were more likely to adopt this strategy.)

Interestingly, their study of SMEs also included a sample of service firms. Table 2.2-5 presents some of the headline findings, with services (software and design) and non-service (electronics, mechanical engineering) contrasted. The results complement those of Miles et al. (2000) in several ways:

- The objects of intellectual property takes different forms (reports, software, engineering drawings, designs, manufacturing techniques, etc.) These vary across the sectors studied.
- Different types of IP are associated with particular products and businesses. And are typically subject to different formal protection practices – and thus different instruments are more pertinent in particular sectors.
- In this study the service firms were likely to use some formal IPR instruments (licensing and trade marks in the case of software, copyright and design rights – unregistered! – in the case of design), but not others – especially patents. Contracts were important in all sectors.

These authors concluded that the relatively low take-up of formal rights seems to have little adverse impact upon SMEs' innovation. (A small minority of respondents reported that the law had had a *positive* effect on their product development - though these tended to be the most innovative enterprises.) Factors such as the availability of resources for investment were seen as greater influences on innovation.

Table 2.2-4: A continuum of intellectual property protection practices

<i>Type of practice</i>	Do nothing	Informal protection practices	Active networking practices	Contracts	Acquisition of registrable intellectual property rights
<i>Examples</i>	No deliberate strategy to protect intellectual property	Develop high trust relations with customers, suppliers & employees; maintain lead time advantage over competitors; build specialist know-how into products.	Member/user of an organisation which seeks to protect intellectual property	Confidentiality clauses & restrictive covenants in customer, supplier & employment contracts; prominent copyright notices; licensing.	Patents, registered design, registered trade & service marks
Increasing legal formality → →					
Source: Blackburn and Kitching (1998)					

The Miles and Blackburn studies confirm that, 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 formal IPR regimes and low levels of innovative activity; other service sectors, as we have seen, may have an increased propensity to use formal IPR mechanisms such as copyright and especially trademarks rather than patent protection; other segments may use few formal IPR protection mechanisms or none at all, but may still have relatively high levels of innovative activity. Perhaps it is this diversity of experience that underlies the relative lack of concern with imitation revealed in the survey studies reviewed above. Many of these issues can only be successfully understood by examining all aspects of the use of IPR and the management of intellectual assets more generally, and by positioning such analysis within the wider IPR regime for services.

Table 2.2-5: Most frequently reported formal IP protection methods by sector

Computer software	Prominent copyright notices (83.3%) Licensing (80.8%) Confidentiality clauses in customer & supplier contracts (74.4%) Confidentiality clauses in employment contracts (70.5%) Trade or service marks (53.8%)
Design	Confidentiality clauses in employment contracts (73.4%) Confidentiality clauses in customer & supplier contracts (70.9%) Prominent copyright notices (67.1%) Unregistered design/design right (49.4%) Restricted publication (39.2%)
Electronics	Confidentiality clauses in customer & supplier contracts (59.5%) Confidentiality clauses in employment contracts (55.4%) Prominent copyright notices (43.2%) Trade or service marks (41.9%) Patents (39.2%)
Mechanical engineering	Confidentiality clauses in customer & supplier contracts (31.5%) Confidentiality clauses in employment contracts (25.9%) Patents (24.1%) Restricted publication (20.4%) Trade or service marks (18.5%)
Note: The five most frequently reported formal practices adopted are reported. Only includes those respondents who regard their products, services or methods of working to be dependent on specialist or confidential knowledge. N=284	
Source: telephone survey, reported in Blackburn and Kitching (1998)	

2.3 Conclusion

Innovation activities of service companies have received more and more attention during the last decade. Our review has shown that in the context of these innovation activities, IPR are playing an increasing role for service companies. Moreover, the distinctive features of the service sector in general - such as intangibility, client-intensity, dense regulation, high IT-intensity and less structured innovation activities - mean that IPR in services has taken on different shapes and functions as compared to IPR in the manufacturing sectors. This is especially true in relation to sectors based upon new Information Technology, such as audio-visual and software services, as well as some more or less technology-based KIBS such as architecture and design engineering. It is plausible that as computer-assisted systems will be further developed and diffused to cover more traditional professional services (law, accountancy etc.) that more products will need to be protected by IPR. What we see at present is a complex articulation of strategies to protect and apply knowledge that is competitively significant - ranging from intra-organisational arrangements (e.g. parcelling out knowledge resources on a "need to know" principle), through employment and trade secrets regulations (restricting staff members from working for competitors), contracts with, or informal lock-in of, business partners, and efforts to attain IPR protection by registration, and checking for misuse.

Based on this discussion of these general features of services and IPR, the next chapter develops a conceptual paradigm and framework of knowledge regimes, which provides the ground for some hypotheses about the use of IPR in service companies. These hypotheses will be tested based on the collected information in the 65 case studies.

3. Knowledge Regimes, Appropriability and Intellectual Property Protection: A Conceptual Framework for Services

Jeremy Howells. Knut Blind, Jakob Edler, Rinaldo Evangelista

3.1 Introduction

Traditionally, services were seen as being passive, non-innovative sectors which had little interest or involvement with the issue of appropriability and intellectual property rights (IPR), with the exception of artistic and text-based rights. For example, in the past the software firms were seen as not being able to appropriate much of the benefit of innovation because of weak IPR regimes (Merges 1996, 272). This chapter seeks to provide a conceptual framework of what is termed here 'knowledge regimes' within the service sector. It then goes on to link this with how service firms, within each of the regimes identified, will seek to use intellectual property rights to appropriate and defend their intellectual property.

This is a difficult task. As noted throughout this report, the service sector is a very heterogeneous segment of the economy. Service firms operating in different sectors of the service economy face very different knowledge, appropriation and intellectual property (IP) regimes. Thus incompleteness of the intellectual property institutional framework in turn strongly influences contractual practices (see, for example, Anton and Yao 1994; Arora 1995). Moreover, as will be stressed later on in this analysis, most service firms will seek to resort to *informal* IP protection mechanisms, *if* they use them at all.

The next section (Section 3.2) discusses the two key dimensions used in the typology of knowledge regimes used here, relating respectively to knowledge types and the level of tangibility of the service output. The following section then outlines the conceptual model in detail (Section 3.3). It is stressed that the framework outlined in this chapter is a simple, a priori (ex ante) model of knowledge regimes regarding intellectual property protection. It is then tested against the data collected from the pan-European survey of service firms. The empirical test of this approach and the respective conclusions are presented in Section 4.3.3 of this report.

3.2 Knowledge and Intangibility

3.2.1 Knowledge

As noted above, this study uses two key dimensions to discuss and conceptualise the issue of knowledge and appropriability in services, namely: knowledge and the degree of tangibility. Before the model itself is presented and discussed, how do we define both knowledge and tangibility? These two concepts will now be explored in turn.

Knowledge can be defined as a dynamic framework or structure from which information can be stored, processed and understood. Knowledge, therefore, is two-way and has a relational characteristic, involving a ‘knowing self’ and an event or an entity (Plotkin 1994, 40). Knowledge also requires a memory; an enduring brain state that must exist to allow the bridging of the time gap between events that have occurred and any claim to know about them (although memory about events in the past in turn undergoes change and therefore forms an unconscious, altering form of knowing; Plotkin 1994, 8). Above all, knowing is an active process that is mediated, situated, provisional, pragmatic and contested (Blackler 1995).

Knowledge is therefore associated with a process that involves cognitive structures which can assimilate information and put it into a wider context, allowing actions to be undertaken from it. Thus knowledge in turn combines the process of learning (Polanyi 1958, 369). The take-up of learned behaviour and procedures is a critical element within knowledge acquisition, both in terms of capturing and transferring it from the individual to the organisational level (Kim 1993), but also in more widely diffusing such competence throughout the whole organisation (Ulrich and von Glinow 1993). To be able to innovate, invent and discover, involves both using existing knowledge, but often also requires generating and acquiring new knowledge and this centrally involves learning. Innovation also involves sharing learned knowledge. This mutual exchange of knowledge and shared learning means that knowledge is intrinsically a socially constructed process (Berger and Luckmann 1966).

There have been various attempts to identify and classify different types of knowledge, but an early and seminal distinction has been made by Michael Polanyi (1958; 1961; 1962; 1966; 1967) who distinguished between explicit (or codified) knowledge and tacit knowledge. The difference between these two broad types of knowledge are linked to the degree of formalisation and the requirement of physical presence in knowledge formation. Explicit or codified knowledge involves know-how that is transmittable in formal, systematic language and does not require direct experience of the knowledge that is being acquired and it can be transferred in such

formats as a blueprint or operating manual.³² By contrast, tacit knowledge cannot be communicated in any direct or codified way. Tacit knowledge concerns direct experience that is not codifiable via artefacts. As such, it represents disembodied know-how that is acquired via the informal take-up of learned behaviour and procedures. Indeed, some tacit knowing is associated with learning without awareness; a process termed as ‘subception’ by Polanyi (1966). However, more formal learning mechanisms also play an important role here with ‘learning by doing’ (Arrow 1962), ‘learning by using’ (Rosenberg 1982) and ‘learning to learn’ (Ellis 1965; Estes 1970; Argyris and Schon 1978; Stigilitz 1987) all being seen as critical elements within tacit knowledge acquisition. Tacit knowledge can also be associated with scientific intuition (see, for example, Ziman 1978, 103) and the development of craft knowledge within scientific disciplines (Delamont and Atkinson 2001) and is ‘sticky’ and often difficult to transfer (von Hippel 1987; 1990; 1994).

Elsewhere, Polanyi (1962) sums up tacit knowing as an act of ‘indwelling’, the process of assimilating to ourselves things from outside. It also involves, though, more innate values as well, such as skills. In addition, it is generally accepted that tacit know-how cannot be directly or easily transmitted, as knowledge and task performance are individual and specific and involves the acquirer making changes to existing behaviour. However, the degree of tacitness does vary (Howells 1996; 2002). Within the range of tacit knowledge itself, the less explicit and codified the tacit know-how is, the more difficult it is for individuals and firms to assimilate it (Cohen and Levinthal 1990, 135; see also Nelson and Winter 1982). More specifically within the context of services, it is this more difficult to assimilate type of knowledge, tacit knowledge, which plays such a prominent role in relationships with clients and suppliers and in the innovation process itself (Chapter 2).

The above discussion about knowledge is important to acknowledge because the proposed knowledge regime model (as a simplification or approximation of reality; Spector, 1965) departs from these descriptions in two ways. Firstly, the knowledge regime model that is presented below makes a simple distinction between codified or explicit knowledge and tacit knowledge. It is acknowledged that this is creating a crude bi-polar dichotomy between codified and tacit knowledge, and that Polanyi himself was at pains to stress that explicit and tacit knowledge were not divided, but should rather be seen as a continuum between wholly explicit knowledge and a wholly tacit form of knowledge.

Secondly, in the operationalisation of the model we use the word knowledge not in its true form outlined above of that which can only reside in and be held by an indi-

³² What Polanyi (1958, 69-131) originally described as ‘articulated’ knowing; although articulation and explicitness are not directly equivalent.

vidual³³, but rather use the term in a more generalised (and arguably subverted sense) as a phenomenon that can essentially reside outside the individual. This proto 'knowledge' is therefore more like a high level form of information which can be more readily taken up in the form of codified knowledge (or not so readily absorbed as a less formal, articulatable form of knowledge, tacit knowledge). Both these aspects of the model are discussed in more detail in Section 3.3.2.

3.2.2 Intangibility and Appropriability

The discussion so far has focused on the issue of knowledge, but associated with this is the issue of tangibility and intangibility. This is arguably a simpler and less problematic concept. Basically, intangibility is anything that cannot be seen or touched. However, the definition and classification of intangible activities, products and assets is generally applied in the negative sense in the first instance, i.e. it is anything that cannot be classified as tangible in nature. Indeed, the fact that service activities involved intangible outputs was an important factor in initial attempts to define and classify services (Greenfield 1966, 8-9). Most of the attention on intangibles has been on intangible investments rather than more general issues associated with intangible activity within services, but whatever aspect of intangibility is considered, measurement problems remain (den Hertog et al. 1997, 34-35).

More importantly here, although services are associated with intangible outputs (and investments), they often involve very close relationships with tangible goods, artefacts and investments in the production and delivery of those services, such as transport or telecommunication services. This dimension is important to acknowledge in the knowledge and intellectual property regime of services, as the level of tangibility is linked to the issue of appropriability. The regime of appropriability governs an innovator's ability to capture profits generated by an innovation. The most important dimensions of such regimes are the nature of the technology and the strength of the legal mechanisms of protection (see Teece 1986). In the case of private goods, neo-classical economic theory has generally assumed regimes of 'tight' appropriability (and indeed zero transaction costs). Conversely, though, in the case of public goods, through intended and un-intended spillovers, appropriability is low or in some cases assumed to be near to zero.

Tangible, embodied 'knowledge' has been seen as being more appropriable than intangible, dis-embodied 'knowledge' (Geroski 1995). Thus, it has been generally acknowledged that it is harder to appropriate intangible innovations using formal IPR mechanisms. By contrast, IPR in general and patents in particular, have been much better at defining and protecting tangible attributes. This may not hold in all

³³ Ancori et al. (2000, 257), though, would argue that this is taking an "absolutist position on tacit knowledge".

cases, particularly in an informal sense, though, as tacit, intangible activities may be very difficult to actually copy because:

- a) the potential copier may not know what the key 'essence' is, i.e. of value and therefore worthy copying; and,
- b) even once identified, the innovation may be difficult to copy because it involves a series of intangible distributed agents; assets which are difficult to bring together to reproduce that quality or essence.

Indeed this paradox of the properties of tacitness and intangibility making it difficult to protect innovations by formal IPR mechanisms, but also the very same attributes making it difficult to copy has been recognised by Geroski (1995, 93) who noted that knowledge transfers were rarely costless, making appropriability less easy than usually observed under these conditions.

3.3 Service Knowledge and Intellectual Property Regimes

3.3.1 The Knowledge and Intellectual Property Regime Model of Services

On the basis of the discussion, definitions and classifications noted above, Figure 3.3-1 therefore seeks to provide a simple typology of intellectual property regimes by knowledge type (codified or tacit) and whether the service is associated with tangible or intangible goods. This produces a simple 2x2 matrix and therefore four hypotheses, which is examined in detail below.

Hypothesis 1:

With services associated with more codified forms of ‘knowledge’ and working with tangible outputs and goods, the intellectual property mechanisms to protect such property would be most suited the patent system (Cell 1). This would cover services directly using and helping to run and construct capital goods and buildings (such as trains or logistical services, construction or technical engineering services). Here information associated with this knowledge regime is explicit, codifiable and (ostensibly) transmittable without bias between individuals. The tangible nature of the outputs that such firms deal with, means that the patent regime is ideally suited for protecting the intellectual property of the firm. The level of appropriability may indeed be assumed to be generally ‘tight’ under these conditions.

Hypothesis 2:

For firms working with services which are codified in nature, but whose outputs are intangible in form, it is hypothesised that copyright protection is the most applicable formal IPR regime. Copyright has been long associated with protecting traditional mediums, such as printed words and artistic creations, but which has now been applied to software programs and other new electronic media is more important (Cell 2). However, it also important for more client-intensive services, such as architectural services, where codified information is the dominant output; this includes drawings and technical specifications. As noted earlier, copyright protection is automatic on the creation of the work, although obviously its protection is retrospectively enforced by taking copyists to court.

As will be discussed below, however, although service firms may be operating under this type of intellectual property regime, they might not seek to use copyright (or indeed other formal IPR tools such as patents and trademarks) by activating it through legal proceedings, because:

- a) it is not worth protecting because it is not novel or innovative enough; and/or
- b) it is too costly to protect because of the likely cost of the legal proceedings required to be deployed in gaining legal protection from copiers.

Hypothesis 3:

For services which are both tacit and intangible in form, more generalised protection can only be obtained via brands (Cell 3) with recourse to protection by trademarks, although this is also available to services in Cells 1 and 2. Brands are essentially trade names which are used to define a specific product. Companies operating under this regime, and not having recourse to patent or copyright, have to use branding via trademarks as the only default option for protection of intellectual property, apart from certain confidentiality, secrecy and labour contract rights (see below). Innovative companies in this knowledge and IPR regime therefore still generate new products which may be worth protecting and because these new innovative products create new *identities*, they can then be protected under new trademark applications. Thus, although brands may seem less associated with innovative activities, recent studies have shown that brands are more (not less) important for high technology products than for traditional consumer goods (Ward et al. 1999).

Hypothesis 4:

For services involved with tacit knowledge but working with tangible goods, no direct protection measures are used, as innovation activity and intellectual property generation are extremely low (Cell 4). Trademarks appear less applicable here (Chapter 2). However, firms within this regime can still use other intellectual protection tools, such as simple secrecy and lead time advantages (Andersen and Howells 2000, 239), but also more formal non-IPR mechanisms, such as confidentiality agreements, trade secrets (von Hippel 1993) and labour contracts, to protect their knowledge bases.

Other types of protection tools (which are also available to, and often used more frequently by, organisations in Cell 3 (as well as Cells 1 and 2)) can include a range of confidentiality and labour contract agreements associated with, for example:

- a) new employees required to sign confidentiality agreements restricting disclosure of the activities to third parties of what they are working on;
- b) employees on leaving the firm are not allowed to work for specified competitors for a specified time;
- c) restrictions on where employees undertake certain development tasks ('on-site restrictions');

- d) restrictions on what work employees can undertake away from the firm or what they physically take off-site ('off-site restrictions');
- e) incentives for long term stayers, via enhanced pay rates and stock options (associated with such mechanisms as 'golden handcuffs'); and,
- f) 'job design measures' (Liebeskind 1998) which fragments key tasks so no one individual can have knowledge about a key task, code or development activity within the firm.

These are therefore some of the *employee-centred* mechanisms that can be used to protect the knowledge base of the company without recourse to traditional IPR mechanisms, such as patents, copyrights or trademarks. As noted earlier, there are other intellectual property protection tools, such as lead time advantages and secrecy and others which parallel the list of a) to f) above. Thus fragmented job design measures are paralleled by and associated with complex product designs themselves which are decomposed into component parts (Sanchez 2001, 208). Decomposition is undertaken to overcome the problem of dealing with complexity 'all in one go', but it also has the advantage of making it much harder for competitors to duplicate the overall design task. The copying and relative loss of a particular component will mean that the competitor still does not have the overall capability to copy the whole product design.

Figure 3.3-1: Classification of knowledge regimes and appropriability in services

Know- ledge Type	Level of Tangibility	
	Tangible	Intangible
Codified	1. Patents (Copyright) (Trademarks) (Contracts*)	2. Copyright (Trademarks) (Contracts*)
Tacit	4. Other Informal IPR Tools (Confidentiality clauses & labour contracts) (Trademarks)	3. Brands - Trademarks (Other informal IPR tools) (Contracts*)

Notes: * These include confidentiality clauses and labour contracts that seek to restrict intellectual property within the firm.

3.3.2 Some Limitations and Characteristics of the Model

Great care must, however, be taken in interpreting the classificatory property regime for services proposed here for several reasons.

Firstly, as noted above (Section 3.2), knowledge here is used in the context of a meta 'knowledge' residing outside the individual. As such, we are talking about the dominant form of knowledge which is created once the information is taken up, or consumed by, the individual using that format, i.e. whether the information is codified or tacit in nature, not the knowledge.

Secondly and related to this, both the type of knowledge discussed and the level of tangibility is portrayed in a crude bi-polar form. Both the degree of tacitness (Roberts 2001) and level of tangibility should be viewed more in terms of a spectrum than a crude bi-polar divide. As Michael Polanyi was at pains to stress, explicit or codified knowledge indeed requires tacit knowledge for its interpretation (Polanyi, 1966, 7).

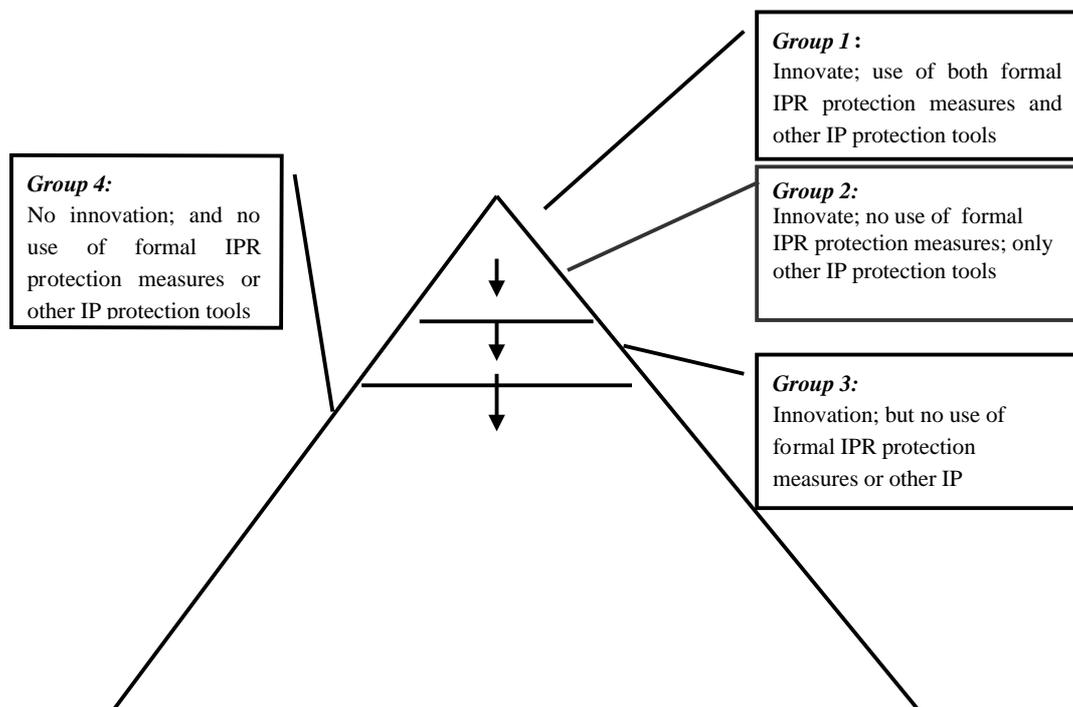
Thirdly, the study (and therefore the model) in relation to intellectual property mechanisms concentrates on formal IPR mechanisms (patents, copyright and trademarks), rather than on other (formal and informal) IP protection tools, such as secrecy, lead time advantages or complex design. This is not because other IP protection tools are less important as protection intellectual property mechanisms (indeed the survey shows that they are much more important), rather because they are deployed by all innovating service firms and organisations (i.e. they are used in all the four regimes or cells) and therefore they are not useful in discriminating between IP knowledge regimes (the four cells). In this sense the model therefore operates a reverse IP paucity allocation hierarchy principle as one moves down from Cell 1 to Cell 4, i.e. the options for protecting IP become sparser as one moves down the different IP knowledge regimes. On this basis, the cells or regimes are denoted by the IP protection tool that offers them, a priori, *most protection* to their intellectual property, moving down the hierarchy from formal IP protection measures, such as patents (Cell 1), copyright (Cell 2), trademarks (Cell 3) to other protection tools (Cell 4). On this basis, although firms in those cells or IP knowledge regimes may not use these specific measures or tools *most frequently* (i.e. patents in Cell 1), it could be hypothesised that they would use it to protect the *most valuable* intellectual property they had developed.

Fourthly, for each cell those firms considering using these different forms of property protection regime are at the pinnacle of their respective sectors (see below) and regime types; as represented by Group 1 in Figure 3.3-2. Most service firms are not innovative and still fewer consider they need to use formal IP mechanisms to protect their intellectual property. Below Group 1 are two groups of companies who do innovate in some way, but who do not consider, or cannot use, formal IPR mecha-

nisms (patents, copyright and trademarks) to protect their intellectual property. The second group, Group 2, instead rely on other IP protection tools to protect their intellectual property. By contrast, Group 3 innovate, but do not use any IP protection tools at all to protect their innovations because they consider any form of protection mechanism worthwhile or valuable for them to implement.

It should be recognised, though, that the great bulk of service companies do not innovate in any recognisable form and this still represents by far the largest group (Group 4). However, this last group is diminishing in size over time as service companies become more innovative (and perhaps in part because researchers are becoming better at recognising and measuring innovation within service firms and organisations). Over time, therefore, the proportion of innovative service firms, measured by a variety of indicators, is increasing; and within this, the group of firms which seek to utilise formal IPR mechanisms is growing (Group 1). As such, the top of the pinnacle, which this group represents, is gradually expanding (i.e. moving down further from the top of the triangle; Figure 3.3-2).

Figure 3.3-2: Innovativeness and use of intellectual property rights in service firms



For most service firms, therefore, operating in all the IP regimes identified, the actual use of the relevant formal IP mechanisms, such as patents, copyrights or trademarks, is not considered.³⁴ Either no mechanisms are used at all, or only other, mainly informal, protection tools are applied.

3.3.3 A Priori Application of the Model

Despite the caveats listed above in Section 3.3.2, a priori, the service sectors that were studied in the overall survey have been allocated according to the typology of knowledge property regimes that were devised. Generally, it was fairly easy to initially allocate the firms within the service sectors, a priori, according to the different knowledge and IPR regimes. These are listed in Figure 3.3-3. However, in the case of both transport services and media and communication services, these two sectors were sub-divided between two groups which had different knowledge and IP environments, namely:

Figure 3.3-3: Classification of knowledge regimes and appropriability by service sector

Know- ledge Type	Level of Tangibility	
	Tangible	Intangible
Codified	1. Patents - Technology-based Manufacturing & Business Services - Transport Services: 1 - Communications & Media: 1	2. Copyright - ICT/Software-based Services - Communications & Media: 2
Tacit	4. Other Protection Methods - Transport Services: 2 - Public Services - Other Services	3. Brands - Trademarks - Financial Services - Wholesale & Retail Services

Notes: Transport Services 1: infrastructure-intensive
 Transport Services 2: customer-focused
 Communications & Media 1: infrastructure-intensive
 Communications & Media 2: content-based

³⁴ Although a study by Levin et al. (1987) found this true of nearly all industries in the U.S. in relation to the formal IPR mechanism of patenting compared with other types of protection mechanisms such as secrecy, lead time or learning curve advantages.

The first group were infrastructure- (and goods-) intensive services associated with providing the basic infrastructure or ‘backbone’ facilities for other (or the same in the case of, for example, railway or basic terrestrial-based telephone services) service providers to use.

The second group were more customer-focused (‘front end’) services in relation to transport (for example airlines rather than charter or leasing aircraft operators) and content-based media and communication services associated with content services that flow ‘over the wire’ (or ‘through the air’ in the case of wireless-based services or non-cable television).

These initial allocations were subsequently tested using the case study material, the results of which are outlined in Section 4.3.3 of this report. In comparison to Figure 3.3-3, a more complex, a posteriori figure is produced in this Section 4.3.3, which indicates:

- a) that sectors actually cover more than a single regime group; and
- b) indicates a dynamic shift in the knowledge regime that different services are inhabiting.

Nevertheless the following analyses will show that the model that has been produced has been fairly robust and does indicate the broad range of heterogeneous knowledge property regimes that firms operating in a variety of service sectors confront in the modern knowledge-based economy.

3.4 Conclusion

On the basis of the above analysis, what can be concluded from this analysis and discussion? We propose an a priori model of knowledge property regimes which seeks to allocate and classify innovative service firms by service sectors according to the type of knowledge, level of tangibility and intellectual property context that the firm or organisation is situated in. We thus state the hypothesis that many, if not most, service firms will not be concerned with utilising formal intellectual property mechanisms, even when they do innovate. Nevertheless, the model successfully describes and allocates service firms according to the four main types of knowledge property regimes listed above in an a priori application.

Moreover, the model is still useful for considering those firms that do not use formal IPR mechanisms by identifying, and providing a typology of, the different generalised knowledge and appropriability contexts that all service firms are confronted with. In a dynamic context, with the increasing innovativeness of the services, more firms for whatever reason will have to have recourse to using IPR and other protection tools to safeguard their ‘knowledge’ base.

4. Results of the Empirical Approaches

4.1 Introduction

The literature review has shown that both the innovation activities and output and the protection activities of service companies are characterised by a broad variety. This has consequences for the empirical analysis of the respective issues.

At the same time, each quantitative analysis of the protection activities, especially when it comes to patents faces serious specific problems. Although there is a sophisticated and well-established methodology to analyse patent data over time, across countries and technologies, it is rather difficult to establish links between economic sectors and their patent applications. Regarding the manufacturing sector, there are some "natural" links, like the application of the chemical industry in the different subsectors of chemistry. However, companies often do not act just in one field of technology but in general very broadly in several areas. This phenomenon increases obviously with firm size.

In the service sector, we observe a very heterogeneous picture regarding intensity and scope of technology use. Furthermore – and more problematic for quantitative analysis – there are only few obvious links between service activities and technologies. Although companies providing telecommunication services rely on ICT infrastructures, the same is true for other transport services. Nevertheless, most of these service companies procure these infrastructure technologies from the respective manufacturing companies, which also own the relevant patents. In addition, most service sectors are dominated by very small companies, which are less likely to apply for patents, due to a lack of knowledge and resources. Finally, meanwhile there is a strong tendency towards a convergence of manufacturing activities and the provision of accompanying services. Consequently, it becomes very difficult and often just impossible to classify a company as a "purely" service or manufacturing company. Summarising these observations, it has to be concluded that there cannot be a straight approach to identifying and quantifying the formal protection strategies, especially the patent activities, of service companies.

In order to solve the problem sketched above, a two-fold strategy has been followed. The first inquiry is targeted to reach a quantitative picture regarding the extent of patenting by service companies and the focus of protected technologies. Two different quantitative research approaches have been designed. In a first step, we determined a sample very large service companies and identified and analysed their patent applications in the period 1990-1997 (section 4.1). This approach stemmed from our experience in the manufacturing sector, where a very small sample of very large (multinational) companies determines both the quantitative development of patent applications and their distribution among the areas of technology. In our sec-

ond approach, that served to check the validity of this first approach, we turned our search upside down. After identifying and ranking *all* top patent applicants in the years 1998 until 2000 we identified among those top applicants the "pure" service companies and based on their share of patents extrapolate the complete share of patents taken out by service companies. By this second approach, we can be assured that we have covered medium-sized and small service companies which are very active in patenting. Moreover, since we conducted this second search for various technological fields it was possible to differentiate the meaning of patents in the service area as for technologies. The results of this second approach are discussed in section 4.2.

These quantitative approaches are complemented by a significant number of case studies, which try to analyse in-depth both the innovation activities of service companies, the whole range of protection strategies and the role of IPR, especially patents (section 4.3).

4.2 Empirical Evidence about Patenting Activities of European Service Companies

Knut Blind

4.2.1 The Patenting Activities of Large European Service Companies

In order to find more quantitative statistical evidence about the patenting activities of innovative service companies and their technological dimension, an adequate methodology had first to be elaborated. The following aspects have to be taken into account from the methodological perspective. It is not feasible to look at the complete list of many thousands of companies which have applied for patents at the European Patent Office and select those which are service companies. One major problem is the definition of a service company. On the one hand, there are the classical service firms like banks, insurance or transport companies, including telecommunication providers. On the other hand, many manufacturers have extended their core business into service activities (see box and further examples in section 4.3.4.8).

Furthermore, patents can only be granted for innovative technical solutions. Consequently, there are no service categories in the international patent classification (IPC). The service companies the products of which are based on innovative technologies protectable by patents may have a significant propensity to apply for patents. Since the recent developments in the information and communication technologies (ICT) are a central driving force for innovations in the service sector, there is clearly the possibility of a growth of patenting here. Whereas technology-based service companies may rely on patent applications, many service companies are either only technology users or provide services with a low technology intensity. Therefore, just focusing on the ICT related classes of the IPC will not lead to numerous service companies among the applicants, since most applicants are taken out by hardware producers.

Traditional Manufacturing Companies with Significant Service Activities: Impact on Patent Statistics

World-wide we experience an increasing convergence of manufacturing and service activities within the same companies. The following two well-known examples illustrate this phenomenon:

1. **DaimlerChrysler** is one of the few world's leading automotive, transportation and services companies. Its passenger car brands include Maybach, Mercedes-Benz, Chrysler, Jeep®, Dodge and smart. It offers financial and other services through DaimlerChrysler Services. DaimlerChrysler Services provides besides vehicle-related financial services trade and project services for customers located in emerging markets with customised consulting, project management services and financing solutions for all their industrial plans and import activities. Finally, DaimlerChrysler Mobility Management offers a broad package of innovative services which improve and facilitate mobility.
2. **Siemens** offers a unique spectrum of products, services and solutions in electrical engineering and electronics. Besides automation and control technologies and information and communication technologies, a range of services belong to its business. It offers business services, especially IT services, energy services, like power generation and distribution, financial services, and training services, including consulting and career development.

Although a significant share of their activities is to provide services, it is often not possible to determine this fraction exactly, because many services are directly linked to products. Therefore, it is difficult to categorise such a company more as a service or a manufacturing company according to the distribution of the total turnover between products and services.

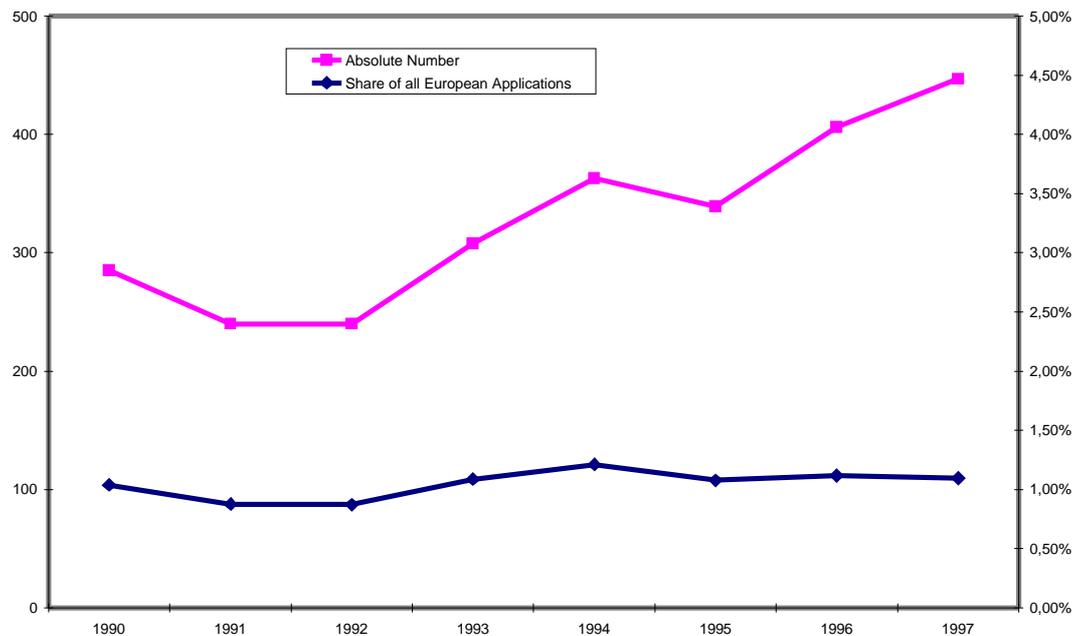
Both companies are characterised by being under the top 10 regarding the patent applications at the European Patent Office. However, it is not possible to differentiate between patents applied by service departments or by manufacturing departments without identifying the single inventor and his position in the company.

Consequently, these companies cannot be included in the analysis of patent applications by service companies, since this approach would certainly overestimate the number of patent applications by service-related business units. Leaving them out on the other hand will lead to an underestimate of patents related to service activities. However, for pragmatic reasons, we follow an approach which concentrates on companies with a core business classified as service activities.

As a patent inquiry covering all service companies in Europe is not feasible, a first approach has been used based on a sample of the 50 largest service companies (without banks and insurance companies³⁵) in Europe according to the number of employees (database: AMADEUS edited by the Bureau van Dijk; see Annex 1). In addition, the results of the Second Community Innovation Survey reveal that, in contrast to the manufacturing sector, the propensity to apply for a patent is only slightly higher in large service companies compared to small and medium-sized service companies.³⁶ Therefore, the bias towards a higher propensity to patent caused by the company size is limited in the service sector.

After setting up the database with the 50 companies, the second step of our approach is straightforward and consists of the identification of patent applications at the European Patent Office by the 50 company sample from 1990 to 1997 in the 30 subsectors of the FhG-ISI-OST classification. Besides the aggregate picture, differentiations according to technology fields and sectors can be performed.

Figure 4.2-1: Patent applications of 50 large European service companies between 1990 and 1997

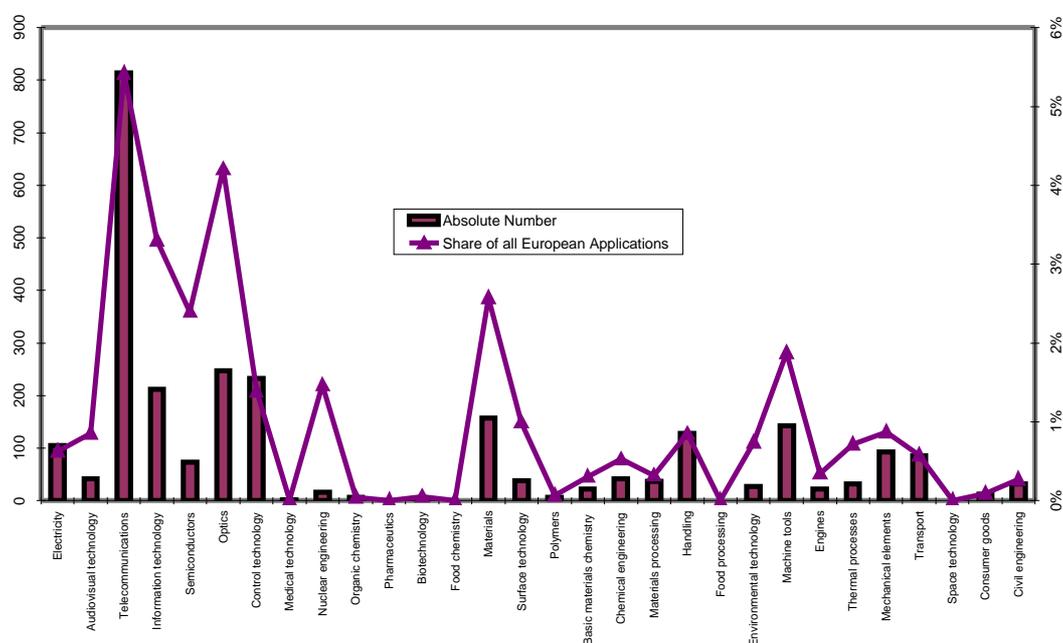


35 An explorative study in the public database Esp@net revealed that banks and insurance companies could not be found as patent applicants.

36 Compare Eurostat (2000), p. 38.

The first important result which supports the methodological approach is that 44% of the sample has applied for at least one patent in the time period considered.³⁷ In Figure 4.2-1, the overall number of patent applications of the company set is depicted. The number of applications doubled from 1990, starting with around 280 applications and rising to almost 450 applications in 1997. The general trend towards higher numbers of patent applications is also reflected by the analysed sample. Therefore, compared to all patent applications of the 15 Member States, the patent share of the sample fluctuates very narrowly around just over 1%. Consequently, service companies did not become more engaged in patenting activities than the manufacturing companies.

Figure 4.2-2: Sum of patent applications between 1990 and 1997 of the sample of large service companies in 30 technology fields



Besides the general confirmation of the slightly positive trend in overall patenting by service companies, the interesting question follows in what technology fields do they apply for patents? Based on the total sample, Figure 4.2-2 depicts impressively the focal point of their patent applications. The applications in the telecommunication and information technology fields add up to almost 50% of all applications of the sample. The number of applications in "Telecommunications" even tripled between 1990 and 1997. Other fields with significant numbers of applications are "Materials" and "Machine tools". In addition, information is provided about the share of the sample's applications respective to the total applications from the EU

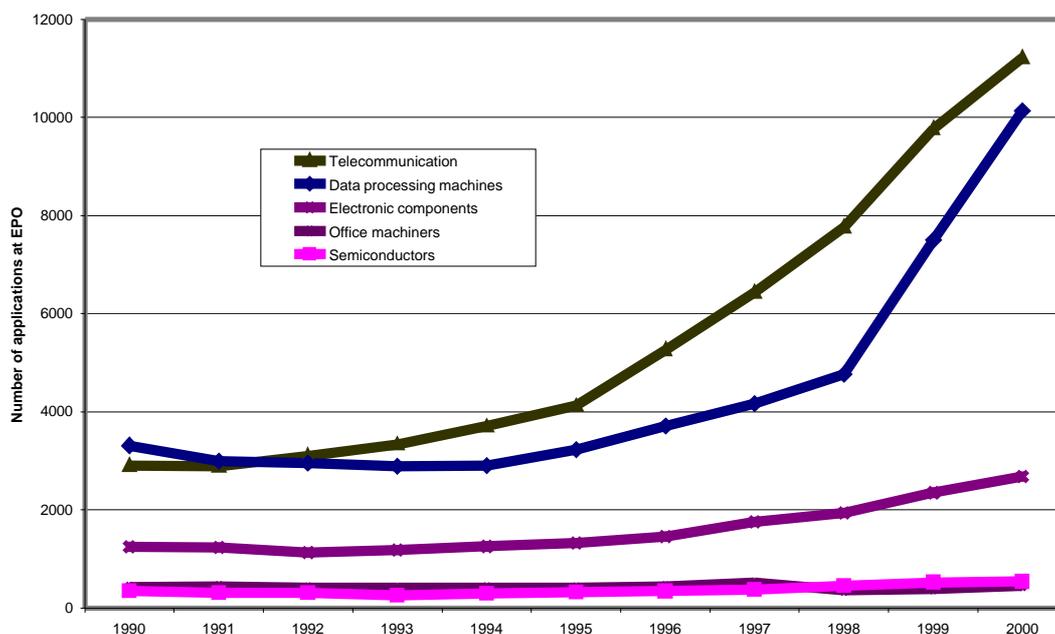
³⁷ In the German Innovation Survey of 1999, less than 5% of the over 2,000 responding service companies had applied for national or European patents.

Member States. The average over all technology fields is around 1%, which is significantly exceeded especially in the field "Telecommunications".

Besides the distribution of the applications among the 30 technology fields, the sample of the patenting companies among the 50 service companies has been segmented according to their business activities. It turns out that over 90% of the applications are made by the telecommunication companies which rely on modern telecommunication technology in providing their services.

For comparison, Figure 4.2-3 illustrates the general developments of the patent applications in IT-related fields. Especially, the annual number of applications in the field of telecommunication has more than tripled in 10 years. The same is true for data processing machines. The technical progress indicated by these significant growth rates allowed the rapid expansion of the telecommunication services. Consequently, especially the large companies providing telecommunication services hold a significant share of patents in this field, since they run own R&D departments.

Figure 4.2-3: Total patent applications at the EPO between 1990 and 2000 in IT-related technology fields



The very small sample of the 50 largest service companies and their very limited number of patent applications indicate that service companies focus their patent activities very strongly on ICT-related fields of technology. All other technology fields are of minor relevance. This quantitative picture supports impressively the hypothesis of the conceptual model regarding the use of patents for infrastructural

technologies, like ICT. Furthermore, this observation will be confirmed by the results of the case studies, which made evident that patents are mostly used to protect IT-related technologies.

4.2.2 Service Sectors and their Patent Applications differentiated by Technologies

Although we have already found some relationships between service sectors and their preferred fields of technologies regarding patenting, we have applied a complementary quantitative approach to provide a more systematic and comprehensive picture. Based on the patent applications of European applicants in the period 1998-2000³⁸, we have constructed rankings in five broadly defined technology fields. Then, among the top applicants we have identified "pure" service companies according to their NACE code, not including companies which besides their manufacturing activities provide related services.³⁹ Based on their share of applications among the top applicants, covering the major share of all applications, we have estimated the share of patents taken out by service companies in total and the total number of applications. The basic assumption behind this approach is that we assume an identical distribution of the applications by service and non-service companies. That means that among the applicants with just one or two patents the share of service companies is assumed to be identical to the share of service companies among the top applicants.

Table 4.2-1 presents the comprehensive picture of patent applications by service companies. The calculated share of patent applications by service companies in the narrower sense is just above 3% of all 56,351 applications. Two thirds of the applications are submitted by companies performing R&D and other business-related services. The only other service companies with significant patent applications are the telecommunication companies. Companies providing computer-related services, including developing software, have also some applications, which may rise in the future, if the IPR regime will be opened up to software patents. The financial and even the transport sector cannot claim significant numbers of patent applications.

If one concentrates on five broader technological fields, two main areas have to be highlighted. Whereas in chemistry, mechanical engineering and vehicle construction, only service companies providing R&D and other business-related services have applied for patents, patent application in electro-technology and in the remaining category are distributed among several service sectors. The main share of

³⁸ Single inventors are not included.

³⁹ Meanwhile, many large manufacturing enterprises have sourced out their IPR management. Therefore these companies have a long record of patent applications, but we do not classify these companies as legal services, since the patents stem from manufacturing companies.

patent applications in electro-technology is submitted by telecommunication companies, whereas in the residual category the R&D services are dominant.

Table 4.2-1 Estimated shares of patent applications in the years 1998-2000 by service sectors in five main technologies (total numbers in brackets)⁴⁰

Service sectors (NACE codes in brackets)	Technologies					Sum
	Chemistry	Mechanical engineering	Electro-technology	Vehicles construction	Others	
Wholesale and retail trade (50-52)						
Transport (60-63)			0.03% (5)		0.16% (29)	0.06% (34)
Post and telecommunications (64)			2.56% (376)		0.27% (50)	0.75% (426)
Financial intermediation (65-71)			0.03% (5)			0.01% (5)
Computer and related activities (72)			0.13% (19)		0.34% (63)	0.15% (82)
Research and development and other business activities (73-74)	3.01% (161)	1.94% (266)	1.34% (195)	0.58% (24)	3.17% (587)	2.19% (1233)
Sum	3.01% (161)	1.94% (266)	4.09% (600)	0.58% (24)	3.94% (729)	3.16% (1780)
Total applications	5,367	13,737	14,645	4,107	18,495	56,351

Note: The table should be read as follows: Approximately 2.6% of the patent applications in the field of electro-technology were submitted by post and telecommunication companies.

Summarising the insights of Table 4.2-1, we find that R&D and other business-related services are most active in patenting, whereas with the exception of the telecommunication companies, other service sectors have no significant patent activities. Regarding technologies, service companies concentrate their patent activities in electro-technology and the remaining category, while – with the notable exception of R&D services – they are irrelevant in chemistry and mechanical engineering. The

⁴⁰ Empty cells do not mean that no single patent application has been filed by service companies, but only that the likelihood is rather small and the percentage is near zero. In chemistry, we have investigated the Top 200 applicants being responsible for 80% of all applications, in mechanical engineering the Top 450 companies responsible for 54% of all applications, in electro-technology the Top 200 responsible for 70% of all applications, in vehicle construction the Top 200 responsible for 75% of all applications and in others the Top 320 responsible for 38% of all applications.

estimated share of 3% is much different from the results presented in Johnson (2002, pp. 30-32), who finds that service companies are not responsible for any patent using an approach, which derives from the non-existence of "service patents", that there are no patents from service companies. However, the result is in line with the share of 1% of the sample of large service companies assuming that 2% of the applications are submitted by medium and smaller service companies. This distribution is also consistent with the observation in the manufacturing sector, where a small number of companies is responsible for a large share of all applications.

Since the approach to differentiate the applications into five main technologies shows that in three major technological fields no significant patent activities by service companies can be observed, we concentrate on two narrowly defined technologies, which may have a higher relevance for service companies. We have selected telecommunication and information technology, defined according to the FhG-ISI-OST classification, since they seem to be promising both from the discussion of the literature and the approach based on the large service companies.

Table 4.2-2 Estimated shares of patent applications by service sectors in two selected technologies (total numbers in brackets)⁴¹

Service sectors (NACE codes in brackets)	Technologies		Sum
	Telecommunication technology	Information technology	
Wholesale and retail trade (50-52)			
Transport (60-63)			
Post and telecommunications (64)	4.70% (221)	1.91% (38)	3.87% (259)
Financial intermediation (65-71)		0.27% (5)	0.07% (5)
Computer and related activities (72)		1.70% (34)	0.51% (34)
Research and development and other business activities (73-74)	0.63% (29)	2.87% (57)	1.29% (86)
Sum	5.33% (250)	6.76% (134)	5.74% (384)
Total applications	4,698	1,988	6,686

Note: The table should be read as follows: Approximately 4.7% of the patent applications in the field of telecommunication technology were submitted by post and telecommunication companies.

⁴¹ Empty cells do not mean that no single patent application has been filed by service companies, but only that the likelihood is rather small and the percentage is near zero. In telecommunication technology, we have investigated the Top 100 applicants being responsible for 85% of all applications and in information technology also the Top 100 companies responsible for 74% of all applications.

Table 4.2-2 reveals a pattern of service sectors and patent applications. First, research and development and other business services are active in both technology fields, whereas wholesalers and retailers have no significant patent activities. The post and telecommunication companies are responsible for almost 5% of the patent applications in the field of telecommunication, which corresponds impressively close to the findings derived from the 50 large service companies covering the period 1990 until 1997, since most of the companies are covered by both approaches. The comparison of the results from the two periods furthermore do not indicate a significant increase of patent activities by telecommunication companies in recent years. Finally, the telecommunication service providers also patent in information technology, which is closely related to telecommunication technology. Financial institutions have also a very limited number of patents in the field of information technology. Comparing the two fields, the share of patents applied for by service companies is highest in information technology, which confirms both the findings of the literature and anecdotal evidence about the issue.

Finally, in order to illustrate the variety of patent applications made by service companies, Table 4.2-3 presents some selected examples covering a broad range of service sectors.

Table 4.2-3 Examples of patent applications by service companies

Name of the Company	Sector	Invention
Auchan SA (France)	Wholesale and retail trade	Carrying device for a load and backpack, especially satchel
Metro AG (Germany)	Wholesale and retail trade	Paying counter for self-service stores
Lufthansa Technik AG (Germany)	Air transport	Safety container for oxygen generators
France Telecom (France)	Telecommunication	Method for carrying out an electronic transaction using several signatures
Deutsche Telekom AG (Germany)	Telecommunication	Method for providing and processing locality information in switched networks
Deutsche Bank AG (Germany)	Financial sector	Method and system for providing web content aggregation and/or web payment
Aioi Insurance Co. Ltd. (Japan)	Insurance	Consultation business support system
Stiegl Immobilien Vermietung (Austria)	Real estate, renting	Drink-retailing apparatus
Technical Casino Services Ltd.(United Kingdom)	Technical services	Casino video security system
Tac Technical Advice & Consult (Switzerland)	Technical services	Marking device for pedestrian crossings

4.3 Empirical Results of the Case Studies

4.3.1 Introduction

The primary objective of the study is to analyse the patenting behaviour of innovative service companies. In a first step, the essence of the existing literature has been reviewed by examining published literature in a wide range of relevant journals and books. Secondly, a database of the largest European service organisations has been set up and we have analysed in which technological fields these organisations have applied for patents. In order to examine in-depth the actual situation, a sample of service companies has been analysed in the year 2001. This approach is able to generate more qualitative insights into the reasons why these organisations protect their knowledge and what they are protecting.

The objective of the case studies was the context related investigation of the basic characteristics of innovation in services and, in particular, of the strategies and specific means used by service firms to "protect" their knowledge assets, their investments in innovation, the new services introduced into the market. The interviews have therefore dealt with IPR issue and more specifically with the role played by patents, trademarks and copyrights, or any alternative strategy implemented by firms, to appropriate the results of their innovation activities (see interview guideline in Annex 2).

For all teams, finding service firms to interview was a very difficult and time-consuming undertaking. More than 200 firms were contacted by mail or on the phone, informed about the exercise and sent a questionnaire. The most common attitude of firms was a non-co-operative one. The usual reaction was that the IPR theme was not a very important one. This was because of either too little internal innovative efforts of the firms contacted or because of the specific nature of innovation and knowledge assets in services. Some (large) firms raised the "confidentiality" issue. In other cases the non-co-operative attitude of firms was due to an attempt to skip the "additional work" required to fill out the questionnaire and carry out the interviews.

The remainder of the report is structured as follows. Chapter 4.3.2 gives an overview about the composition of the sample and general results concerning innovation activities and the role of IPR in the service sector. The results of the test of the theoretical hypotheses elaborated in Chapter 3 based on the very limited number of case studies are presented in Chapter 4.3.3. Due to the restrictions of the qualitative analysis, qualitative pictures of innovation and IPR in seven service sectors are shown in Chapter 4.3.4. Finally, part 4.3.5 concludes with a very limited number of detailed company cases demonstrating best or better, or at least good practice regarding the use of IPR in service companies.

4.3.2 Overview of the Case Studies

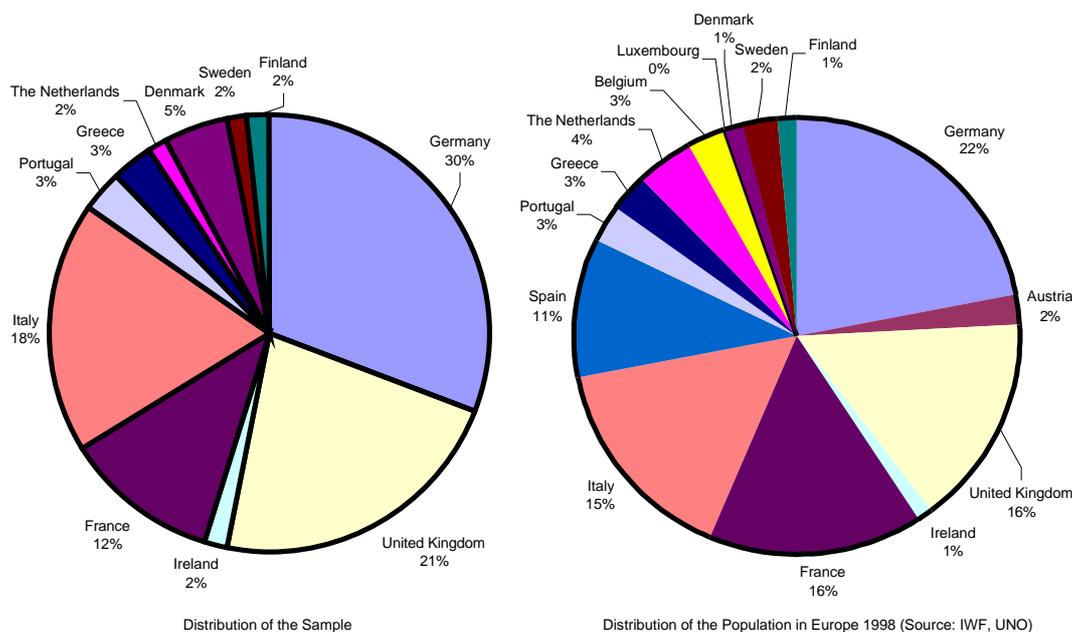
Knut Blind

4.3.2.1 General Characteristics of the Sample of Companies

In total, case studies of 65 European service companies were performed. It turned out that each service company has a very specific attitude both to innovation and to strategies for protecting its intellectual property, depending on its business activities, its age and its competitive environment. However, in order to give a general descriptive overview, the distribution of the cases by country and service sector and other selected characteristics are displayed in this first chapter.

The following Figure 4.3-1 presents the distribution of the cases by Member States and as reference the distribution of the total population. The Scandinavian and Mediterranean countries (except Spain), the United Kingdom and Germany are well represented. However, the sectoral influence is most important for the innovation activities and the strategies or difficulties to protect intellectual property rights.

Figure 4.3-1: Distribution of cases and total population by member states

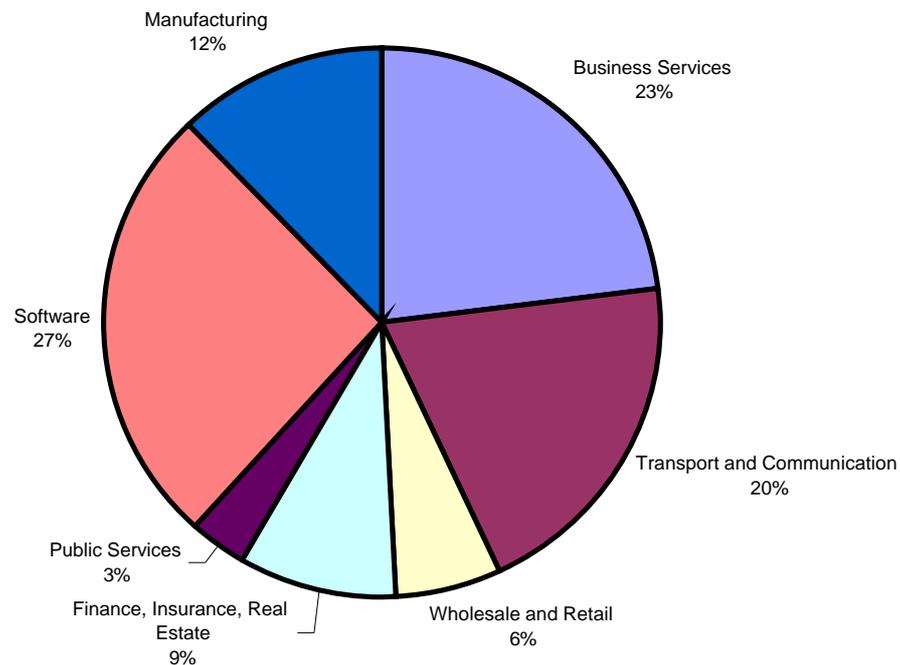


In contrast to the regional distribution, the sectoral coverage cannot follow the distribution of employees in the different sectors (see Figure 4.3-2), because the wholesale and retail sector employ over 40% of the workforce in the whole service sector.⁴² However, this sector in particular is neither very innovative and nor very

⁴² Source: Services in Europe edited by Eurostat (1999).

technology-intensive. On the other hand, the innovative software and R&D service sectors together with the business services (consultancies) employ less than 20% of the workforce. Consequently, the sample covers all service sectors, but has a focus on innovative and technology-intensive services, like software development, R&D and other business services, which may therefore have a need for protection of their intellectual property.

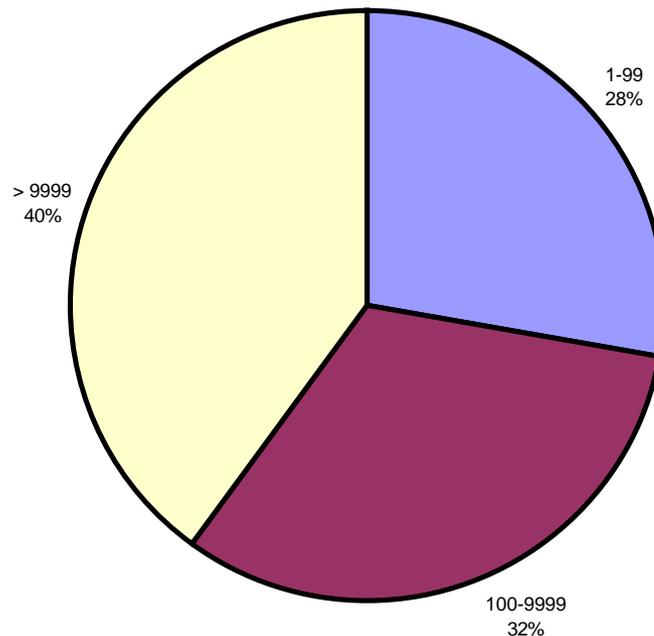
Figure 4.3-2: Distribution of cases by sector



Besides the sector, the company size is a very important determinant for the importance of intellectual property rights, and the strategies and resources being devoted to protect them. Figure 4.3-3 demonstrates impressively that our sample of companies consists mainly of large firms, some even are MNEs with more than 100,000 employees. This distribution is not at all representative of the real size distribution in the service sector. However, several studies on the role of IPR and especially patents in the manufacturing sector have shown that for SMEs, IPR are both less important for their business success and are less frequently used, because of the high fixed costs to run a patent unit or to hire a patent attorney. One major interest of this study is to elucidate the motives of service companies to use patents in their protection strategies. Therefore, the focus has been on companies with some IPR or patent activities, which are more likely to be large firms. One has to bear in mind that less than 10% of the innovative service companies asked in the Second Community Innovation Survey have applied for at least one patent. Nevertheless, we

have also included small companies with and without patent activities as a kind of control group.

Figure 4.3-3: Distribution of cases by company size (number of employees)



4.3.2.2 Innovation Strategies and Activities

Generally, over two thirds of the companies in the sample claim to have an explicit innovation strategy, although most of the companies have problems to describe the content of the strategy in detail and the process by which the strategy was developed. This phenomenon indicates that many companies in the service sector see the necessity to have an innovation strategy, but have not yet spent much time developing one. This problem is more crucial for small and medium-sized companies and is reflected by the smaller share of SMEs possessing an innovation strategy at all.

The resources which the sample of the companies devotes to the innovation process are significant, although some of them have problems with exactly defining their expenses spent on innovation processes. On average, 15% of all expenses are dedicated to innovation, which is much above the average among the service companies.⁴³ Despite the small number of observations, it is obvious that small companies

⁴³ Eurostat (2000), p. 42, reports that in service companies the expenditures allocated to product and process innovation have been 2.8% of the total turnover.

invest more resources (20%) in innovation activities than the large companies (13%). This picture is confirmed by the share of personnel working on product and process innovation inside the company. On average over all companies, more than a quarter of the workforce is committed to innovative activities. In the small companies of the sample, it is around half. These figures are very high compared to the average in the European Union, because we have both a strong bias to very innovative companies in rather dynamic sectors and a rather broad definition of innovation activities.

Figure 4.3-4: Importance of innovation activities (1 = not important to 5 = very important)

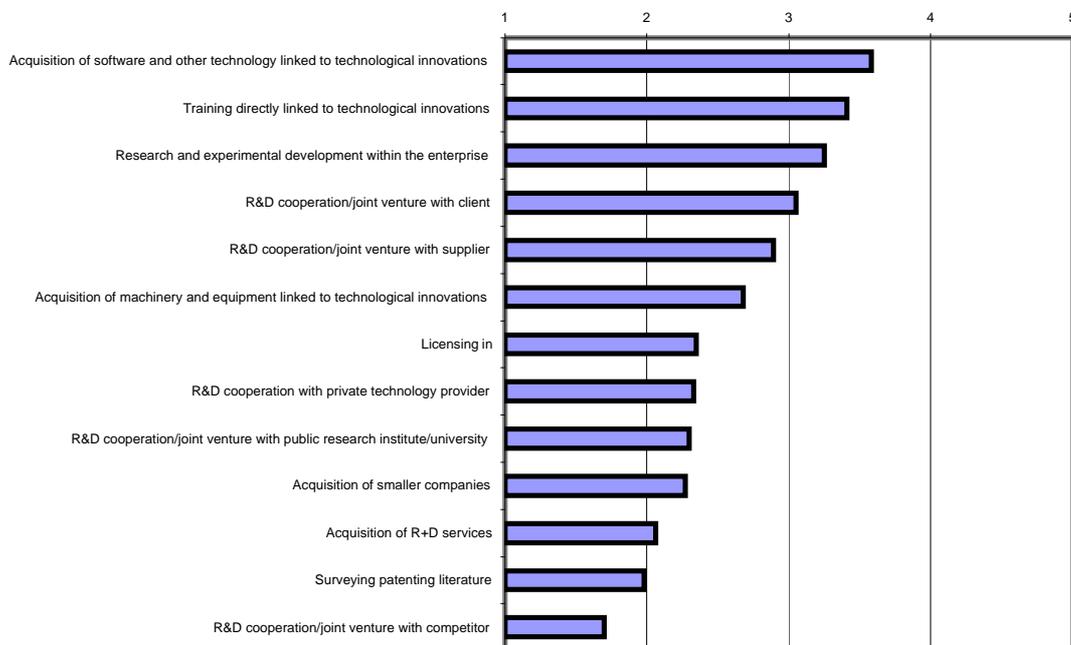


Figure 4.3-4 illustrates the ranking of the innovation activities of the interviewed service companies. Most important for the companies is the acquisition of software and related technology. External sourcing is therefore more important than internal research and experimental development, which receives a grade just above medium importance. In addition, this result underlines that software, understood as an essential part of information and communication technology, is crucial for innovations in the service sector. Besides the technological dimension, the provision of services relies highly on the input of the human factor. Consequently, the training of the staff, which is directly linked to technological innovations, is of second priority for the service companies examined. Still above average are R&D co-operations with clients, as many innovations in the service sector are driven by the needs and

demands of the customers.⁴⁴ Therefore, besides the growing importance of customer relationship management (CRM), a close collaboration in R&D is an effective means to generate service innovations. As last bundle of innovation strategies, both the R&D co-operation with suppliers and the acquisition of machinery have to be mentioned. In contrast to the market and demand side, innovations may be also created by the use of innovative and advanced technologies. These can be sourced either by the simple acquisition of machinery offered by different suppliers or by the joint development with technology-producing companies, which allows an early integration of the service companies' needs during the technology developing process.

The role of intellectual property rights is obviously only of minor importance among the set of innovation strategies. Both the licensing of intellectual property rights, like patents, trademarks and copyrights, and screening the information contained in patent documents are of low importance for most of the companies. Especially the last result indicates that, in contrast to the manufacturing sector, the disclosure function of the patent system plays a very small role for companies in the service sector.

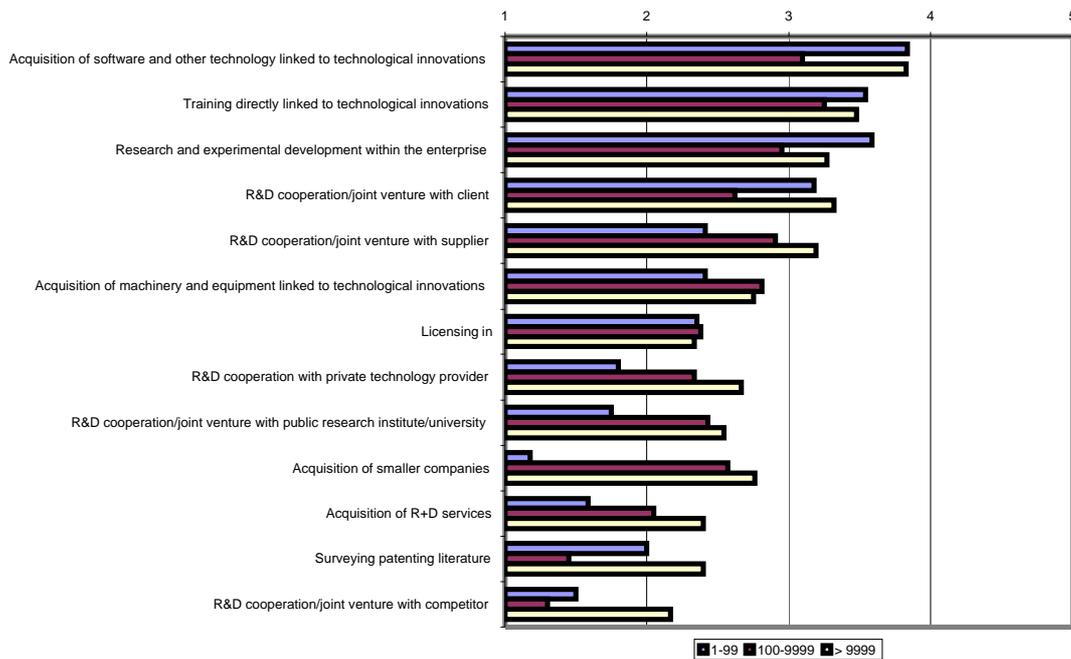
In order to gain insights into the role of the different innovation strategies for small and large companies, the aggregated results are differentiated by company size (see Figure 4.3-5). A clear bias caused by company size can be detected only for very few innovation activities. On the contrary, the most important mechanisms are highly valued both by smaller and larger companies, whereas the medium-sized companies address a lower importance to these instruments.⁴⁵ A clear size bias can be observed connected with the R&D co-operations with suppliers, private technology providers and universities. Whereas the acquisition of machinery is lowly valued by small companies comparative to medium and large companies and probably caused by a sectoral bias, it is reasonable that for small companies the take over of other small companies is of very low concern. Finally, licensing of external technological know-how is of little importance for all groups of companies. Surveying patenting literature is of slightly higher interest for larger companies.⁴⁶ Nevertheless, small software companies meanwhile make use of the content of software-related patents from time to time.

⁴⁴ Compare the results for Germany in Blind et al. (2000).

⁴⁵ This surprising distribution may be caused by a sectoral bias due to many small software companies in the group of small companies. The influence of the heterogeneous service sector on the results of size-differentiated analysis is also mentioned related to the CIS2 results (Eurostat 2000, pp. 58ff)

⁴⁶ The CIS2 already demonstrated that patents important as a source of information for innovation are only for a small minority of service companies. Cf. Eurostat (2000), pp. 66-71.

Figure 4.3-5: Importance of innovation activities differentiated by firm size (1 = not important to 5 = very important)



4.3.2.3 Objectives of Innovations

Besides the innovation activities, the goals that product and process innovation can help to achieve are able to complement the picture of the service companies examined (Figure 4.3-6). The most important objectives for product innovations are two-dimensional. One more quantitative target of the companies is to extend both the range of markets served and the range of services provided. Diametrical to this quantitative dimension is the goal of improving the quality of the services themselves and of optimising the chain of services supplied. In general, the larger the company, the more important these goals are assessed to be, with the exception of the optimisation of the service chain, where frictions are obviously an important problem for smaller companies. The replacement of mature services being phased out and reaction to short innovation cycles are of slightly more than medium importance. Still, the fulfilment of standards and regulations cannot be neglected. The innovation strategies of competitors are obviously of minor importance for the service companies analysed, since it is not very important for them to react to them.

Figure 4.3-6: Importance of objectives of product innovations differentiated by company size (1 = not important to 5 = very important)

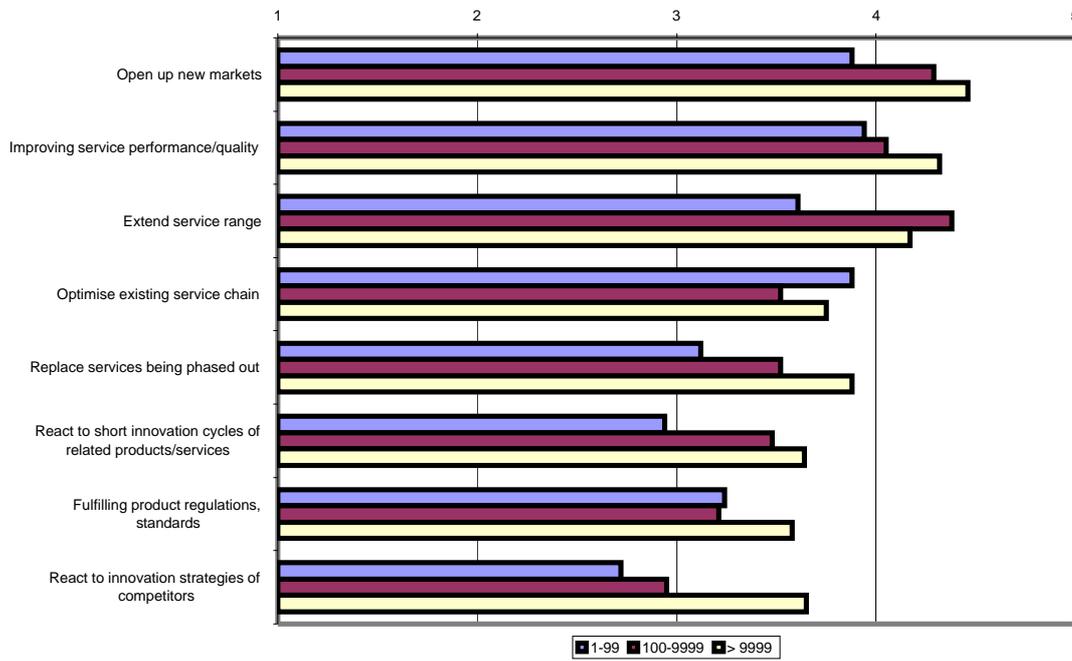
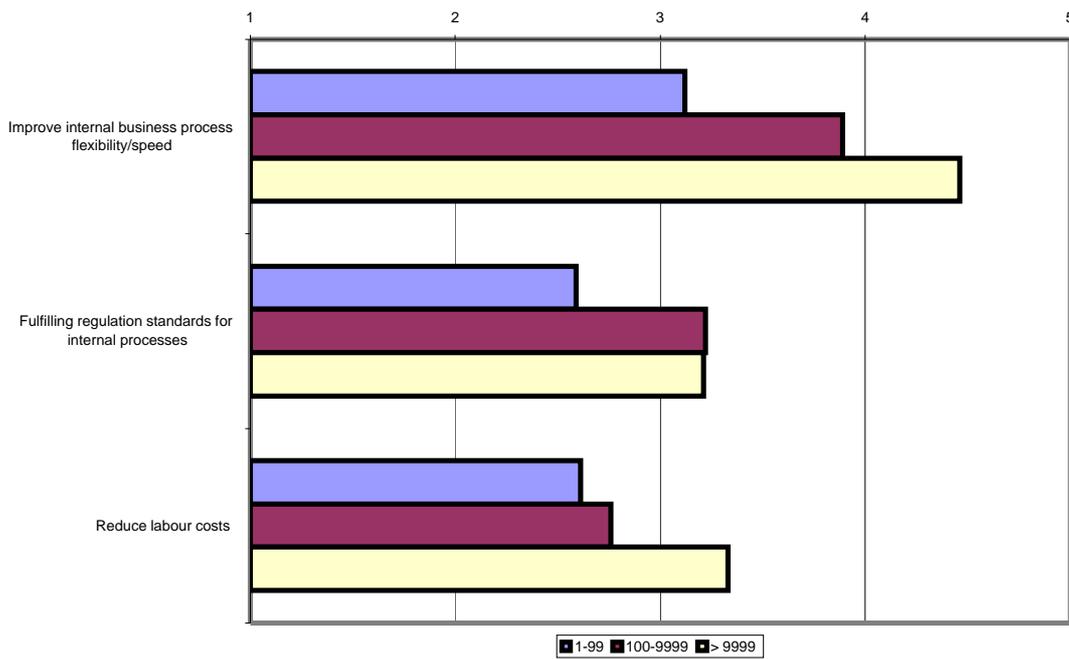


Figure 4.3-7: Importance of objectives of process innovations differentiated by company size (1 = not important to 5 = very important)



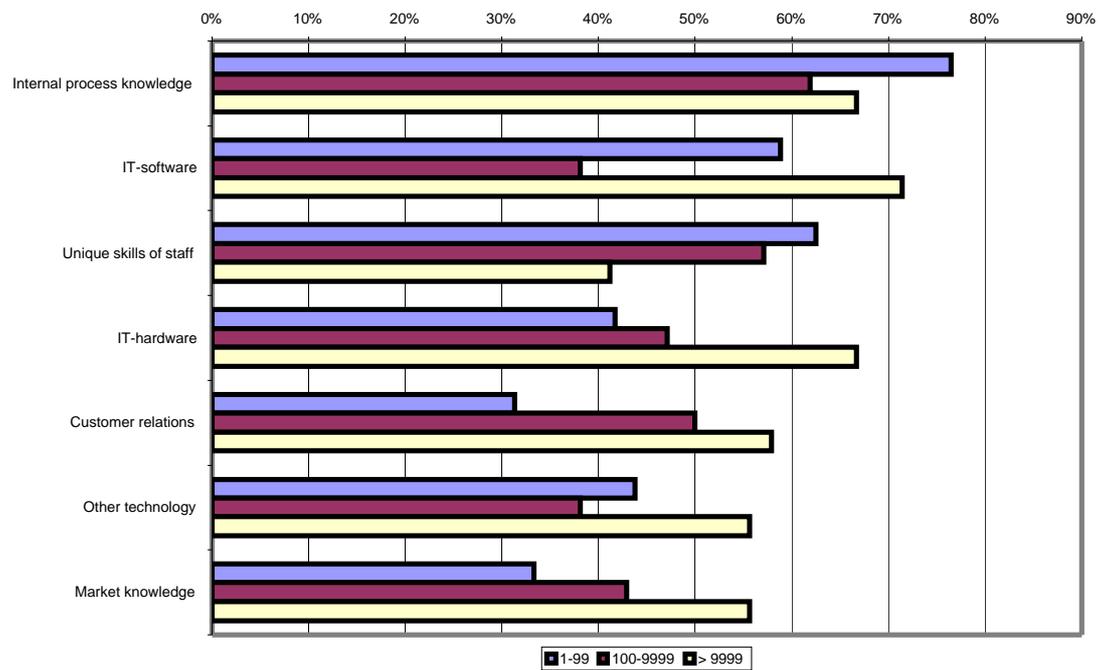
The objectives of process innovations are in general of smaller importance compared to the goals of product innovations (Figure 4.3-7).⁴⁷ The improvement of the internal business process flexibility is of high importance, especially for the larger companies. The fulfilment of internal standards is only of medium importance and the reduction of labour costs are only of medium relevance, even for the larger companies.

4.3.2.4 Objects of Protection

In order to understand better the assessment of the effectiveness of different protection strategies, it is important first to clarify what assets the companies try to protect from competitors, customers and other actors in the market. Figure 4.3-8 presents a ranking of the assets to be protected. Most important is defending internal process knowledge, which is crucial for providing services. Since the provision of many services relies on ICT, software is the next asset necessary to be protected. The high share of small companies protecting software is caused by the dominating role of software companies in the category of small companies. For the majority of all companies, it is important to safeguard the unique skills of their staff. The smaller the companies, the more important is obviously the qualification of their staff. Larger companies have consequently less problems with replacing personnel who leave. IT-hardware is an asset to be defended only for the majority of the large companies, because they are more likely to own unique IT-hardware. Consumer relations represent no special problem for smaller companies, since their personnel has – especially in services – a very close relationship to each individual customer. However, the larger the company, the looser the relationship to the individual customer becomes. Consequently, half of the larger companies perceive the need to protect their consumer relations. Since the same reasoning can be applied to the market knowledge, smaller companies tend to protect this asset less than larger companies.

⁴⁷ This corresponds to the results of CIS2. Cf. Eurostat (2000), p. 56.

Figure 4.3-8: Share of companies protecting different assets



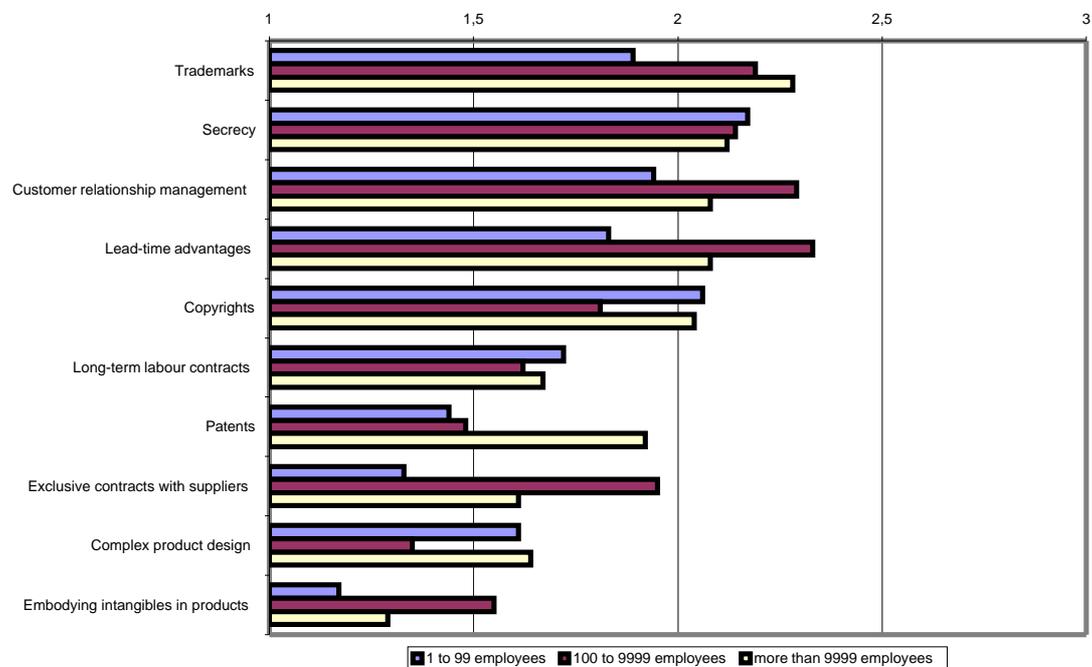
4.3.2.5 The Use of Protection Strategies in General

Since we have seen that the majority of the companies interviewed is protecting one or two or even several different assets, the question follows whether this behaviour is accidental, or integrated in an explicit strategy to protect knowledge embodied in their service products. Slightly more than half of the companies claim to possess an explicit protection strategy and there are almost no differences between the size categories. Companies with no explicit strategy often mention that either there is nothing to be protected or that there are only inappropriate protection instruments. However, most of the companies with an explicit protection strategy do not devote significant resources, like establishing a small unit responsible for this kind of strategy development.

More insights into the actual implementation of the protection strategy can be gained by the addressed importance of different protection instruments. We have divided the protection instruments into the intellectual property rights (patents, trademarks and copyrights), secrecy, the arrangement of contracts with employees or suppliers, and strategies like trying to gain a lead advantage at the market, customer relations management, or technical solutions like complex product design and embodying intangibles in products.

In general, all the proposed protection instruments reach values just above medium importance, which reflects the restricted importance of protection strategies in general for some companies (Figure 4.3-9). For four instruments the importance is assessed clearly as above average. Besides the use of trademarks as one of the intellectual property rights, informal protection means like secrecy, customer relationship management and gaining lead time advantages enjoy a relatively high importance. Whereas secrecy is almost of equal importance for all companies independent of size, the other three most important strategies are valued slightly more highly by the larger companies compared to the small companies. The use and prosecution of copyrights especially are as important for the small software companies as for the medium and large companies.

Figure 4.3-9: Importance of different protection instruments differentiated by company size (1 = not very important to 3 = very important)

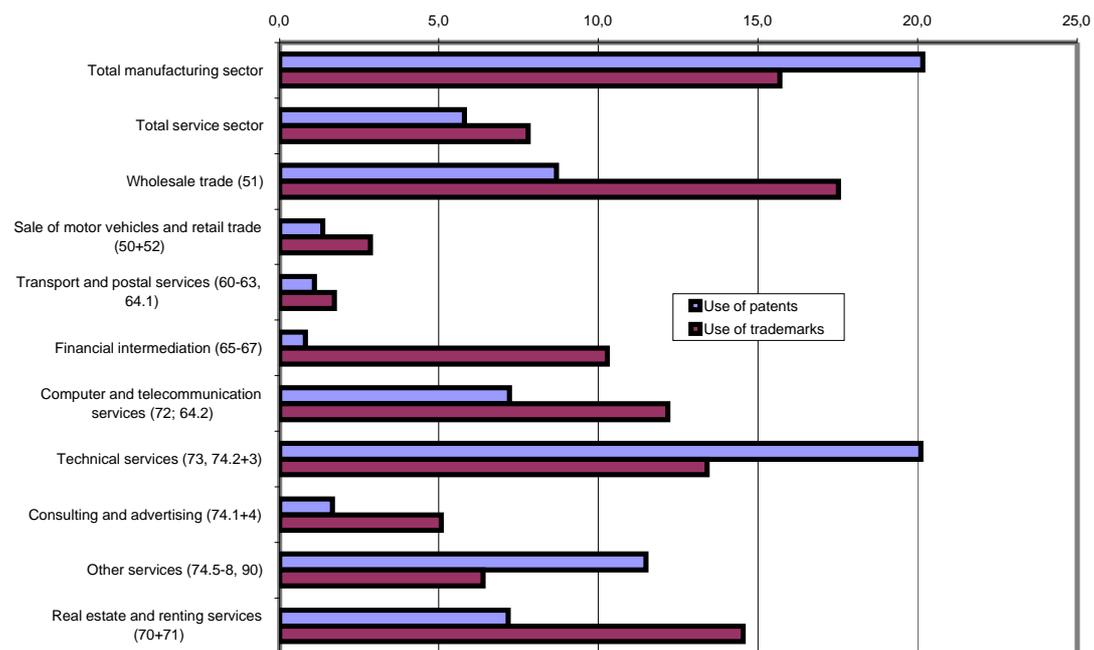


Patents are the least important intellectual property right for the interviewed service companies, although a significant share of them expects a much higher importance of this instrument in the future. Nevertheless, at present only the large and often also manufacturing companies attach a medium importance to patents. In concrete numbers, 35 out of the 65 companies analysed possess no patents at all. Another 18 companies claim to have up to 10 patents granted. Finally, only eleven companies hold more patents. The relatively low importance of patents confirms the CIS2 re-

sults, which report that only 7% of the innovative service companies have applied for at least one patent.⁴⁸

In order to have a more recent and detailed reference, Figure 4.3-10 presents the results of CIS3 in Germany (Source: ZEW 2002), concerning the question whether companies use patents or trademarks for the protection of their inventions or innovations. In general, the results of CIS3 for Germany have been confirmed, less than 6% of the German service companies make use of patents. For comparison, the share in the manufacturing sector is over 20%. However, the use of patents in the service sector is very heterogeneous. The highest use of patents can be observed among providers of technical services, who mainly support companies in the manufacturing sector and have therefore a good chance to elaborate a patentable solution whilst performing their services. In the residuum category "Other services" with cleaning and security services and photo laboratories, the share of companies with patents is also over 10%, since they very often develop process innovations in order to increase the efficiency of their services. Sectors with almost no patents are the retail trade, transport and postal services, financial services and consulting and advertising.

Figure 4.3-10: Share of German service companies making use of patents and trademarks for protecting their inventions or innovations in %



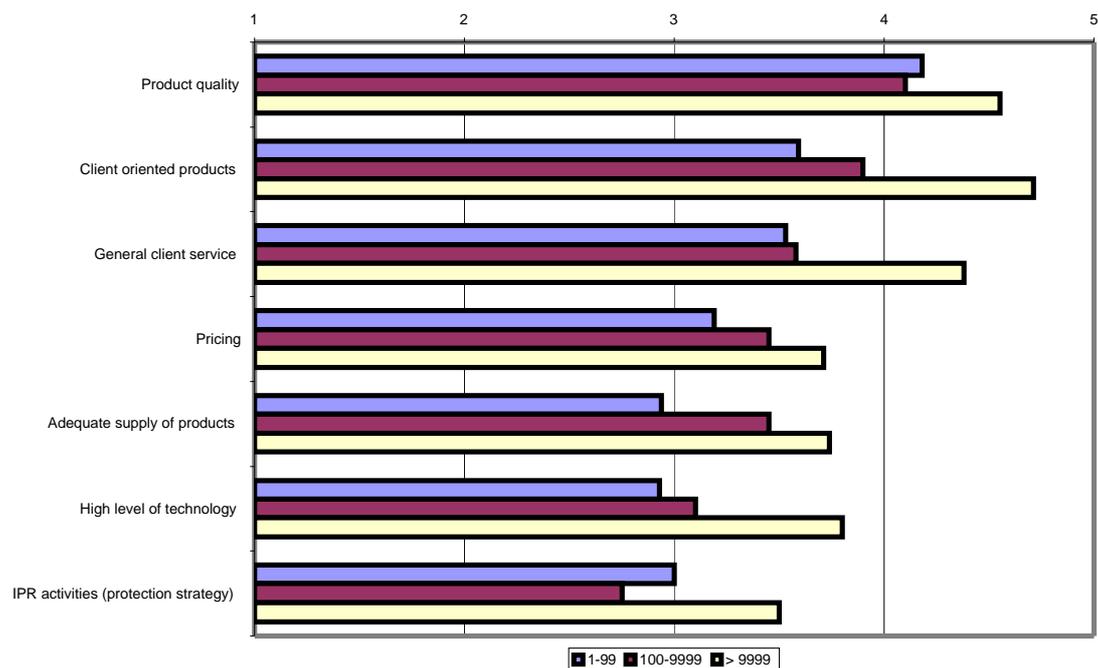
Source: ZEW 2002; Nace codes in brackets

⁴⁸ Cf. Eurostat (2000), p. 38.

Since trademarks enjoy a rather high importance⁴⁹ among the 65 companies analysed, the shares of companies using trademarks in the German service sector are also reported in Figure 4.3-10. On average, the share is slightly higher at around 7.8%, but still just half of the portion in the manufacturing sector. Companies in the wholesale trade, providers of technical, computer and communication, and financial services, and real estate and renting services make use of trademarks more often than the average. It is not evident whether a substitutive or a complementary relationship between patents and trademarks exists at sectoral level.

The relatively low importance of both the intellectual property rights as formal protection instruments, with the exception of trademarks, and the informal means can be explained by the overall assessment of the IPR activities in relation to the other business activities of the companies. Figure 4.3-11 demonstrates obviously the restricted importance of the IPR activities compared to the much higher weight the companies attach to product quality, client orientation, client service, price, adequate supply of products and services and a high level of technology. This picture represents the current situation. Nevertheless, many companies indicate that especially their IPR activities and their IPR portfolio will gain more importance in the near future.

Figure 4.3-11: Importance of different business assets including IPR activities differentiated by company size (1 = not important to 5 = very important)



⁴⁹ In the sample of case studies, over 80% of the companies claim to have registered trademarks.

In order to identify the relationship between the different protection instruments, different approaches can be followed. Instead of a large correlation matrix, a comprehensive overview can be reached by performing a factor analysis, which identifies different types of companies concerning their preferences for protection tools. In Table 4.3-1, the result of the factor analysis is presented. Four factors have been identified. There is obviously one group of companies for which the whole set of intellectual property rights is of major importance (Factor 3).⁵⁰ A second set of more informal strategies consists of using secrecy, gaining lead-time advantages and taking care of customer relations (Factor 1). Thirdly, the protection of the inputs into the innovation process, human capital and deliveries from other suppliers, by legal contracts is another combination of strategies (Factor 2). Finally, the technical solutions of using a complex product design and embodying intangibles in physical products characterise a last pair of tools (Factor 4).

Table 4.3-1: Protection types: results of a factor analysis

	Factor 1	Factor 2	Factor 3	Factor 4
Patents	-0.256	0.284	0.656	0.223
Trademarks	2.01E-02	-8.24E-02	0.810	-7.27E-02
Copyrights	0.355	-0.391	0.604	-0.152
Secrecy	0.761	3.39E-02	-5.85E-02	-7.19E-02
Long-term labour contracts	4.68E-02	0.824	2.30E-03	4.55E-02
Lead-time advantages	0.637	8.79E-02	0.167	0.449
Customer relationship management	0.684	0.377	1.80E-02	0.143
Exclusive contracts with suppliers	0.352	0.686	-5.60E-02	-2.96E-02
Complex product design	1.50E-02	-1.45E-02	8.04E-04	0.892
Embodying intangibles in products	0.483	9.54E-02	-0.101	0.500

Besides the differentiation by company size, the importance attached to the different formal and informal protection instruments depends also on the objects which the companies like to have protected, since there is a difference in appropriateness whether one tries to protect inputs necessary for the innovation processes, the service processes themselves or the innovative outputs. Table 4.3-2 highlights the significant results of a t-test, which tests the difference of importance of different protection instruments between companies expressing a demand for protection related to the different objects covering the whole spectrum between IT-hardware and customer relations.

⁵⁰ The importance of patents does correlate significantly with the importance of trademarks as a protection instrument.

Table 4.3-2: Relationship between objects of protection and importance of protection instruments⁵¹

Protection Instruments	Objects of Protection						
	IT-hard-ware	IT-soft-ware	Other technology	Internal process knowledge	Unique skills of staff	Market knowledge	Customer relations
Patents	+++	+++					
Trademarks		++		--			
Copyrights		++					-
Secrecy		+		++	++	++	++
Long-term labour contracts							
Lead-time advantage		++				+++	+
Customer relationship management					+	++	+
Exclusive contracts with suppliers							
Complex product design		+				+	
Embodying intangibles in products							

Focusing on the three major intellectual property rights, the following picture appears. For companies which like to protect their IT-hardware and -software, the importance of patents as protection tool is significantly higher than in companies with no interest in protecting their hard- or software. For those companies which wish to protect their more "soft" or intangible assets, patents are likely to play a less important role. Consequently, this result confirms that patents are more appropriate for hardware and software as outputs of the innovations process and not applicable for the protection of inputs, internal processes or relations to customers. Trademarks and copyrights are only significantly more important for companies safeguarding their software. Trademarks have even a significantly lower importance for those

⁵¹ The plus and minus represent significant differences of t-tests comparing the ranking of importance by companies protecting vs. not protecting the respective objects (+++/- = 1% level of significance; ++/- = 5% level of significance; +/- = 10% level of significance). For the reader, the three plus in the first cell express that companies which want to protect their IT-hardware attach a significantly higher importance to patents as a protection instrument than companies for which IT-hardware protection is not important.

companies wanting their internal process knowledge to be protected. The same negative relationship exists between the importance of copyrights as protection tool and customer relations. Intellectual property rights lose importance when internal processes or the relationship to the customers is crucial for the company.

By contrast, secrecy is a meaningful mechanism, especially for companies which like to protect their internal process knowledge, the unique skills of their staff, their market knowledge and their customer relations. In addition, secrecy is an important protection instrument in the software sector, since two distinct features of software are the low cost of copying and distribution. They threaten the economic value which a software innovation represents for a company, because the existence of one undesired copy due to imperfect secrecy can theoretically destroy the whole potential demand for a new product. Since secrecy is partly given up as soon as a new software enters the market, although customers are in general not allowed to give away copies, lead-time advantage is obviously important in the software sector. Gaining a lead-time advantage is significantly more important for companies which try to protect their developed software. Lead-time advantage has a special function in the software sector, which belongs to the so-called network industries.⁵² Market success of software relies crucially on its broad and fast distribution in order to generate positive network externalities, which increase the value of the software for the users. Companies are therefore able to demand prices which significantly exceed their production costs. By being first in the market with a new software, it is much easier to realise a broader usage of the product and to generate the mentioned network externalities, since the longer a user works with software of a specific supplier, the higher the switching costs if he wants to change to a software of another supplier, even if its quality and its spectrum of features is superior to the product in use.

Since the satisfaction of the needs of the customer is crucial for the success of service companies, meanwhile significant resources are devoted to the management of customer relations. Therefore, especially for companies which attach a high value to their customer relations, but also to the market knowledge, customer relationship management enjoys an importance much above average among the protection tools. There is even a slightly higher importance of customer relationship management for those companies which try to protect the unique skill of their staff – a relation not obvious to explain.

Besides secrecy, a complex product design is preferred by companies eager to protect their software. Following this way, the companies apply mechanisms to prevent the decompilation of software and other piracy protection.

⁵² Compare the textbook of Shy (2001) regarding the economics of network industries.

The overall picture of the relationship between the objects the service companies want to protect and the assessment of the importance of the protection tools allows us to derive the following general conclusions. First, intellectual property rights are obviously appropriate to protect the output of the innovation process. And patents are able to cover even both IT-hardware and -software. Second, the crucial input factors, the knowledge about the service process itself and the relations to the customers, which are often more important for the business success, cannot be protected by intellectual property rights. Consequently, secrecy, lead-time advantage and customer relationship management enjoy a higher valuation by companies which safeguard especially these assets. Finally, software is a special case, since not only all of the proposed intellectual property rights but also the more informal instruments of secrecy, lead-time advantage and complex product design enjoy a higher importance for the companies concerned.

4.3.2.6 The Role of Intellectual Property Rights

Since the major objective of the whole study is to identify the role of patents in the service industries, a separate chapter is devoted to the motivations of the service companies to use formal intellectual property rights, including patents, trademarks and copyrights. The inclusion of the two latter instruments can be justified by two arguments. First, according to the ranking in Figure 4.3-9, both instruments achieve a higher importance than patents, and second, in contrast to patents which are closely related to the protection of an invention or innovation the registration of trademarks in particular does not absolutely require an inventive or novelty aspect.

4.3.2.6.1 Patents

First of all, concentrating just on patents, the share of companies which uses this protection instrument is about half of the total sample and even more than 60% of the companies assess patents of low importance. Furthermore, only one quarter of the companies follows an explicit patent strategy, discusses regularly about patents and patent strategies and contributes a high importance to patents for protecting their knowledge. If one takes into account the high evaluation of the share of companies with their origin in the manufacturing sector, the use and the importance of patents for service companies are not so different from the above mentioned result of the Second Community Innovation Survey and the Third Community Innovation Survey in Germany.

Companies have difficulties with attributing patents either to the service or the manufacturing area. Consequently, only two thirds of the companies can differentiate between these areas and there are no significant differences between patents applied for service-related or manufacturing-related products. In contrast, the companies apply for patents mostly for product innovations and only to a little extent for

process innovations, this pattern is also observed in the manufacturing sector. The broad majority of the companies using patents claims that they make a patent application only for the minority of the innovations expressing that the majority of innovations in the service sector is not patentable.

Since we have observed in the last few years a strong increase of patent applications, whereas the expenditures for research and development have been constant in most countries, there seems to take place an entangling between R&D as input and patents as output of the innovation process. Regarding the sample, we find the following relationships. The percentage of expenses for innovation, including expenditures for machinery and software, on the total turnover does not correlate both with the use of patents and the patent intensity, defined as granted patents per employee. However, companies with higher shares of personnel working on product and process innovations hold also more patents per employee. This result is confirmed through the positive relationship between the assessment of the importance to perform R&D internally and the appraisal of patents as protection instruments. Summarising these observations, it becomes evident that service companies with own R&D activities are both more likely to use patents and more active in patenting compared to companies with little or no own R&D effort.

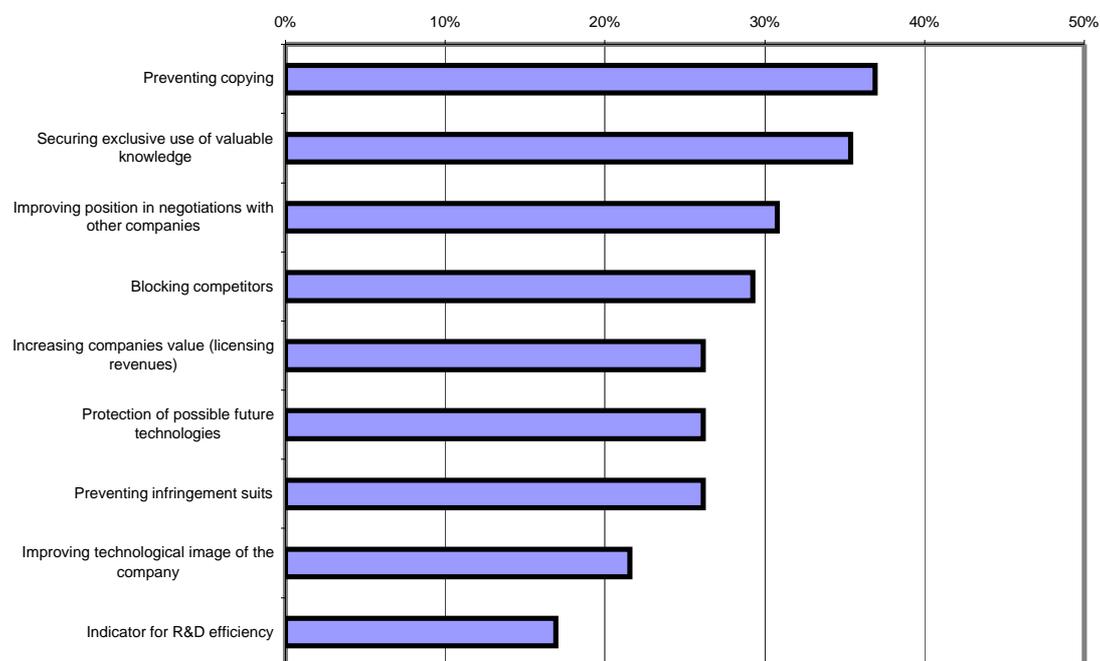
The most important destination area of the patents applied for is Europe, but closely followed by United States, which is as important as the home country. Only in Japan is the patent protection slightly less important than in the other regions.

Most of the patents are exploited by the companies themselves, an exploitation by other companies through licensing out is in contrast to the manufacturing sector in most cases not yet broadly developed, although sophisticated licensing strategies are gaining in importance. The majority of the granted patents are kept in force between six to ten years.

In Figure 4.3-12, the ranking of the most important motives for patenting is presented. Most important reason for patenting for the companies analysed is the traditional motive to prevent competitors from copying their own innovations, which is closely related to securing the exclusive use of valuable knowledge. The more strategic motives of patenting, like to improve the position in negotiations with other companies or to block competitors' patenting activities, are of secondary importance. Finally, increasing the company's value, protecting possible future technologies and preventing infringement suits are important only for half of the companies using patents actively. Only for a minority of companies do patents contribute positively to their technological image or serve as an indicator for R&D efficiency. The latter is only true for large companies with origins in the manufacturing sector, since they have both a long-lasting experience with patents and enough applications per year in order to be able to calculate reliable and comparable indicators.

Although the number of cases is rather limited, the rankings by the small, medium and large companies show some obvious differences. It turns out that the order of patent purposes among the large companies is more or less reflected in Figure 4.3-12. For medium-sized companies, the prevention of infringement suits is the third most important motive for patenting, whereas this reason is of least importance for small companies, which value in contrast the improvement of their technological image very highly, as well as blocking their competitors and improving the negotiation position in relation with other companies. Although the number of observations is too small to claim a sound statistical basis, these results give hints that patenting in the service sector is driven by different factors, depending on the company size.

Figure 4.3-12: Main motives of companies for patenting (share of companies)

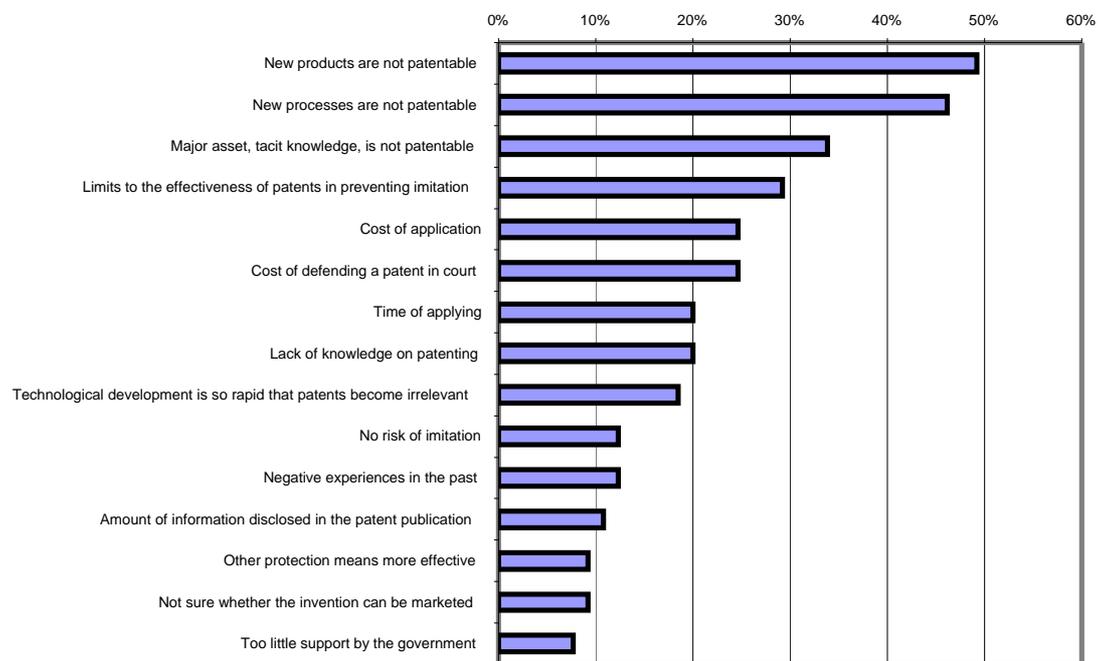


Patents also have an important information function which is certainly true for the manufacturing sector. However, two thirds of the service companies using patents actively know and use also patent information databases. Around half of the companies observe the patenting strategies of the competitors, and scan patenting activities in the market in general and own patenting requirements and possibilities.

In order to gain more insights into the low usage of patents by service companies, it is helpful to have a look at the reasons which prevent companies from patenting. The general perception of almost half of the interviewed service companies is that their new products and services including their tacit knowledge are not eligible for patenting. More than one quarter of the companies doubts the effectiveness of pat-

ents in preventing imitation and a fifth of the respondents claim that patent protection is irrelevant, since the technological cycles are becoming shorter. The cost and time argument is also of secondary importance for not using patents. Finally, at least one fifth of the companies admit their limited knowledge about patent protection. All other motives for not patenting are only important for a very restricted group of companies. Surprisingly, the support of the government is insufficient only for less than 10% of the companies.

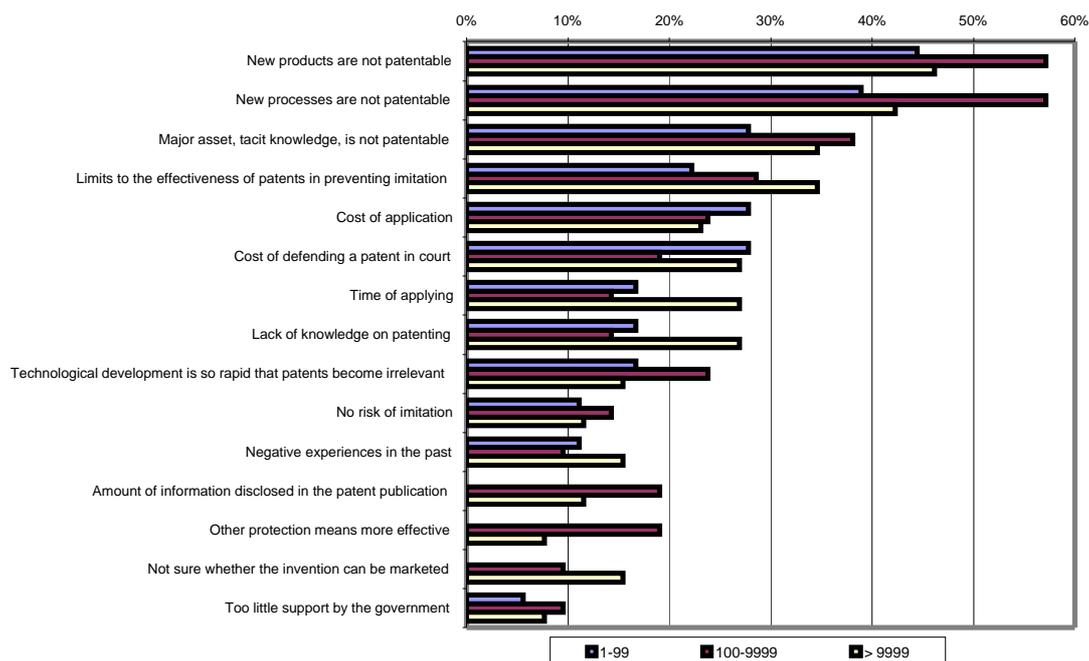
Figure 4.3-13: Reasons of companies for not patenting (share of companies)



Concerning the aggregated statistics, the low use of patents could only be corrected by a drastic change in the patent system, by opening it up to services and service delivery processes. Taking into account the recent discussion about software and business patents, this former unreal option may come true, at least in very specific niches of the service sector. For the majority of inventions, it will not be feasible. Therefore, one has to concentrate on measures facilitating patent applications in order to increase the share of service companies using patents. In order to make the SME dimension more explicit, Figure 4.3-14 differentiates the reasons not to patent by company size. Whereas the general doubts respective to patents are less important for small service companies, the application costs are the only reason which is more important for this group compared to medium-sized and large companies. From this observation it can be argued that this negative aspect of patenting may be solved by some policy initiatives targeted to support SMEs in the service sector.

Besides building up know-how, administrative support in the application process, but also in defending patents in court seem to be effective.

Figure 4.3-14: Motives of companies for not patenting differentiated by company size (share of companies)



4.3.2.6.2 Trademarks

Trademarks provide protection for marketing assets such as brands or the names of firms.⁵³ A mark (the trademark is the most common form of mark) is a distinctive sign used in association with goods or services to distinguish them from those of competitors. If properly protected, it gives the owner the right to prevent others from using it. The mark can be made up of names or numbers, devices or figurative elements such as shapes and colours, sounds, or of a combination of such elements. The owner of a mark, which conforms to specific conditions and which has been accepted and registered with the authorised agency, has exclusive rights. In other cases the owner cannot claim any exclusive rights. A registered mark gives its owner a monopoly on the use of that mark for a fixed period, usually 10 years, and for specific goods or services, within a defined territory. The registration of the mark can be renewed any number of times.

⁵³ A study of PriceWaterhouseCoopers edited in 1999 confirms the importance of marks for a sample of over 100 German companies.

An important requirement for trademark protection is their actual use in the marketplace, so that marks reflect not only a potential, but a real use of a new service. In principle, it is possible that marks are applied for existing services. But one can assume that in most cases, the registration of a mark has the function of supporting the introduction of a new service.

According to Figure 4.3-9, the registration of trademarks and the use of secrecy are the most important strategies to protect innovations in the analysed service companies. In contrast to patents, which are mostly preferred by very large companies, this company size bias is far less significant in the use of trademarks. Therefore, trademarks are relevant for a broader group of service companies, especially including small companies. Consequently less than one fifth of the companies analysed make no use of trademarks. Although trademarks are frequently used by the companies, not all of them follow explicit principles in their decision processes or have regular discussions about their trademarking strategies. This observation is accompanied by a very dispersed responsibility for the whole process, ranging from the marketing department, the single product developers or the legal department in charge of trademarks. If trademarks are registered, they cover mostly services, but also a significant minority is dedicated to products. The number of registrations per year is mostly limited to very few, only the large globally active companies extend their trademark portfolio by more than one hundred new registrations per year. However, not only these large companies, but also medium and even some small companies acquire not only a registration at the national trademark office, but are likely to extend the coverage to the whole European Union by registering community trademarks at the office in Alicante. Analogous to the need for a European patent, a community trademark was established in 1996.⁵⁴ Since then, it is possible to achieve a uniform right applicable in all Member States of the European Union with only one application at the Office for Harmonisation in the Internal Market (OHIM). This new option is appreciated by many of the companies and therefore, only little criticism was expressed and negative experience reported regarding the existing regime.

Due to the slightly different functions and claims of trademarks, the motives of companies for registering trademarks have to be presented and analysed. In Figure 4.3-15 a ranking of the motives differentiated by company size is presented. Most important for all company sizes is to increase the visibility in the market. This incentive for trademarking is very different from the rationale of patents and belongs definitely to the marketing and not directly to the companies' innovation strategy. For small companies active either in a locally restricted market or possessing close relationships to their customers, the visibility argument is slightly less important. The same is true for trademarks supporting the company's corporate identity due to

⁵⁴ <http://www.oami.eu.int/en/role/brochure/br1en08.htm>

small number of employees. In contrast in medium and large companies, trademarks are a crucial element for the strategy to build up a corporate identity. The intention to protect a specific product comes in only in the third position in the ranking of the motives. Although the protection dimension is common to both patents and trademarks, trademarks are focused on the protection of products and services alike. Consequently, the need to protect specific knowledge or technology has low or almost no importance for the registration of trademarks. In contrast, patents aim to protect firstly technology, on which new products may be based. Furthermore, similar to patents, trademarks help also to increase the value of the company. However, whereas the value-enhancing effect of patents relies mostly on the generation of licensing revenue, the value of the intangibles trademarks is mainly based on the attention the companies' products and services receive in the market and only in very rare cases on the revenues achieved by licensing out trademarks. Finally, a phenomenon similar to patent races or usage of patents to block competitors can – at least at the moment – not yet be observed in the area of trademarks in the service sector, since the motive to counter trademarks of competitors does not play a significant role.

Summarising the importance of and the motives for registration of trademarks, significant differences to patents can be observed. First, trademarks are a much more important protection instrument than patents, which play only a restricted role for service companies. Second, trademarks are mainly used for marketing and corporate identity reasons and to protect specific products and services. Since trademarks are a restricted protection instrument, consequently only to a very limited extent, do the companies try to protect specific technologies by means of trademarks in contrast to patents. In Table 4.3-2, the significant relationship between companies seeking to protect software and the importance of trademarks is highlighted.⁵⁵ Since trademarks increase the visibility of products in the market, they are an important accompanying strategy to promote positive network externalities⁵⁶ in the software sector.

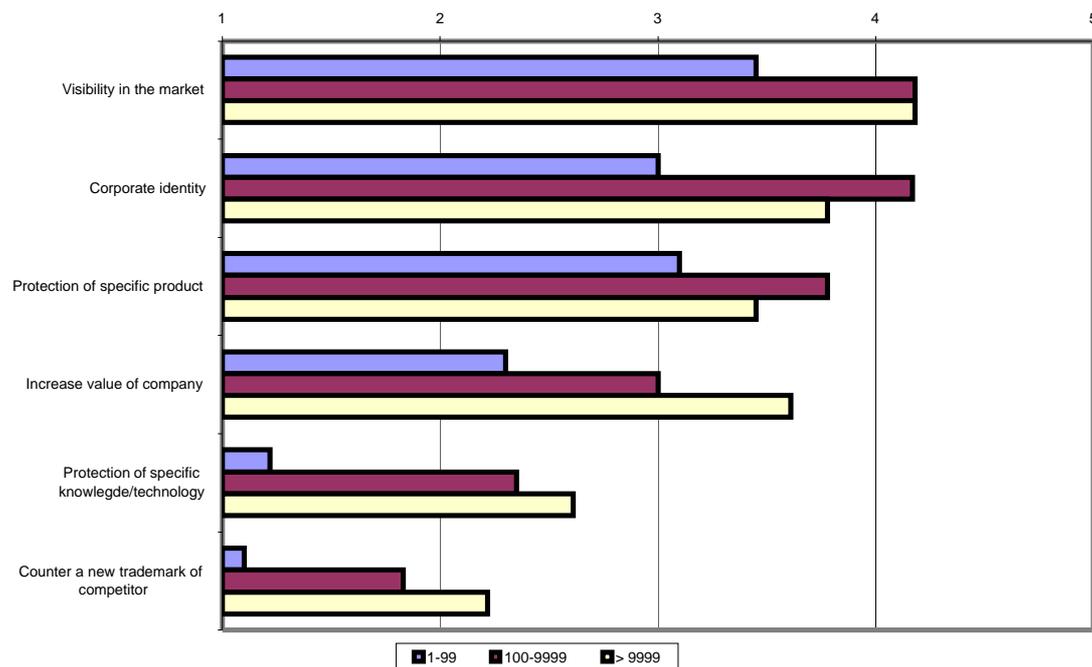
Although trademarks are much more often used by service companies than patents, they can serve only to a very limited extent as an indicator for new technologies and are also a distorted indicator for innovative services, since trademarks are often a crucial element of the marketing strategy of the companies which just seek to increase the visibility of their services in the market. In addition, the corporate iden-

⁵⁵ This result is confirmed by Blind et al. (2001), who found out in a survey among German software companies that 60% of them actively use trademarks.

⁵⁶ Positive network externalities are caused by the effect that additional users of network goods, like physical telecommunication networks, but also like virtual networks of common (computer) languages, add to the utility of the already existing users by increasing the possible communication possibilities or by simply increasing the market for complementary products (hardware), which may cause price decreases or higher product varieties in the long term.

tivity of service companies is often closely linked to their portfolio of trademarks, a motivation which is even further away from innovative technology and services.

Figure 4.3-15: Motives of companies for registering trademarks differentiated by company size (share of companies) (1 = not very important to 5 = very important)



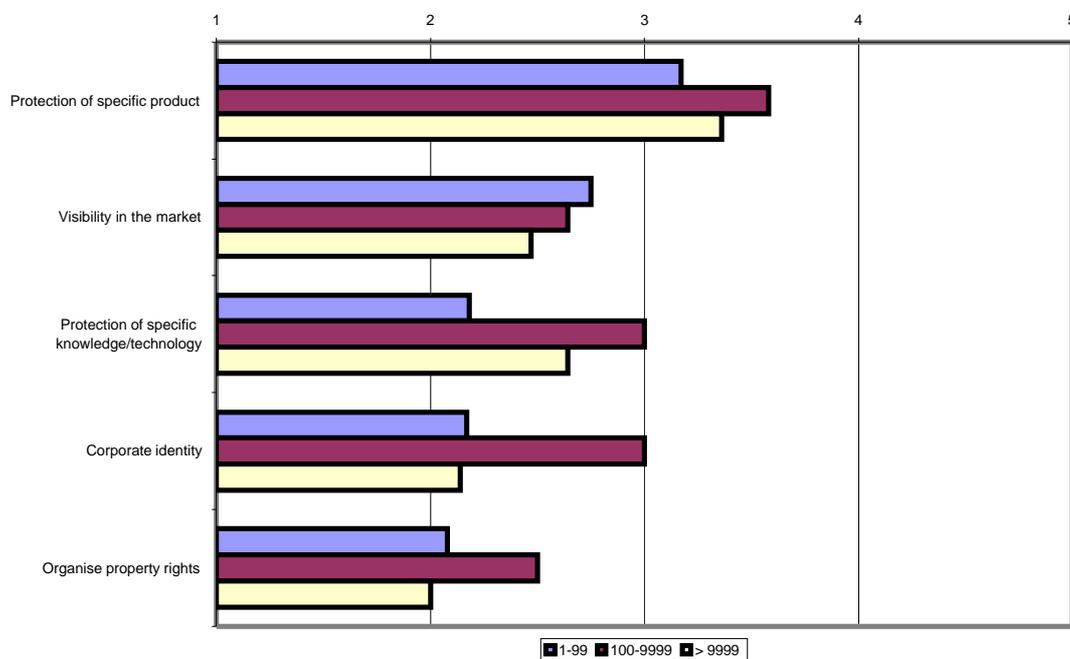
4.3.2.6.3 Copyrights

The final formal intellectual property right to be analysed is the use of copyrights, which do not have to be registered, in contrast to patents and trademarks. Copyrights are significantly more important for the service companies than patents. However, they do not reach the importance of trademarks based on the aggregate of all companies. Moreover for patents and trademarks, we observe the typical size bias with large companies assessing a higher importance to these formal instruments. This is not true for copyrights, since small companies attribute the same importance to this instrument as large companies do. Furthermore, copyrights are even more important for small companies than the registration of trademarks. This phenomenon can be easily explained by the cost and expertise arguments. Whereas trademarks, but especially patents, incur significant registration or application fees and require a critical mass of legal knowledge, copyrights can be used without incurring registration costs or hiring a lawyer for the legal and administrative procedures.

Concerning the motivations to make use of copyrights, there is a similarity to the

pattern of trademarks, although all motives are slightly less important compared to trademarks (Figure 4.3-16). The most important incentive for using copyright protection is the protection of a specific product, mostly software or other kinds of information. All other motives do not reach even medium importance. Second in the ranking of the motives, especially for small companies, is to increase the visibility of the services supplied in the market, third the protection of specific knowledge or technology. Finally, copyrights also underline the corporate identity of the service companies to a limited extent.

Figure 4.3-16: Motives of companies for using copyrights differentiated by company size (share of companies) (1 = not very important to 5 = very important)



4.3.2.7 Conclusion

Although the number of the service companies included in the study is rather limited to perform sophisticated statistical analyses, the presentation of the quantifiable data collected in the interviews was sufficient to elaborate structural patterns of innovation behaviour and protection strategies in service companies, including differences depending on company size.

However, the heterogeneity of the innovation activities and the implementation of strategies to protect company-specific knowledge and technologies between the service sectors requires a differentiation by sectors. Since only a very limited number of cases are available for single sectors, in Chapter 4.3.4 qualitative pictures of seven service sectors are sketched out.

4.3.3 Empirical Evidence of the Hypotheses Derived From the Conceptual Model of Knowledge Regimes in Service Sectors

Knut Blind

In Chapter 3, a conceptual paradigm and framework of knowledge regimes, appropriability and intellectual property protection has been developed and hypotheses have been derived about the divergent use of formal IPR and informal protection instruments by different service sectors. The application of this paradigm and the test of the postulated hypotheses require, in a first step to typologise the 65 companies analysed and to form sector-like clusters. Then, in a second step, the importance of different types of IPR regarding these clusters is analysed.

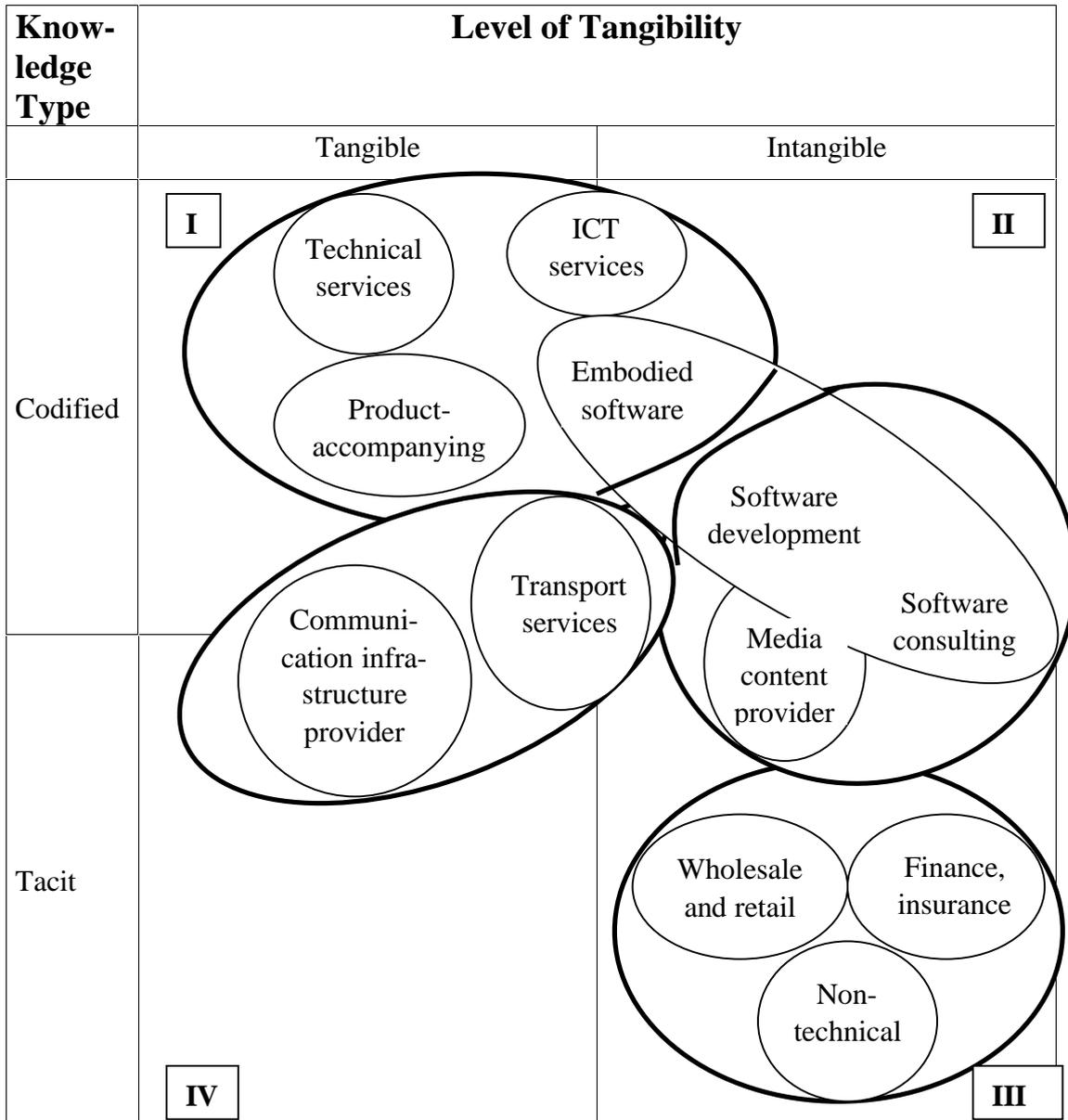
The companies or sectors are arranged into the four cells defined by the two dimensions of the degree of tangibility and the type of knowledge. Based on the description of the companies, their major assets used and services provided, the following mapping is the result of the application of the typology. Although very often no clear-cut distinction is possible between the categories in contrast to the a priori application of the model, where a very simplified approach is applied attributing a service sector just to one cell in the matrix.

Moreover, in reality both the tangible-intangible dimension and the tacit-codified dimension represent a continuum. And most service sectors cover different cells, since they are not only located at the very extreme positions of the two dimensions, but mostly in between. Consequently, in contrast to the ex ante application of the model, based on our case studies we will be more precise and locate the companies or the respective sectors between the four quadrants and form clusters of different, similar sectors in order to reach a critical mass of observations for some quantitative analyses. However, we still try to form clusters of homogeneous cases.

In quadrant one, those services, analysed in our sample, are clustered which deal mostly with tangible assets and deliver mostly services involving codifiable knowledge. This area covers services directly using and helping to run and construct physical goods. Knowledge within these framework conditions is explicit, codifiable and apparently transmittable. First, technical engineering services fall under this category, since they rely or deal directly with tangible assets, like machines or other kinds of technology. Furthermore, mostly codified knowledge in form of technical documentation is involved. Closely related to technical services are ICT services, which deal with hardware components and deliver also codifiable outputs, like manuals, instructions and switching diagrams, ICT services and the development of software which is embodied in hardware components and certainly codified in its respective programming language. Finally, product-accompanying services, like maintenance and repair, are closely linked to physical products. A group of companies, which deal both with tangible and intangible assets, are those enterprises developing software embedded in hardware, like machinery, robots or cars.

The second quadrant classifies companies of our sample which deal more with intangible assets, like software or movies, which themselves belong to the category of codified knowledge. Besides codified knowledge, also to some degree tacit knowledge is involved, both as input like the problem solving capacity of software developers and as output in form of reputation or attention.

Figure 4.3-17: Clusters of service sectors differentiated by knowledge regimes



The combination of a high degree of intangibility and tacit knowledge describes the service companies and sectors in the third quadrant. Here, we find the non-technical service companies of our sample in the widest sense, including whole-sale and retail companies and the financial sector. Customer relations and the skills of the staff,

like those of brokers in banks, are decisive for the success of these companies. Especially, since some of them deal with standardised tangible goods, which are not able to differentiate competing companies.

The fourth quadrant is characterised by a high level of tangibility especially of the infrastructural inputs necessary for providing the services combined with more or less tacit assets, like specific skills of the staff or individual customer relationships. The case analysis has shown that typical companies fulfilling these criteria are transport companies, like freight forwarders, railway companies and airlines. In addition, telecommunication carriers also rely on large and complex technical infrastructures. Furthermore, the knowledge involved is also codified in the sense of the used software running the digital telecommunication networks or the physical transport systems, like airlines or railroads.

In Figure 4.3-17, the four clusters in the respective quadrants are presented. As already pointed out, we have modified the clear-cut distinction made in the conceptual Chapter 3 and located along the two dimensions. The clustering is based on the information provided by the case studies, based on personal interviews with company representatives responsible for IPR and innovation related issues.

Based on the conceptual model worked out in Chapter 3 (see Figure 3.3-1), hypotheses about the use of various IPR in service sectors depending on the respective IPR have been derived. These main hypotheses focused on the four cells of the matrix can be articulated as follows:

- (1) With services associated with more codified forms of knowledge and working with tangible assets and goods, the intellectual property mechanisms to protect such property would be the patent system (Cell 1).
- (2) Service sectors active in a regime of codified knowledge and more intangible assets look first for copyright protection, but also trademarks (Cell 2).
- (3) The registration of trademarks is most appropriate in a knowledge regime characterised by a high degree of intangibility and tacit knowledge (Cell 3).
- (4) In a regime where tangible assets are combined with tacit knowledge, formal IPR are of little importance and informal strategies play a major role (Cell 4).

Figure 4.3-18 presents the assessment of four clusters of service companies. The cluster with its focal point in cell 1 is named "Hardware-related services". The sectors covering both cell 1 and cell 4 are "Transport and communication sectors". In contrast, the cells 2 and 3 are touched by "Software and media services". Finally, cell 4 is filled up with "Non-technical services (finance, sale)".

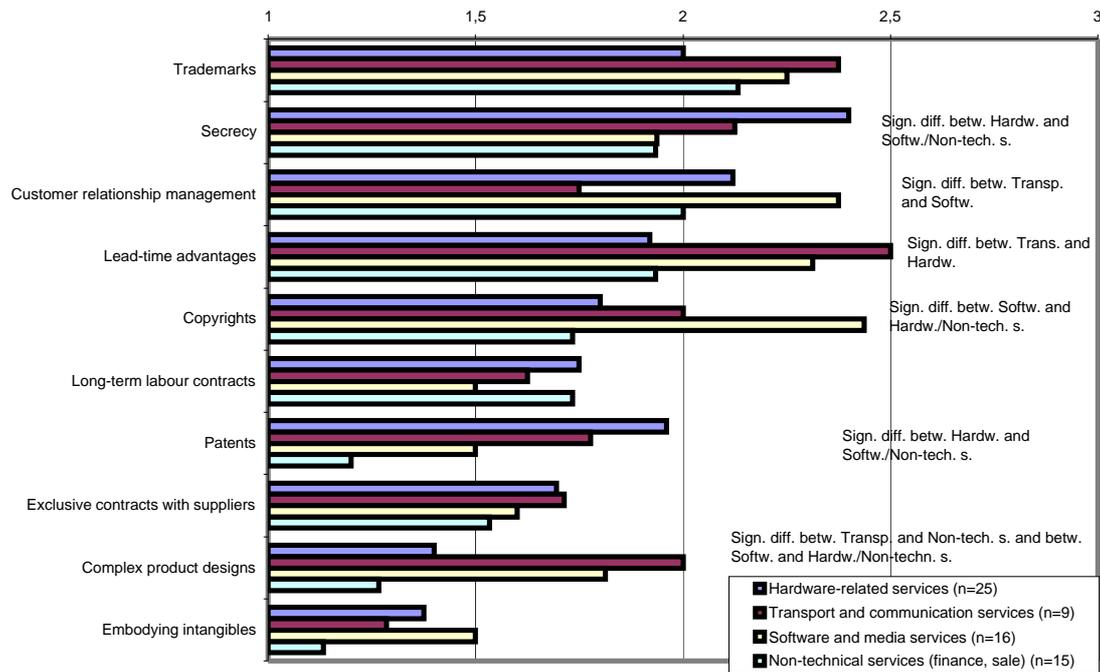
Looking at the results of comparative t-tests, one has to take into account the small number of observations (nine) in the "Transport and communication services" and

25 in "Hardware-related services", which do not allow obvious differences in the statistical sense.⁵⁷ Nevertheless, some significant results can be reported. Regarding patents the first postulated hypothesis can be confirmed. "Hardware-related services" assign a much higher importance to them in comparison to "Software and media services" and "Non-technical services". Although the differences to "Transport and communication services" can be neglected, which is in line with the arrangement of this sector in-between cells 1 and 4. Furthermore, the hypothesis emphasising the very high importance of copyrights especially by the "Software and media services" is also confirmed, since these companies assess a significantly higher importance in comparison to both the "Hardware-related services" and the "Non-technical services". In addition, the difference between the "Software and media services" and the "Transport and communication services" is not so significant, which confirms the assumption about the importance of copyright-protectable software also for running the large and complex hardware infrastructures of transport and communication companies. The actual use of trademark registration does not follow hypothesis (3), since all four clusters of service companies attach a rather high importance to the registration of trademarks. Consequently trademarks obviously complement the use of patents or copyright protection and are no substitutive means for service companies. This is also because they are not used as protection tools but rather as marketing tools. This also explains their use across all sectors and knowledge regimes. The test of hypothesis (4) focusing on the importance of informal protection delivers an ambiguous picture. For the patent-emphasising "Hardware-related services", secrecy is much more important than for both the software and the non-technical services. However, the hypothesis is supported regarding the importance of lead-time advantage and complex product designs, since "Transport and communication services" evaluate them significantly higher than "Hardware-related services" regarding the first informal strategy and higher than "Non-technical services" for the second informal strategy. This result confirms that lead-time advantages are crucial for network industries.

Summarising the results of the proof of the four hypotheses, it turns out that the conceptual paradigm of knowledge regimes reflects rather well the actual use of IPR and other informal protection strategies by the different clusters of service companies. Even if one takes into account the very small number of observations, significant differences regarding the importance of protection strategies can be detected, which confirm the hypotheses derived from the conceptual framework.

⁵⁷ We report differences, which reach a level of significance below 10%.

Figure 4.3-18: Importance of different protection instruments differentiated by sectors (1 = not very important to 3 = very important)



4.3.4 Sector Studies

4.3.4.1 Introduction

Although the number of the service companies included in the study is too limited to perform sophisticated statistical analyses, the presentation of the quantifiable data collected in the interviews was sufficient to elaborate structural patterns of innovation behaviour and protection strategies in service companies, including differences depending on company size.

However, the heterogeneity of the innovation activities and the implementation of strategies to protect company-specific knowledge and technologies between the service sectors requires a differentiation by sectors, as already pointed out in the conceptual model of different knowledge regimes. Since only a very limited number of cases are available for single sectors, in this chapter just qualitative pictures of seven service sectors are sketched out taking a view of the structure of the respective markets, describing their innovation behaviour, analysing their IPR strategies and activities and finally focusing on their idiosyncrasies.

Due to uniqueness of some of the service companies analysed and the broad, often not comparable range of strategies and activities, the chapter does not conclude with a comparative view. A differentiated statistical analysis by sector is not possible due to the very small number of observations in most of the sectors. And the overall picture on basis of the whole sample was already presented in the preceding chapter.

4.3.4.2 The Retail and Wholesale Section

Jeremy Howells

4.3.4.2.1 Structure of the Sample and Sector Characteristics

The wholesale and retail trade sector together employ almost 20 million people, around one third of the whole service sector.⁵⁸ Most of the companies employ less than 10 persons, indicating the importance of small and medium companies. Given the very small number of cases (Table 4.3-3), the relative size of the overall sector, and the large company size of the case studies, a sectoral summary is at best going to be 'heroic'.

Currently, especially retailers face a very strong price competition. However, decreasing prices are only possible by a continuing optimisation of the value-added activities. Furthermore, the retail sector has witnessed consolidation in the form of mergers and acquisitions during the past few years and there have been no new entrants. In order to relieve the competitive pressure, an increased customer orientation is a further essential strategy of most retail companies.

Compared to other sectors, the level of innovative activity and consequently the importance placed on IPR is low. However, this may be changing as both retailers and wholesalers have to become more intelligent and knowledgeable buyers and as the logistics, e-commerce and Internet revolution increasingly have a role to play both in enhancing competitive advantage and in undertaking more commonplace, day-to-day operations. Furthermore, the companies in the retail sector can escape the cut-throat competition, which decreases the profit margins often to a very low level, only by innovations allowing a temporary relief from this very strong competitive pressure or the brief generation of significant profits.

Table 4.3-3: Wholesale and retail trade firms

Sector	Firm size	Country
Retail Trade	Large	Germany
Retail Trade (Drugstore)	Large	Germany/Austria
Retail Department Store	Large	United Kingdom

⁵⁸ The numbers are related to the NACE sectors 51 and 52 of wholesale and retail trade. Source: Eurostat (1999), pp. 145-148.

4.3.4.2.2 Innovation Assets and Strategies

Outwardly, there is very little innovative activity within the sector. According to CIS2, only one third of the wholesale companies claim to be innovative, a low share in comparison to the average of 40% within the service sector. All the companies surveyed in this sector have very low levels of innovative capacity, measured in terms of expenditures for internal R&D or Intellectual Property Rights (IPR) held. Because there is very little research and development within the enterprises, the companies depend on external inputs for their innovation activities. Therefore, all companies have to interact with technically competent and innovative partners, in particular and they have to be 'knowledgeable consumers'. The key innovative focus of companies is on Information Technology (IT) or process-related innovations where Intellectual Property (IP) protection is not significant or important. Despite this, innovation per se was not a central element within the firms' overall strategy.

4.3.4.2.3 IPR Strategies

All the companies had very little IPR activity. Since, in relation to the other obstacles for innovation the inappropriateness of the protection of innovations and of their exclusive appropriation is of low importance. The reason for this low assessment is the fact that the most important assets of the company which it tries to protect are its market knowledge and its consumer relations.

What involvement there is, is restricted to trademarks in the range from one to several hundreds. For one company especially, copyright is particularly important for defending intellectual property. In the future, most companies feel this could change as product designs become more significant or patents on process innovations associated with purchasing and transaction technologies.

By contrast with formal IPR above, for all companies informal protection mechanisms are very important, especially secrecy and lead times play an important role in their overall defence of their IP. These are seen as remaining important in a firm's overall strategy to protect its IPR, but also in relation to the lack of applicability or enforcement of IPR.

Basically, IPR mechanisms were not applicable to the sector, although whether this was a problem depended on the sub-sector and firm strategy. For one company the lack of applicability of IPR mechanisms is not seen as any problem to its overall strategy; however, for others IPR is difficult to process and register and not 'efficient' or easy to protect IP with.

4.3.4.2.4 Idiosyncrasies

The wholesale and retail companies have in most cases no internal research and development or innovation activities. Consequently, there are no physical objects to be protected by IPR, especially patents. On the contrary, these companies are confronted with the patent-protected products of manufacturers.

In contrast to the more defensive behaviour concerning patents, their trademark strategies are much more pro-active. They use trademark registration actively to increase its own value and to counter the trademark strategies of its competitors. Most of the products in the range of goods are protected by a dealer's brands which compete with manufacturer's brands.

4.3.4.2.5 Conclusions/Reflections

Retailers are innovative, not in the sense of developing new products by themselves, but both by screening and integrating new promising products in their product range and by analysing the trends of the consumer preferences. Consequently, they are not seeking patent protection, but are more confronted with the patent rights of manufacturers. On the other hand, they seek the competition with the manufacturer in the field of trademarks. Here, they promote their dealer's brands very strongly against the brands of the manufacturers.

Overall, the companies have no involvement with IPR apart from trademarks. They have no patents and generally the importance attached to innovation and IPR was low. However, there is a realisation that this is changing and that innovation is becoming more central to creating and maintaining a firm's competitive advantage. On this basis, involvement with formal IPR mechanisms, apart from just trademarks, is going to occur and will become more significant to their operations.

4.3.4.3 The Transport Sector

Ian Miles

4.3.4.3.1 Structure of the Sample and Sector Characteristics

The transport services sector accounted for 4.2% of value added in the EU-15 in 1997 (Eurostat 1999), with over 3.8 million employees in land transport (7% of total EU service sector employment), 260,000 in water transport (not covered in the case studies here), and 367,000 in air transport – another 1.8 million were in supporting auxiliary transport services.⁵⁹ Land transport enterprises tend to be small, most employing fewer than 10 employees and featuring relatively low average skill levels. Air transport enterprises are much larger with high average skill levels, in terms of higher education qualifications. In the CIS2 survey, substantially fewer transport service enterprises (29%) were found to be innovative than were service enterprises in other sectors (46%), though there were differences across countries, and air transport enterprises were much more likely to be innovative (47%). As with other service sectors, the most widespread aim of innovation amongst transport services, was to improve the quality of service offered. Other important factors were opening new markets, improving flexibility reducing labour costs, environmental damage, and energy and materials costs. Less than half of the innovating transport enterprises conducted R&D - much less than amongst innovating services as a whole. Typically, most innovating transport enterprises engaged in R&D on an occasional (rather than continuous) basis, and do not spend much on innovation. Only a small number – less than one percent – considered patents to be very important.

As with other service sectors examined in CIS2, sources within the enterprise were the most widely identified sources of information for innovation. Customers and competitors followed, with suppliers, and fairs and exhibitions also widely identified as relevant. The most widely undertaken innovation-related activities was the acquisition of machinery and equipment; with other common activities including the acquisition of other external technologies (including software), innovation-related training, and preparation for the introduction of innovations. Few innovating transport service enterprises had co-operative arrangements for innovation; overall, competitors were the most common partner for co-operative projects, though in some countries suppliers or customers were the most common partners.

In the sample of this study, the firms covered in the transport sector are two postal services, a railway company, an airport, and an airline company (Table 4.3-4). These are all large companies – some are among the largest employers in their countries. They are clearly exceptional in terms of European transport services, but their high levels of employment mean that their innovation strategies are liable to be

⁵⁹ The structure and innovation processes in transport services are described by Tether et al. (2000), from which source the discussion in this section is drawn.

socially important ones; while their strategic importance to national economies means that these strategies can also be economically significant. An important feature of several of the cases is that they have been state-owned companies that are now to a greater or lesser extent privatised or subject to greater market forces. These do typically remain heavily regulated services – and safety and/or security concerns are strikingly high in most of them.

We would expect the case study firms to be more innovative than the CIS2 account suggested – not only because larger firms tend to be more innovative – even if not always more innovation-intensive – than smaller ones. Earlier studies and reports in the press and elsewhere indicate that firms such as those covered here are intimately involved in substantial innovation projects – innovations in postal services include optical character recognition and automated sorting, in rail services innovations such as environmental impact minimisation strategies in rolling stock design, land remediation in old stations are undertaken. Thus we would anticipate that these cases display relatively high levels of innovation, and that technology innovation is nothing new for them. However, they may also share some characteristics with more average transport service firms.

Table 4.3-4: Transport firms

Sector	Firm size	Country
Air transport (airline)	Large	Sweden
Air transport (airport)	Large	United Kingdom
Logistics, mail, financial services	Large	Germany
Postal service	Large	United Kingdom
Transportation of persons and goods	Large	Germany

4.3.4.3.2 Innovation Assets and Strategies

Only one of the case study firms, a postal service provider, follows an explicit innovation strategy. Divisions need to ensure that their own innovation strategies are consistent with the principles established by the firm (e.g. ensuring Internet compatibility). Overall strategies are currently focused on synergy and integration of branch activities, especially in the wake of acquisitions and intensified competition. There is no central R&D unit (though there is a centre of excellence for IT solutions), and suppliers are an important source of new technological ideas.

The other postal service shares some of the above features, but does not have an explicit innovation strategy. However, considerable volumes of money are allocated to innovation, mainly oriented to cost reduction, efficiency improvement, and service quality. Furthermore, it does operate a small R&D group, and also has an engi-

neering group and many IT staff. It co-operates in R&D with university departments and other partners.

The interviewed railway company has no explicit innovation strategy, though it sees technological improvement as vital to its services and future and operates a technology development centre. The overall levels of expenditure here are rather low, since the main sources of technology are obtained externally, and practically all research projects are co-operative ones (with suppliers of technology and also private research institutes).

The interviewed airline company also has no explicit innovation strategy, and does not seem to see the need for one. The case study failed to ascertain the existence of innovative activity in the firm, although at the very least there must be acquired technologies to handle.

Finally, the airport services company is responsible for several regional airports, owned by a consortium of public authorities in its home region. It is highly technology-intensive, with a lot of IT-related technology development. There is no explicit overall innovation strategy, with innovation and development undertaken at individual directorships. Regulatory circumstances and efficiency improvements are main drivers. A small number of external suppliers (including ICT suppliers) are sufficiently sophisticated to be partners in this process. Thus innovation efforts are sometimes undertaken in such collaborations, sometimes on an in-house basis.

In finding a general assessment of the innovation strategies of these large transport companies, it becomes obvious that most of them do not follow an explicit innovation strategy, although it is crucial for them to apply continuously the most advanced technologies either developed internally, but mostly sourced from external suppliers.

4.3.4.3.3 IPR Strategies

The common feature of the cases is that they typically have little explicit IPR strategy, at least as concerned patents and technological innovations, but were often moving toward more elaborate and explicit strategies. Only one case seemed not to participate in this general move. Trademarks are generally highly important, and copyright and contractual arrangements are also significant strategies. Informal protection instruments, like secrecy, are also only of limited importance for these companies.

The one postal service has no explicit IPR strategy, though it is now beginning to examine patent possibilities more systematically (and uses external patent lawyers). IPR strategies mainly involve trademarks, where there are corporate strategies (and effort to integrate the strategies of new branches). The second postal service is in

the midst of intensified awareness of IP issues and development of IP strategy, with an internal group working on all IP issues. Patenting is becoming increasingly important. It is also administered by external lawyers. Trademarks are important and valuable, copyright is important (for stamps as well as publications), and registered designs are used for street furniture. Attention is being paid to relations with suppliers, to whom much IP has been "leaked" in the past. Unlike the other postal service, patent databases are used as a source of intelligence here.

The interviewed railway service has a large number of patents (mostly registered only in the home country). But an explicit IP strategy is very new. Recent years have seen a relocation of the IP unit to the technological headquarters away from an R&D site, and reporting to senior R&D management. The preparation of written guidelines aimed at substantially increasing the number of technological innovations that are patented. There is again an effort to be more proactive, especially in dealing with suppliers through technological agreements – important since the firm does not manufacture hardware, but does contribute to design and feature innovations.

The management of the analysed airline sees no rationale for patenting, but trademarks are very important. Trademark responsibilities are outsourced, though decisions are taken at a high level.

In the examined airport, there is again no written IP strategy, though the salience of IP is believed to be growing rapidly. The firm has only one patent. Trademarks are very important, especially in the world of electronic commerce. Copyright is applied to a wide range of published material, and software developments are becoming increasingly important. Contracts with suppliers and contractors are important for protecting designs in software and IT systems, as well as in other business products and processes.

Summarising the IPR and protection strategies of the transport companies, the very implicit innovation strategies they follow are also reflected in rather inactive IPR strategies. However, the progressing liberalisation and the intensified competition is raising the awareness about their importance and slowly also their activities in this respect.

Common issues concern the complexity of IP arrangements, in particular as they vary from country to country. An undertow of concern surrounds the match of IP arrangements to the circumstances of companies that are late in developing IP strategies.

The interviewed postal service appears to have insufficient experience of patent issues to have well-formulated views. The same is true of the airline, which sees little relevance of patents to its activities. The management of the airport similarly

raised no specific issues, but was grappling with the rising importance of IP for the firm, and the need to alert staff to this issue. Whether there is a role for public authorities – or private business services – in promoting awareness of the potential value of IP instruments to such firms is an interesting question, which will be addressed.

With respect to an increasing internationalisation, problems concerning the lack of uniformity of patent systems are considered significant ones by the other postal service. It is difficult to get good advice on such issues as (and international variations in approaches to) software patenting, rules about prior disclosure, etc. Legal processes make obvious that rulings on patent issues are made by technically uninformed judges.

The examined railway company is having to devote much more effort internally to establishing what is patentable, as a more explicit IP strategy is developed and implemented. In some circumstances, this could be seen as indicating the need for more clear and detailed principles in patent regulations. However, the firm's efforts might also suggest that there is a great deal of local knowledge that needs to be developed and linked to IP analysis, and that this task may require local effort as much as it calls for further elaboration of IP systems. Indeed, it could be that without better understanding of local circumstances and how they vary – including the circumstances of companies that are relatively late to developing IP strategies – IP regulations might well be developed in suboptimal or inequitable ways.

4.3.4.3.4 Idiosyncrasies

These are all large companies, and most are subject to considerable transformation in their competitive and regulatory environments. Their detailed circumstances are very diverse, but probably have elements in common with many other large service, infrastructure and utility companies.

While extending its national activities and aiming for a global presence, one of the postal companies appears to have limited awareness of the scope for patenting. This may stand it in poor stead when confronting US competitors, in particular, especially in the context of business process patenting. The other postal service examined is still publicly owned, though being brought to face stiffer competition, and anticipating more of this. Its management structures retain a legacy derived from the history of being an unchallenged public authority, however, and managers have relatively little focus on innovation. Problems such as economic uncertainty and difficulties with trade unions as efforts are made to restructure employment levels and working conditions are substantial preoccupations.

The railway company is in effect a privatised successor to a state monopoly, and faces competition mainly from other modes of transport. It shares with the still

state-owned postal service provider an effort to develop a more proactive IP strategy, especially with respect to ensuring that the firm obtains full credit for its contribution to technological innovations.

The airline analysed apparently regards technological innovation as a secondary function, if that, and handles IP on a case-by-case basis. This appears to be a much less developed strategy than that of many other airlines. Airports are very heavily regulated and safety conscious. The latter factor (together with the use of advanced technologies) means that a small number of expert suppliers serve this firm and many of its competitors. IP breaches of various kinds – imitation by competitors (direct or otherwise), and "passing-off" by other actors in its business environment - are seen as challenges to the interviewed airport's image. Along with some other companies in the transport sector, and some other cases in other services studied, there are active efforts to establish IP awareness among staff.

4.3.4.3.5 Conclusions/Reflections

Although transport technologies are progressing significantly, the companies providing transport services have not completely perceived the need to develop and apply definite innovation strategies including explicitly also IPR strategies. Obviously, some of these service providers are still state-owned and enjoy less competitive pressure. On the other hand, even a liberalised transport market reveals characteristics of a natural monopoly, which enjoys economies of scale over a wide range of outputs, like other public utilities. Consequently, the competitive pressure has been relatively restricted in the past. Recently, we experience both a further deregulation or liberalisation within the separated transport markets and an increasing competition between different modes of transport, like railway providers compete meanwhile with airlines in domestic flights. In addition, the transport sector becomes more international and first multinational transport companies emerge via large mergers and acquisitions. The responses to these challenges are twofold. On the one hand, transport companies seek for the implementation of innovative technologies trying to outcompete the rivals in speed, flexibility and comfort. On the other hand, the companies try to tie their customers closer to their services by means of sophisticated marketing instruments. Consequently, explicit innovation strategies have to be developed and implemented. And the key assets of their innovations, like technologies, but also skills and market knowledge, have to be protected more effectively, also by using the whole portfolio of IPR.

4.3.4.4 The Communication and Media Sector

Birgitte Andersen

4.3.4.4.1 Structure of the Sample and Sector Characteristics

The communication and media sample includes a broad range of activities and characteristics (see also Table 4.3-5). Three of the interviewed companies are the leading telecommunication service providers, not only within the country in which they are located respectively, but have also world-wide affiliates. Two companies are the leading mobile phone operators within the country in which they are located respectively. One company facilitates trading in postal businesses, including letter and parcel distribution and financial and postal services. Three companies are information and/or media content producers (mainly for television and radio) as well as distributors or traders of such. However, whereas one leading media content and broadcaster in the country in which it is located, and even in the world from a historical point of view is concerned with broadcasting its media content, another of the oldest and largest news service providers in the world and a small start-up company creating media content and related concepts specialise in developing trading systems and business-models for trading their information or media products. The remaining two firms that formed part of the interviews in this sector are solely media content producers (mainly for television and radio) and/or organisers of related activities. Media content production is generally regarded as manufacturing by the industrial classification schemes and by the firms themselves. However, the delivery of the media product or the assistance in media production to third parties is considered as a service. This explains why a firm whose primary activity is media content provider or producer is classified within "Wholesale and retail", whereas a firm whose primary product includes organising media-related activities is classified within "Communication and Media".

Several of the companies have close relations to the public sector by being either semi-public or mainly public or publicly regulated. Or they were privatised from being public to private in the 1980s and 1990s, as is the case with all the interviewed national telecommunication service providers.

Table 4.3-5: Communication and media firms

Sector	Firm size	Country
Information producer and trader of such	Large	UK
Media content producer	Large	UK
Media content producer and distributors and trader of such	Large	UK
Media content producer and organiser of related activities	Medium/Large	Germany
Media content producer and trader of such	Small	Germany
Mobile phone operator	Large	Italy
Mobile phone operator	Large	Greece
Postal business	Large	UK
Telecommunication service provider	Large	Germany
Telecommunication service provider	Large	UK
Telecommunication service provider	Large	Denmark

4.3.4.4.2 Innovation Assets and Strategies

The innovation assets and strategies are manifold for the communication and media sector. For all the communication and media service providers, integrating and extending the service range by offering ‘new services’ is essential. This is especially triggered by increasingly shorter life cycles of their products, which in turn also makes investment more risky. Innovation therefore is also in royalty management and royalty collection. This is especially very central when products are faced by huge investment (set-up and development costs), but also short period of returns. Innovation is also in the area of watermarking and encryption, in order to enhance the control of the flow of media and information content. Finally, innovation is in the area of developing better ways of creating and delivering and consuming the service.

Thus, overall, innovation is a central part of maintaining its competitive position. Only for one firm is competitiveness primarily related to price rather than innovation of new services or the way in which the service is produced, delivered and consumed. However, for the postal service provider, those two aspects of competitiveness are inter-related, as innovation should lead to cost reductions and improved efficiency, leading to competitive pricing.

The strategic challenges in a highly competitive environment of complex products are often met by acquisitions or more co-operative agreements with suppliers and technology providers or even public research institutes. Hence, innovations are also organisational. Some innovations include acquisitions of new especially software

technology, resulting in training programmes. Another strategically important aspect in risky communication and service business of short product cycles is ‘final consumer’ and ‘business’ customer relationship management (CRM), including exclusive contracts with clients and suppliers.

A variety of innovation sources are generally mentioned, including the more traditional R&D. However, not all media services firms have formal R&D, but recognise all their services as innovation as each of them are of distinctive character.

4.3.4.4.3 IPR Strategies

For media or information content providers rent is mainly captured via aggressive creation and management of copyrights and trademark royalties, which reflect the ways in which value is created from their creative expressions and symbolic material. Motives behind trademarking are branding, marketing and setting territories, and the motive for copyright is royalty generation through licensing. Although some of the firms apply science-based technology for their operations, they do want to compete as generators of such.

However, although copyrights are very important for the businesses, they are expensive to monitor. Especially in the United States, where cases of infringements are more important, as damages are much higher than anywhere else. This has however triggered important research and patenting on watermarking and related encryption technologies, mainly carried out by trading and broadcast service providers.

For telecommunication and broadcasting and trading systems, patenting has increased in activity. Even defensive patenting in the prevention of infringement suits is normal. In some cases patenting is not even viewed as an appropriate strategy due to risk of expensive infringement law-suit cases. Motives behind patenting have changed from being mainly about exclusive use of knowledge, to be about licensing revenue and signalling to competitors, customers and shareholders. Signalling will create a stringent bargaining power in R&D co-operation. Also, especially for complex technologies with broad and complex knowledge bases, creating patent-pools is important as the cost of future inventions will otherwise be too high. Licensing markets are expensive and highly competitive. IPR for both information and media content providers, as well as broadcasters or traders, are about being on all platforms in the technological web to maintain bargaining power in all of those areas when it comes to setting standards and for R&D collaborations.

One media content producer highlights the problem of patenting of business methods. The argument is that what services firms are good at is the way in which they do business – i.e. deliver their service – but business methods are not patentable in

the EU, as opposed to America, where it is argued that this opportunity allows to create territories for services firms.

Generally, in most cases the IPR strategy is well structured. Only for one mobile phone operator is tacit knowledge and distinctive know-how viewed to be more important than the more IPR-able inventions.

4.3.4.4.4 Idiosyncrasies

The communication and media sector has faced increased intensity in competition. This has both been in relation to ‘new services (product innovations)’, rapid evolutions of process technologies (ICT), and the emergence of new market needs (market-driven evolution). IPR have first more recently become effectively co-ordinated into the primary strategies of the communication and media firms. Also, huge investment in Internet technologies is also very recent.

Many of the firms interviewed had been government-owned enterprises or were heavily regulated by the public sector. Such regulations caused problems in competitive markets, as revenues in such cases (especially media services) are fixed by licensing fees. Hence, innovation is treated as a ‘cost’ to stay in the game, rather than long-term investment for growth. Such firms now consider that the only solution is to either look outside their public domain to profit maximise revenue from licensing, or they have to look for mergers with private firms.

However, the world is complex, and it should be recognised that although IPR is important for the communication and media sector, there are also many other problems to take care of in the management of an organisation to foster growth and development. This also became clear from all the interviews.

4.3.4.4.5 Conclusions/Reflections

IPR are becoming increasingly important strategic assets for communication and media firms, as the competition in this sector intensifies. To be a public or semi-public organisation in this game is difficult, as firms in such cases cannot employ all their means (type of service, content, market territories, and price) to compete in the game. There seems to be a trade-off between serving ‘the public interest’ in the short run, and managing the organisation for growth and development in the long run.

4.3.4.5 The Financial Sector

Knut Blind

4.3.4.5.1 Structure of the Sample and Sector Characteristics

In this chapter, the financial sector is defined in a broad sense including both four banks or financial services, one insurance company and one company involved in real estate activities (Table 4.3-6). All companies have established a number of innovative Web- and Internet-based activities, which complement but also substitute their existing range of services.

Due to an ongoing concentration process, the company size of banks, insurance enterprises, but also real estate companies is biased towards large or at least medium-sized companies. In addition, world-wide mergers create multinational companies also in these sectors. Both of these trends are reflected in the six companies analysed, since four of them have significantly more than 10,000 employees up to almost 100,000 employees, including also the affiliates in the United States. Despite the concentration process, the intensity of competition ranges between medium and high. Since the globalisation process in these sectors is just in an initial stage, the competition takes place mostly in a national framework, except for large banks, which already experience competition on an international scale. These large players consequently face also only a limited number of competitors. The same is true for narrowly specialised financial or real estate services. Nevertheless, despite the changing framework conditions towards an internationalisation and a high degree of competition, the companies in the banking, insurance and real estate sector show a good or even a very good performance.

Table 4.3-6: Companies in the financial sector

Sector	Firm Size	Country
Bank	large	Germany/US
Bank	large	Italy
Financial services	medium	Italy
Financial services	large	United Kingdom
Insurance	large	Germany
Real estate	medium	Germany

4.3.4.5.2 Innovation Assets and Strategies

With the exception of the still relatively conservative real estate sector, all other companies interviewed claim to possess an innovation strategy. Innovation activities consist mainly in a continuous effort to develop new financial or insurance

services and increase the quality of the existing ones, which confirm the incremental nature of innovation in the service sector. However, during the 90s many innovation activities were focused on the development and introduction of new services based on the use of ICTs (i.e. home banking). Technology therefore plays a relevant role in the banks and insurance companies though mainly as an "enabling factor", although some interviewees assess the importance of technology for the success of their business still as low, which indicates a certain degree of reluctance to accept the crucial role for the provision of their services.

Although innovation activities take place, some companies still have problems to quantify exactly the resources and personnel devoted to innovation. This is also caused by the fact that the most important sources of innovation consist in the acquisition of hardware and software which represent a sort of "technological platform", based on which the new services are developed. Nevertheless, internal research and development and R&D co-operations with technology providers are already of a significant importance with increasing emphasis in the future, since an efficient absorption of the acquired technology can be reached by a critical mass of internal staff with technological expertise. Finally, caused by the dynamism of the technological dimension, the human factor needs continuous training in order to avoid devaluating the human capital, and to exploit effectively and efficiently the options of the new technological base of the banking and insurance sector.

In contrast to other sectors, besides the improvement of the service performance and quality and extending the service range, including the penetration of new markets, the fulfilment of standards and regulations are crucial for banks and insurance companies. New financial services have not only to comply with the existing regulatory framework, but also the existing service range has to be adapted to changes in the regulations. Therefore, the latter is often as important as other objectives for "innovation". Finally, companies in these sectors become naturally 'risk averse' in relation to innovative activities, since their success does not only depend on the acceptance by the customers, but also by the regulatory institutions. Focusing on process innovations, the companies aim mostly for an improvement of the internal business processes and for a reduction of the labour costs as a dominant cost-producing factor.

4.3.4.5.3 IPR Strategies

For companies in the banking, insurance and real estate sector, intellectual property plays – at least at present – only an minor role. In relation to other competitive assets, the relevance of intellectual property rights is low or just medium. Consequently, the majority of the companies does not have an explicit IPR strategy and a lack of IPR has only a low importance as an obstacle to innovation. Major obstacle to innovations is instead the existing regulatory framework, which often does not adjust fast enough to current trends in business models and technology. This low

assessment can be explained by the fact that the most important asset the companies try to protect and to foster is their relationship to their private and professional customers. The acceptance of services these companies provide needs a certain degree of trust which the customers have to build up, although the regulatory framework in the financial and insurance sector is mainly devoted to customer protection. However, customer relationships cannot be protected by intellectual property rights. Another asset to be protected is the knowledge of the staff, often very crucial for the success of the companies, since they are responsible for a good relationship to the customers and the crucial investment decisions.

Consequently, most protection strategies have only a medium or even low importance for the companies. Besides gaining a lead-time advantage relative to their competitors, only trademarks possess a significant importance. The formal IPR like patents and even copyrights are not important at all. On the other hand, secrecy has also no special weight. One reason for this low rating is that public and regulatory pressure guarantee a certain degree of transparency of their business transactions.

Since patents cannot be applied to most assets of banks and insurance companies, the discussion is focused on the details of the use of *trademarks*. All companies have registered trademarks, in one company up to 70. In addition, almost all companies claim to possess an explicit trademarking strategy, although for some they have only a medium importance among the set of protection instruments. The major motivations behind trademarks all have to do with increasing the company's visibility and value. The protection of intellectual property in a narrow sense is of almost of no importance. Although in general little problems are reported using trademarks, sometimes conflicts with trademarks of competitors and companies of other sectors using similar names or symbols occur and even first "trademark races" can be observed. Internally, the awareness about the importance of trademarks as a supporting marketing instrument is often not well developed, or even denied. *Copyrights* also are used by the majority of the companies, however, they are somewhat less prominent than trademarks, because their effectiveness seems to be limited. Finally, one bank is internally developing software for telephone banking and Internet market places. The software is distributed to the customers on a CD-ROM, which is embodying "intangibles", like software into products.

As for the *criticism raised towards the IPR system* in Europe, the large majority regard a European harmonisation, respectively the Community trademark, as helpful in order to minimise the costs and time needed for trademark registration. In general, the limited options to protect the intangible assets of banks and insurance companies is criticised and a further harmonisation of the existing heterogeneous national legislative frameworks is called for.

4.3.4.5.4 Idiosyncrasies

The main asset in the banking and the insurance sector is a trusting relationship to both the commercial and the private clients. However, the trend towards online-banking has meanwhile increased the role of technology in the customer relationships. Nevertheless, in the current situation, the focus of the companies' IPR strategies is still on the customer relationships, whereas the awareness of the need to protect the supporting technologies is not yet well developed. The main and already well developed IPR activity concerning the customer relationship is a sophisticated and systematic registration of trademarks for all new services, if possible, and mainly already on an international level. For increasingly Web-based companies, like banks and insurance companies, a future field of IPR conflicts will be a struggle for attractive domain names. First litigation has occurred.

Concerning the infrastructural role of technology for this sector, a need for explicit protection is not perceived, because either the technology is procured externally or internally developed. However, these technologies are not supplied to the market. Therefore, there is – at least at present – no awareness concerning threats of imitation by competitors.

4.3.4.5.5 Conclusions/Reflections

Under the current patent regime, the financial and banking sector have little demand for patent protection due to the intangibility of its main asset, the trusting customer relationship. However, anticipating the trend towards patenting business methods in the United States, banks and insurance companies will also be involved in patenting issues, because first patents for portfolio selection mechanisms essential for portfolio managers have been applied for at the European Patent Office. Depending on these first granting decisions, the banking sector will be affected by these patents to an extent which is not yet perceived by most of the banks, even the global players. The same kind of business patents may change or even threaten the business of insurance companies.

However, banks and insurance companies already use trademarks more intensively, for aggressive marketing strategies accompanying other strategies around customer relationship management, on a national and increasingly on an international level. In this IPR-led competition one or a few aggressive players determine the strategic path, others have to follow in order to secure their survival. This is all the more important since international competition necessitates a new form of awareness and the installation of technical means to play the trademark game effectively. It seems that many companies in the sector have not yet fully grasped this necessity, but the awareness is growing. Especially since lead-time advantages based on the introduction of new financial services last only for a few months and imitation is very easy. In addition, it is thought that because of the widespread use of ICTs for the provi-

sion of financial and insurance services, the "protection issue", meant in a broader sense, will soon become a critical matter. Nevertheless, besides strong customer relationships the key knowledge assets are embodied in the qualifications of the staff, like understanding the characteristics and the evolution trends of financial markets or the assessment of risks in the insurance markets. And there is no strategy or formal IPR tool which can protect these assets. The only strategy for these crucial assets is the one aiming at retaining the most knowledgeable and qualified personnel, especially considering the upcoming shortage of skilled labour due to the critical demographic developments, in sense of overageing, in most industrialised economies.

4.3.4.6 The Business Service Sector

Rinaldo Evangelista

4.3.4.6.1 Structure of the Sample and Sector Characteristics

This report synthesises the results of the case studies carried out in the so called "business service sector". Out of the 65 interviews carried out by the different teams involved in the project, 17 fall in the area of "business services" (Table 4.3-7). In the latter we include industries belonging to the 74 NACE category and also R&D services (NACE 73). The list of the business service firms taken into account in this report, their location and main activity are reported in Table 2.1-1. This sub-sample is somewhat biased towards the most innovative and highly value added business services sectors. The bulk of interviews have in fact been conducted in firms belonging to three main business service sectors: R&D, Engineering and Technical Consultancy. Legal, advertising, facility and security services have also been covered with one firm interviewed in each of these sectors. The dominance of highly innovative business services is justified by the phenomenon investigated in this project (IPR regimes and strategies), which is likely to be relevant in service branches where innovation plays a significant role. Most of the firms contacted belong to the most traditional business branches of business services and have in fact shown only a limited interest and concern regarding innovation at all and in particular the IPR issue. Compared to the overall sample of the 65 service firms examined in this project, small and medium-sized firms are well represented in the business service sub-sample. This reflects the dominant role played by small firms in these industries. The "size factor" could have important implications with reference to the way the IPR issue is perceived by the firms and the specific strategies followed to protect their knowledge assets. On the contrary, considering the sectoral focus of this report the national coverage of the sample is of secondary importance.

Along with firm size also the characteristics of the market in which service firms operate could have important implications for the IPR issue. The *level* and *scale* of competition, as well as the number of competitors could influence the need of protecting the results of innovation activities from imitation. R&D and Technical Consultancy emerge on the basis of the interviews carried out as sectors characterised by low-medium levels of competition with most firms operating in niche markets, facing few competitors. In a few cases R&D and technical consultancy service firms are affiliates of larger companies to whom they provide their research outcomes. On the contrary, firms providing engineering services seem to be operating in much tougher competitive environments, facing many competitors both nationally and internationally. Most of the firms interviewed are characterised by good economic performances, both in terms of growth of sales and profits. This is largely due to the dynamic nature of the sectors and markets in which these firms operate.

Table 4.3-7: Business service firms

Sector	Firm size	Country
Advertising	Medium	Italy
Engineering	Small	Italy
Engineering	Small	Italy
Engineering	Small	Italy
Engineering	Medium	Germany
Facility Services (cleaning)	Large	Denmark
Legal services (IPR)	Small	Italy
Public Administration and Research	Medium	United Kingdom
R&D	Small	Italy
R&D	Large	Germany
R&D	Small	France
R&D	Small	United Kingdom/France
R&D (ICT/Telecom)	Medium	Italy
R&D and Tech. Consult.	Small	France
Security	Large	France
Tech. Consultancy	Large	Germany
Tech. Consultancy (IPR)	Small	Greece

4.3.4.6.2 Innovation Assets and Strategies

In most of the business service sectors, innovation represents an important strategic asset. Virtually all firms interviewed have indicated to pursue an explicit innovation strategy, in most cases devoting to innovation activities a substantial amount of financial and human resources. Important differences emerge, however, regarding the nature and sources of innovation. R&D and Engineering service sectors have a clear technological base. The innovative output of the firms operating in these sectors consist by and large of "manufacturing-related technologies" though research activities in the field of software and IT is increasing. The R&D sector is a typical science-based industry while all the other business service sectors (including Engineering and Technical Consultancy) are mainly technology users (mainly ICTs). The interviews have confirmed that (apart from the R&D service sector) technology is perceived by most service firms as an "enabling factor", that is something which is necessary to introduce new services and delivery processes, but which does not represent the key knowledge asset of the firms. The acquisition of software and IT equipment, service design and training are the most frequently quoted modalities

through which business service firms innovate, although there seems to be an increasing propensity of these firms to cooperate with universities and private research centres. As far as the objectives of innovation are concerned clear-cut differences across the sectors considered do not emerge. Firms in the different business service industries seem to pursue a variety of objectives at the same time. The most commonly quoted are the substitution of obsolete services, the enhancement of service quality, the improvement of the internal processes (speed/flexibility) as well as the reduction of labour costs. The obstacles to innovation show on the contrary a clear sectoral connotation. In the technologically intensive service industries (R&D and Engineering), the most important obstacles or constraints to innovation activities have to do with "high cost" of research activities and innovation projects and the "lack of adequate financial resources". Firms in all the other business service sectors indicate different types of obstacles such as those linked to the presence of regulations and standards (Advertising Services), and "low response of clients" (Legal and Facility Services).

4.3.4.6.3 IPR Strategies

The different technological or "knowledge regime" which characterises the heterogeneous universe of business service industries emerge as crucially important for explaining not only the nature of innovation activities but also the relevance of the IPR issue and even more the specific strategy (if any) followed by firms to protect their knowledge assets. As already mentioned above, the key explanatory factors have to do with the type of knowledge assets underlying the innovation activities which can be distinguished as follows:

- a) Knowledge assets which have a strict technological manufacturing-related base;
- b) Knowledge assets related to software development and ICTs;
- c) Knowledge assets on markets, customer tastes and habits, internal business methods etc.

It stands out clearly from the interviews that these knowledge assets and the associated innovation outputs present different possibilities and modalities to be protected. All in all, however, with the exception of a few technology-based services (i.e. R&D and to a lesser extent Engineering Services) the "appropriability issue" is not perceived as a particularly important one. In all the other sectors the lack, or limited effectiveness, of existing IPR laws and institutions is not perceived as something which constrains innovation.

The lack of an explicit IPR strategies is explained by the following factors. On the one hand, there is no adequate possibility of protection on the supply side. Concerning the demand side, often the companies perceive no risk of imitation. Furthermore, in most industries firms usually identify other key competitive factors, the

most important being the enhancement of the quality of the service delivered, customisation and the adequate supply of services. Besides the R&D service firms, only one consultancy firm and one providing cleaning services has indicated IPR as a relevant competitive factor.

Among the knowledge assets which deserve (or would deserve) protection, the most frequently cited are those related to new software developments, new ICT configurations, internal processes and markets. Despite the low importance attached by the firms interviewed to the IPR issue, some concern on the increasing importance of such an issue is spreading also outside the R&D and Engineering sectors. In particular a few firms perceive the lack of knowledge and managerial competencies in this area as a serious weakness. Especially in the Engineering and Technical Consultancy sectors the protection issue is getting more important in relation to the widespread use of ICTs through which firms provide their services and communicate with the external environments.

The importance attached to the appropriability issue seems to be affected by the competitive environment in which firms operate. Most firms have indicated that the liberalisation and opening-up to international competition of services might increase the importance of the IPR issue. The ownership structure of firms also matters. Some of the firms interviewed are part of larger corporations and only to limited extent exposed to market competition. This circumstance diminishes the importance of protection strategies somewhat.

Among the different IPR tools, *patents* are the least used by services firms and those to which firms attach less importance. Once again, the exception is represented by R&D service firms. Only very few firms have indicated that patents represent an important protection tool, and all of them are specialised in the provision of R&D services. All the other firms consider patents as not relevant. The main reason why business service firms do not make use of patents is because "new products and processes in services cannot be patented" along with the fact that both tacit knowledge and knowledge on internal processes cannot be patented. By and large, inventions and innovations can be patented as long as they have a well defined technological base and the knowledge content of such innovations can be codified. Both aspects are not found in most business service industries: technology does not represent the key competitive factors for the firms operating in the business sectors and innovation activities in most business service sectors consist of day-to-day incremental improvements of the internal processes and in a continuous improvement of the services delivered. Also, in the most knowledge-intensive business sectors innovation activities do not lead to any tangible product nor to any well defined innovation item which can be represented in a codified form. Only R&D firms identify, in the high costs of applying and defending a patent, factors which limit the use of patents.

Business service firms in general make more use of *trademarks* than patents. Most of the firms interviewed have at least a trademark registered (in some cases also outside the domestic market) and one third of the firms considers trademarks as a protection tool of high or medium importance. Quite interesting is the fact that trademarks emerge as relevant protection tools in the least technologically intensive business service sectors (Advertising, Security and Facility services) while losing relatively in relevance among R&D service firms. However, it should also be added that in most cases trademarks have only a very indirect "protection function". Trademarks are in fact used first and foremost for commercial and marketing purposes, generally to enhance the "visibility" or the "corporate identity" of the firms. The objective of "protecting a specific product" is mentioned only by one fifth of the firms among those interviewed. A couple of firms indicate the presence of administrative problems as an impediments to the use of trademarks.

Copyrights seem to be used as IPR tools especially by consultancy firms. All firms interviewed in this sector (and also some R&D service providers) attach a great importance to copyrights as a means to protect their knowledge assets. The two firms providing advertising and facility services perceive copyrights as an IPR tool of medium importance. Most firms have indicated that copyrights are used mainly in the software area and when new procedures and business methods are codified and formalised in manuals or books which circulate internally or outside the firm.

The interviews carried out in the business service sector seem to show that firms located in this industry tend to protect their knowledge assets through a combined mix of different *informal IPR strategies*. Secrecy is considered an important protection strategy by half of the firms interviewed and its importance is perceived to be increasing in the future. The retention of qualified personnel, through the use of specific contractual clauses or the provision of economic incentives is often jointly used with secrecy. Keeping tight links with customers and the provision of high quality services is the other way business service firms seem able to retain market shares as well as build up and exploit their distinctive competencies. The most innovative and dynamic firms often mention "lead-time advantages" as the only way to gain profits from innovation.

Criticism of the existing IPR systems, and indications on how to improve them are rather vague and very diverse across the firms interviewed. This reflects on the one hand the low concern of firms about the IPR issue and, on the other hand, an objective difficulty to protect knowledge and innovation in services. Some of the most innovative technology-based business service firms (R&D service providers) have complained about the high costs of applying for patents in Europe and about the insufficient protection secured by the patent offices. These firms suggest therefore to introduces normative and procedural changes to reduce costs and speed up the patent application process. The other firms often ask for the introduction of IPR tools properly designed to fit the specifics of service products and knowledge assets

which are intangible in their very nature (reference is often made to software and ICTs related innovations). Few firms also ask for a better enforcement of the existing rules which protect from patent and trademarks infringements. However these suggestions remain rather vague and difficult to be put into practice.

4.3.4.6.4 Idiosyncrasies

Business services include a rather heterogeneous mix of sectors and models of innovation. IPR could potentially play a role among all the so-called knowledge-intensive business services, that is, those service firms which generate knowledge themselves or those which disseminate such knowledge by providing customised applications and consultancy to a wide range of users. The knowledge content of these services are, however, very diverse and only in few cases can the existing formalised means of protection be used or are effective. R&D service providers have usually a strong technological base and their innovative output is usually patentable. In the case of engineering services, the increasing use of ICTs in the project design phases and for the final delivery of such products to clients makes the IPR issue potentially a critical one. Copying is a relatively easy job but at the same time something which is difficult to prevent with the existing IPR tools. A different case is represented by the broad category of consultancy services. Here formal protection tools cannot be used for a variety of reasons: because of the specific nature of the knowledge base of these industries, for the high customisation of the solutions proposed to clients and the intense knowledge sharing between service providers and clients. Problems of "who owns what knowledge properties" usually arise in these industries and this holds true when private actors cooperate with public actors.

4.3.4.6.5 Conclusions/Reflections

A stylised feature of the business service sectors is their being more knowledge-intensive compared to the other branches of services. There is however a good deal of heterogeneity within such variegated universe and clear sectoral specificities exist in terms of knowledge assets, models of innovation and specific strategies followed by firms to turn innovation into a competitive factor. The need to protect intellectual property and the means through which firms try to protect their knowledge assets are therefore very diverse across industries and across the different competitive contexts in which business service firms operate.

With the exception of the technology-based services (R&D and to a lesser extent engineering services) the "appropriability issue" is however not perceived as particularly important by most business service firms. Similarly, the lack, or limited effectiveness, of existing IPR laws and institutions is not perceived as something which constrains innovation. Other obstacles to innovation are perceived as more important, such as the cost of innovation and the presence of financial constraints.

Among the different IPR tools, patents are the least used by services firms and those to which firms attach less importance. R&D service firms are the exception. The main reason why service firms do not make use of patents is because of the very nature of innovation activities in services. Most business service firms are massive users of ICTs, but innovation activities consist of day-to-day incremental improvements of the processes and services delivered. Such activities do not lead to any tangible product nor to any well defined innovation item which can be represented in a codified form.

Business service firms make much more use of trademarks than patents. Most firms interviewed have at least a trademark registered (in some cases also outside the domestic market). However, trademarks have only an indirect "protection function". Trademarks are in fact used first and foremost for commercial and marketing purposes, generally to enhance the visibility of firms. Copyrights are used and perceived as important protection tools only by very few firms (mainly software firms).

Firms regard other informal protection means as more effective. The retention of qualified personnel, through the use of specific contractual clauses or the provision of economic incentives are the most cited strategies. Keeping tight links with customers, the provision of high quality services and "lead-time advantages" are the most effective ways service firms retain market shares as well as build up and exploit their distinctive competencies.

Some concern about the importance of protecting the key knowledge assets is nonetheless emerging. In particular, a few firms perceive the lack of knowledge and managerial competencies in this area as a serious weakness. This increasing awareness is associated with the emergence and progressive expansion of a proper "market for knowledge". The interviews reveal that firms are slowly coping with the peculiar characteristics and opportunities offered by this new market. It is the opinion of some of the most dynamic firms interviewed that the expansion and full development of this market will push firms to be more concerned about the IPR issue. It is also foreseen that in parallel the institutional setting governing IPR in services will need to change with the introduction of more appropriate and effective means to protect firms' knowledge assets.

The criticisms raised by firms of the existing IPR system, and the suggestions on how to improve it remain however rather vague and do not converge towards any concrete proposal. This reflects on the one hand the still low concern of firms about the IPR issue and, on the other hand, an objective difficulty to protect knowledge and innovation in services.

4.3.4.7 The Software Sector

Knut Blind

4.3.4.7.1 Structure of the Sample and Sector Characteristics

This chapter deals with the companies in the software sector, which is of increasing importance in the European Union. Already in 1996, there were more than 60,000 companies in the United Kingdom, more than 40,000 in Italy and more than 30,000 in Germany.⁶⁰ These high numbers can be explained by the size structure of the sector, since on average the software companies employ only between 3 and 8 employees. Besides this bias towards very small companies, a further crucial feature is the high labour intensity, because the software developers are the crucial asset and the equipment with physical capital is restricted.

Among the companies analysed (Table 4.3-8), a quarter can be categorised as software companies. The distribution of their location is equally between western, central and southern Europe. In contrast to the real size distribution, the sample is equally composed of very large and international companies on the one hand, and medium-sized and small companies on the other hand. Most of the small and medium companies face in general competition just on the national level, all large, but also some medium-sized companies are confronted with competitors from abroad, especially the United States. Although the intensity of competition is in general high, companies are very often active in very specialised and narrow niche markets. This specialisation leads often to a reduced degree of competition and only a limited number of competitors. On the other hand, large companies developing standard software for mass markets also often face only a limited number of also large competitors, since only very few programmes can survive in these markets, which require large numbers of users. Due to the fact that the market for software products has been expanding for several years, most of the companies analysed performed very well. However, due to the inevitably following consolidation process and the recent world-wide recession, recently the profits of most software companies no longer rose so sharply and some even experience significant losses.

The product and service range which the companies offer on the market is very broad and differentiated. Small companies' main business activity is often software development shaped to the individual needs of the customers, like Internet presentations of companies. Other often larger companies deliver e-business platforms for the New Economy, supporting supply chain or customer relationship management. Only a very small number of companies provides service to professional users of LINUX, respectively Open Source Software. Software encryption products, that facilitate secure data transmission, improve business security, efficiency and reduce

⁶⁰ The numbers are related to the NACE sector 72 of computer and related services. Source: Eurostat: (1999), pp 166-167.

communication costs, are another niche of the broad product spectrum of the companies analysed. Finally, IT consulting services for small, medium-sized or large users up to public administrations represent a major share of the companies' activities to medium and large ICT users. Additional services offered are training for employees.

Table 4.3-8: Companies in the software sector

Sector	Size	Country
ICT Systems and Services	Large	United Kingdom
ICT Systems and Services	Small	Ireland
ICT Systems and Services	Large	France
R&D in ICT/Telecom	Medium	Italy
(Internet) Software	Small	Germany
Software	Medium	Germany/US
Software	Small	Germany
Software	Small	France
Software	Small	France
Software	Large	Italy
Software	Medium	Portugal
Software	Medium	Portugal
Software	Medium	Italy
Software	Medium	Germany
Software	Medium	Germany
Software development	Large	United Kingdom
Software, Membership Services	Small	United Kingdom

4.3.4.7.2 Innovation Assets and Strategies

Almost all of the software companies interviewed claim to possess an innovation strategy. The role of technology for competitiveness is a key factor in most companies. In companies where the key factor for the innovation strategy is the excellence and usage of new software programmes or the reconfiguration of existing software in order to serve sophisticated customer needs, technology is just an enabling factor. Due to the wide range of software products and services, a great heterogeneity concerning both the innovation strategies and the importance of technology can be observed. Furthermore, the share of personnel working on product or process innovation varies between below 5% and up to 90%.

Similar to the average pattern of the overall sample, the acquisition of software and other technology is the most important innovation activity. However, in contrast to the other service companies, the sample of software companies is more likely to

perform intramural research and experimental development, which corresponds to the significant share of R&D employees. Concerning the future, many companies plan to extend their R&D efforts significantly and to look for co-operations with universities and other research institutes. However, close R&D co-operations with clients are also of high importance for the innovation strategy of most software companies. Finally, the qualification of the employees is vital for innovation. Therefore, continuous training directly linked to technological innovations is already performed in most companies and likely to increase in importance.

The priorities among the objectives are slightly different from the whole sample. Reflecting the rise in the sector, the expansion into new markets is only at place four among the objectives of innovation. Most important aims are the extension of the service range, the improvement of service performance and quality, the optimisation of the existing service chain and on the process level, the improvement of internal process knowledge.

The obstacles for innovation cover both the lack of financial means, but also the shortage of qualified personnel. Due to the recent recession and the lay-offs in this sector, the latter bottleneck should be relieved at least temporarily. Finally, possible lacks of IPR are not perceived as serious obstacles for innovation.

4.3.4.7.3 IPR Strategies

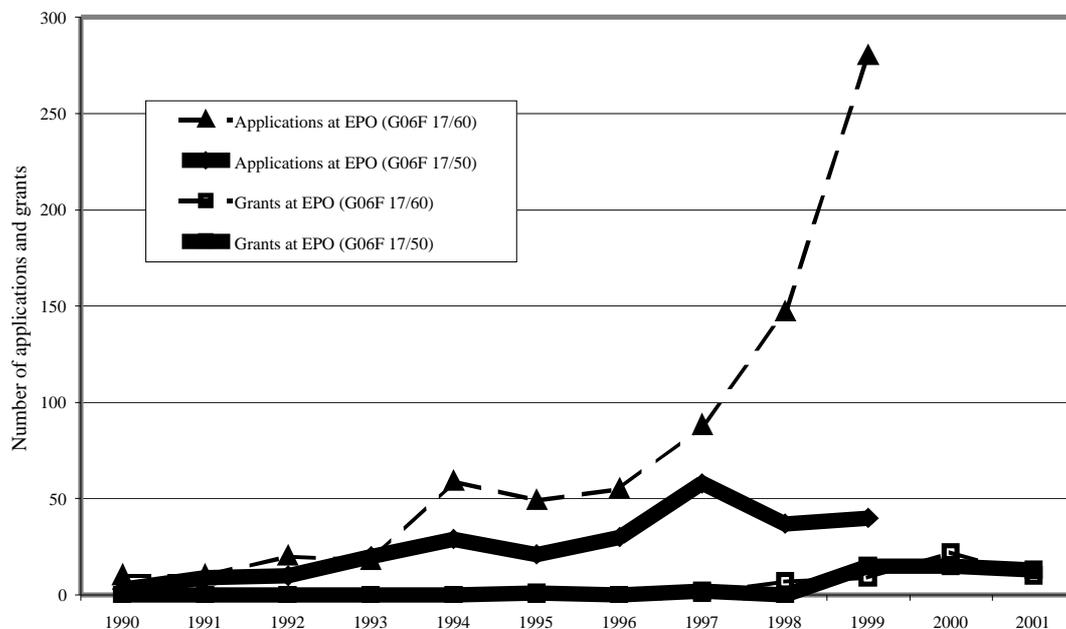
In contrast to other sectors, most software companies have developed an IPR strategy. Since they are the crucial assets of the business, both IT software and IT hardware are the objects for protection in most companies. However, it is also important to protect internal process knowledge, like in other service sectors. Due to the virulent threat of software piracy, the protection of software is understood. Obviously, some software companies are also active in developing hardware, which also needs protection.

Among the portfolio of protection strategies, lead-time advantage, customer relationship management and secrecy are the three most important means to protect the inventions and innovations. The formal intellectual property rights copyright and trademark are almost as important as the set of informal instruments. However, patents have a significant weight as a protection instrument only in single companies, although almost half of them have applied for patents. Nevertheless, many companies expect a serious increase in the near future. Technical solutions, like using complex product designs or embodying software in products (CD-ROMS), are not very attractive for most of the companies. In some companies, policies aiming at retaining qualified personnel within the firm are regarded as the most crucial protection strategies.

Among other different business assets, IPR is at least as important on average as pricing. Much more important are the product quality, the client orientation of the products and the general client service. Whereas IPR is of lower importance in the other service sectors, software itself is automatically copyright protected, which is crucial for the whole software business. Besides software, crucial for IT consulting, reports, consultancy documents and training material are also protected by copyright.

In order to illustrate the change of the IPR regime for software, Figure 4.3-1 represents the applications and grants of patents at the European Patent Office in two software-related patent classifications. We see a significant increase in the applications and meanwhile the first patents were already granted. However, if one has a closer look on the applicants, one observes that most of them are producers of computer hardware and not "pure" software companies.

Figure 4.3-19 Applications and Grants of Patents on Data Processing Procedures⁶¹



Focusing on the companies making use of patents, their main motivation is the prevention of copying and securing the exclusive use of valuable knowledge in order to defend their competitiveness. Besides these traditional motives, companies are also aware of strategic aspects like blocking competitors and preventing infringement suits.

⁶¹ The classification G06F 17/50 covers computer aided design programmes and G06F 17/60 administrative and business processes.

When analysing the reasons which hinder software companies from patenting, we can concentrate on the perception that new software products are not patentable. Some companies report negative experience with the patentability of their products. Regarding the recent proposal by the European Commission on the patentability of computer-implemented inventions, the current legal insecurity will probably be abolished by a solution allowing software patenting if the requirement of a technical contribution is fulfilled. At the moment, problems arise through the different standards of protection mechanism between the US and Europe, especially regarding software patents. One main problem could be the protectability of software in the US, which could be used by large competitors – and might hinder own further development. Finally, the high cost for patenting and for possible lawsuits constitute problems for small companies.

Since trademarks are used by three quarters of the software companies in order to protect the company name or software products, the reasons for their use are briefly discussed. The visibility in the market is the major function of a trademark. Secondly, via trademarks the companies try to protect specific products, but to a lesser extent technology. In general, trademarks do not cause problems in the legal perspective like patents. Finally, copyright is also used to protect specific products. However, although there are few problems, its effectiveness is rather limited, since it is difficult to enforce.

Since there is a high level of legal uncertainty concerning the role of intellectual property rights in the software sector, the companies call for a change of the current regime. However, there is no agreement about the direction of this change. Since copyright is insufficient protection, especially large and experienced companies demand the introduction of software patents like in the United States, also in order to raise their competitiveness abroad. Small and medium-sized companies are already afraid of patent litigation, which might increase after an expansion of patent protection to software. And even companies possessing patents are afraid to lose legal conflicts with large companies in the future, since the latter may be able to extend their patent portfolios significantly. Finally, a significant share of the companies is not able to make statements about the current IPR regime because of insufficient knowledge about it.

4.3.4.7.4 Idiosyncrasies

Since the innovation activities and the IPR strategies among the software companies analysed are very heterogeneous, it is difficult to identify common idiosyncrasies. Nevertheless, the software sector as a whole is very innovative, both in terms of resources spent on R&D and concerning its output of innovative products and services. After a long phase of significant increases of the whole software and related consultancy market, since a few years a consolidation has been taking place which increases the intensity of competition. This tendency has crucial consequences, both

for the innovation activities and the IPR strategies of the companies. First, the software companies are forced to be even more innovative in terms of new products and services, but also in terms of quality and price. Second, the threat of product imitation by competitors increases. These two effects together lead to an increased importance to protect the innovative assets produced. This general development is reflected by the situation of a large software company. Despite its market leadership in software development since the beginning of the 90s, the company has only recently developed a systematic approach to protect its software products from imitation by competitors.

Concerning the use of different protection instruments, the software sector is not so different from other service sectors. First, the informal instruments of secrecy, lead-time advantage and customer relationship management are obviously preferred in relation to the use of formal IPR. Copyrights, applicable to all software, and trademarks, important for the visibility in the market, are of secondary importance. The use of patents has only become relevant in the last few years with an increasing importance. This is caused by two external developments. First, some European companies have achieved significant market shares in the United States, which has allowed the patenting of software in practice since the end of the 80s. Second, the European Patent Office has granted software patents in the last years and the proposal of the European Commission is likely to justify this practice *ex ante*. Consequently, the European software companies are being increasingly confronted with patents of its competitors. In order to protect its own innovations and to prevent patent infringements against itself, patenting has reached a crucial importance for the companies' success in the future. At the same time, it is hard for small companies to play the patent game, i.e. to use patents themselves and to protect themselves against unintended infringement on existing patents. There is a high degree of uncertainty for small software-based service companies that would be even exacerbated if the US American trend of patenting business process methods would be realised in Europe too.

Finally, in contrast to all other service sectors and also to manufacturing sectors, the role of Open Source mode has to be highlighted. It is essentially a counterpart to the much more common Microsoft systems. This alternative is becoming increasingly popular, not only amongst individual software developers, but also amongst business firms. Its key feature is the disclosure of the underlying code of the software used, thus providing transparency for users and developers and enabling interactive development of new software. Moreover, in the long run the utilisation and adaptation of software in this mode is supposed to be rather cheap. In contrast, the traditional, proprietary mode only allows the usage of software and the adaptation of interface. It is officially part of the Open Source movement, i.e. it agrees to open up its own source code and at the same time is allowed to utilise source code of others. Therefore, patents make no sense and the Open Source movement rejects the idea of

patents in the software sector in general. In their opinion, patents endanger the flow of code information necessary to improve software constantly.

4.3.4.7.5 Conclusions/Reflections

For the business success of software companies, it is very important to reduce the legal uncertainty caused by the intransparent and unharmonised patent granting practices in Europe. Therefore, they call for a globally uniform, binding and enforceable patent law. The question in which direction a harmonisation should be pushed ahead is not answered unambiguously. Adapting to US customs and making "software as such" generally patentable is rejected out of hand by the majority of the small companies. However, large companies with business activities in the United States, where they are confronted with numerous software patents, suffer from the heterogeneous patenting practices in Europe and the United States and therefore request an adaptation towards the US regime. Nevertheless, there are critics in the United States meanwhile who point out that the surge of software patents has negative effects on the innovation dynamics of the whole software sector. Due to the fact that software development is very often a sequential process, relying on already existing programme codes, especially small software-developing companies will be endangered by patent infringement suits if software patenting will be allowed and used broadly. Even larger software companies face problems and need a long time to adjust to changed patenting conditions. A further danger is seen for the development of Open Source as a kind of public good, that on principle is available for use by all economic units and thus in the sense of the new growth theory promotes the general technical progress and therefore innovation dynamics. Should a further dynamism of patenting set in, and at the same time the Open Source development be hindered, then a legal special ruling should be considered.

4.3.4.8 The Manufacturing Sector

Jakob Edler

4.3.4.8.1 Structure of the Sample and Sector Characteristics

Manufacturing companies, especially large ones, are increasingly integrating service activities in their company portfolios. A large share of the services provided is already delivered by companies whose core business is in the manufacturing sector, and the boundaries between service companies and manufacturing companies is becoming more and more blurred. The diversification of manufacturing companies into services does not follow a uniform pattern, though. While in some highly diversified companies services are offered that might have no relations to the products at all, in many cases the services provided either extend the benefit offered by the product or are directly linked to the product, like after-sales consulting, interface management, maintenance etc.

The sub-sample of eight manufacturing companies in this study consists of a range of 5 different manufacturing sectors, with a focus on electronics (four companies).⁶² This focus was – ex ante – not intentional, but obviously in the electronics sector the importance of services and the diversification into service activities of all sorts is most advanced. Six out of the eight companies are very big, and two are rather small companies. Three out of these eight companies offer service activities that are not only product-related activities, but also stand alone. These three companies are all big ones (see Table 4.3-9). Although the selection is by no means representative, it is nevertheless an indication that mainly very big manufacturers have started to build up strong service sections that can provide stand-alone service next to the accompanying activities. At the same time, the small and medium-sized manufacturers focus more intensively on their core business and define service mainly as maintenance of products sold or product-related after-sale service. On the other hand, and in particular in the ICT, some smaller companies have combined technology-intensive manufacturing – or adjusting standard products – with technological consulting in relation to the products offered.

The competition is international for all but one company, meaning that protection strategies have to take into consideration the regulations and strategies applied abroad. However, the actual degree of competition is very different within the sample, ranging from no competitor to "numerous", with the majority of companies reporting to have between 3 and 10 competitors. Finally, the performance of the

⁶² The other sectors are vehicles, manufacturing equipment, food manufacturing and distribution, toys and recreation.

sample is rather varied, ranging from poor (one company) to very good (three companies).⁶³

Table 4.3-9: Companies in the manufacturing sector

Sector	Size	Country	Service Type
Automotive	large	Germany	stand-alone (being reduced)
Electronics	large	The Netherlands	only accompanying
Electronics	large	Finland	mainly accompanying
Electronics, Information Technologies, Energy, Finance	large	Germany	stand-alone, strong
Electronics, mainly Control and Automation Equipment	small	United Kingdom	only accompanying
Equipment (manufacturing)	small-medium	France	only accompanying
Food Manufacturing and Distribution	large	United Kingdom	stand-alone
Toys and Recreation Parks	large	Denmark	stand-alone service integrating the products

4.3.4.8.2 Innovation Assets and Strategies

All companies interviewed in the manufacturing sector indicated that innovation is a key to their success, and six out of eight companies have an explicit innovation strategy. The objectives of innovation are very broad, service innovations are not confined to simply accompanying the innovation process of the manufactured products. Emanating from the manufacturing areas, innovation is linked to more or less explicit R&D activities and the R&D intensity is rather high in the manufacturing companies. Interestingly, the importance of technology is rated high by five out of the eight companies, which means that services potentially entail technological features that are eligible for patent protection.

In line with current tendencies of interaction and feedback loops in innovation activities, most companies report that their innovation strategy and their innovation activities are vertically linked to suppliers and customers, with customers being somewhat more important.

One major reason for increased services in the portfolio of manufacturers is the increasing tendency towards customer orientation and towards long-lasting, all-

⁶³ However, it has to be kept in mind that this sample of companies is characterised by heterogeneous companies, and therefore the performance might differ between different business areas.

embracing customer relationships. Therefore, it comes as no surprise that the innovation activities in this sample are market-driven, instead of science- or technology-driven. The fact that the innovation process is largely customer-driven – and in some cases strongly related to the marketing functions – has severe consequences for the protection strategies of the companies, since the market and competition aspect is immanent in the innovation activities.

4.3.4.8.3 IPR Strategies

For the manufacturing companies intellectual property seems to play a major role, six of eight companies indicate medium or high relative importance of IP – in relation to other competitive assets – and of its protection. Therefore, the companies in the sample have, on average, more elaborate IPR strategies for their service activities than other samples in this study, applying a whole range of instruments. At least the big manufacturing companies have started to optimise – if not maximise – their IPR portfolio and revenues. As one extreme example, one company has recognised the potential of its knowledge intensity in manufacturing and service delivery and has even started to make a major business out of the respective revenues.

Together with secrecy, the single instrument most often mentioned in the interviews were *trademarks*. Seven out of eight companies have trademarks and rate them of medium or high importance. For these companies, trademarks are one cornerstone of the protection strategy and will further gain importance. The major motivations behind trademarks all have to do with being recognised and building up identity, both for the market and internally, and to increase the visibility and the value of the company. The protection of intellectual property in a narrow sense is of a secondary importance. This motivation structure might be explained by the need to build up service identity where in many cases the manufacturing identity prevailed for many years.

However, the major finding in analysing the service activities of manufacturing companies is that these companies are much more strongly inclined to use *patents* to protect their assets. Only two companies attribute low importance to patents, while four companies indicate high importance. This has two major reasons. First, in many cases the service is strongly related to the manufactured product itself and technically linked to it. Therefore, the patent strategies of the manufactured product are enlarged to include the service also. Second, the tradition of patenting – and the rising tendencies to do so⁶⁴ – in the manufacturing sector affects even the stand-alone service areas, where the practices of manufacturing areas are imitated. These

⁶⁴ A recent study for the German Federal Ministry of Education and Research has analysed the patenting behaviour of 88 big companies in four manufacturing sectors (electronics, chemistry, mechanical engineering and vehicles). From 1990 to 1998 the number of patent registrations per year has almost doubled, and the increase is true for all four sectors.

tendencies are growing, it is obvious that the protection of intellectual property is increasingly impinging upon the service strategies of manufacturing companies.

Just like in the manufacturing area, patents are used in a prophylactic way – i.e. the companies protect themselves against a potential infringement of patents registered by other companies – as well as in order to protect other companies from developing the same technologies. Moreover, patents are strategic assets used not only to protect the knowledge, but also to generate license revenue, to improve the situation in company co-operations, and to improve the technological image. Furthermore, the usage of patents not only includes the registration of patents, but also the usage of patent databases and literature in order to screen new technologies and to protect against patent infringements.

The knowledge protected by patents is mainly related to information technologies and to internal process knowledge. For most of the companies interviewed, a major feature in service-related patents is the protection of hardware and software that is developed in order to deliver the services. While the protection of IT hardware is not different from the protection of regular manufacturing end products, the protection of software raises several new issues for the companies. Often, this software is embedded in the manufactured products, sometimes, however, software is the key to some stand-alone services provided (see below).

Copyrights also play a role, however, they are somewhat less prominent than patents or trademarks. This is even more true for *contractual provisions*, like exclusive contracts with customers or long-term contracts with employees, which also are much less important.

As for the *criticism raised towards the IPR system* in Europe, the large majority of manufacturing companies – no matter if big or small, if innovative or not – regard a European harmonisation, respectively a uniform single European patent, as helpful in order to minimise the costs and time needed for the patenting process. However, beyond this general assessment, the criticism is diverse, depending of course on the company's size and on its protection activities. For example, while one company complained about the European Patent Office as being slow and time-consuming, another big company regarded the EPO as being efficient and quicker than national offices. The smaller companies regarded the system as being advantageous for big companies who are able to invest the necessary resources and build up networks in order to play the game.

4.3.4.8.4 Idiosyncrasies

The importance of software in the service-related activities has severe consequences for the protection demands of the companies. Given the strong link to the manufacturing tradition of protection via patents, the manufacturing companies are the drivers behind the growing trend to file patents for software applications and are key players in the movement for software patents. Some of the manufacturing companies, especially the big ones, actually set the problems of service patents equal to the problems of software patents and are strongly in favour of patents on software-related technologies.

As seen above, the manufacturing companies are also drivers of the growing tendency to protect intellectual property in the service sector also, building on their tradition and capacity in their core business. However, at the same time they oppose and fear the tendency of patents on business process methods, as it can be observed elsewhere, especially in the US. Since all companies have some sort of international activities, and as business process patents are by definition service-related, a major problem of the companies in the future will be to be confronted with patents on service activities that are not yet possible in Europe, but implemented in the USA.

4.3.4.8.5 Conclusions/Reflections

The protection of intellectual property in service activities is becoming more and more important for manufacturing companies. Protecting knowledge through all legal, contractual and strategic means is a growing concern of the companies. In this mix of instruments, patents seem to become relatively more important. In contrast to pure service companies, manufacturers can see no difference between patents on technologies for products and those for services. The fact that, given the rising role of information technologies within traditional industries, many of the service patents will be in the software area, does not make a difference, whereas pure service companies who base their services on software have not yet built up a comparable patent awareness and infrastructure. The leading edge in patenting a whole range of activities apparently gives service-intensive manufacturers an advantage in the ongoing IPR race. Since most of the companies are further investing in their patenting infrastructure and actively struggle for the possibility to have software patented on a large scale, the leverage in protecting all kinds of services might even become stronger in the future. At the same time, these companies will set the trend towards more patenting in the service sector, especially for software-related technologies. From the uniform criticism raised by the manufacturing companies it follows that a European harmonisation of the regulations to protect intellectual property would certainly ease their IPR strategies. Most importantly, the companies call for a central European legal system in order to claim their patent rights against violators through one central court and not via several national systems.

In conclusion, it is far from clear if the on-going tendency to intensify protection, mainly through patenting, is for the long-term benefit of the service sector as a whole. Instead of increasing security and room of manoeuvre for the companies, the manufacture-driven patent race that impinges both on software-related technologies and traditional technologies might lead to follower strategies that result in inefficient resource allocation in the long run.

4.3.4.9 Summary

The main observations from the seven sector studies are the following. First, there are major differences between the service sectors regarding the general company characteristics, the innovation activities, especially R&D, and the strategies and activities to protect intellectual property. Second, even within the sectors there are differences, especially if the activities of the respective service companies are rather heterogeneous or if one compares companies of different size.

However, the qualitative pictures of the sector studies confirm also the conceptual approach of different knowledge regimes, which was already supported by the quantitative analysis in Chapter 4.3.3. In the next section, we go even one step further and have a look at single service companies, which demonstrate at least good, sometimes even best practice regarding the adequate use of IPR and other informal protection instruments, and also take into account their framework conditions, like the relevant knowledge regime and available resources.

4.3.5 Best Practices Regarding the Protection of Intellectual Property

4.3.5.1 Introduction

In order to identify "Best Practices" regarding the protection of intellectual property in service companies, one has first to discuss what can be understood by "Best". One simple view would be to define the maximal possible use of IPR as "Best" without taking into account the incurred costs and the adequacy of this approach.⁶⁵ Since it is obvious that a maximisation both of IPR use and protection in general does not have to be "Best", a more differentiated approach has to be followed, which takes the framework conditions into account. Therefore, "Best" means a comprehensive, strategic, conscious, and context-related usage of IPR means. However, due to the heterogeneity of the service sectors in general and the service companies within one single service sector, it is almost impossible to identify companies with the same framework conditions and then to determine the "Best Practice" in the more differentiated sense. Nevertheless, we have selected five service companies and describe them, their innovation and protection activities in the following sections, trying to cover by this selection all those types defined by the conceptual approach of knowledge regimes, which make an intensive use of formal or informal protection strategies.

The first case represents a large non-profit R&D service organisation. Although due to its size it cannot serve as an example for all R&D service providers, their sophisticated and comprehensive use of the whole range of IPR present a general example also for smaller service companies of how IPR are able to secure competitive strength and to generate significant revenue streams. Like the first case, the second case of a software company takes also a holistic approach to intellectual property rights in order to secure the various benefits of their use besides the simple protection from competing imitators. The third case, a small engineering and development service company in the area of machines for street cleaning and of other special vehicles, proves that IPR and other informal protection strategies can also be followed independent of company size. Case four presents a small manufacturer of high technology equipment providing also product-accompanying services. This company protects its know-how base just by using technical devices, which is appropriate only in hardware-related environments. In contrast, the large media company (case five) deals with intangible assets and needs to make an intensive use of the adequate IPR and licensing strategies. In total, these five cases demonstrate the wide range of protection strategies service companies can make use of, always taking their very specific framework regarding the involved technology and the respective service contents into account.

⁶⁵ Since the use of protection strategies by one single company has impacts on other companies, "Best" could also be understood as optimal for the total of all companies. However, we do not concentrate on this macroeconomic rationality in this section about "Best Practices", but only in Chapter 5 discussing policy considerations.

4.3.5.2 Large Non-profit R&D Service Organisation: Encompassing Protection Approach (Case I)

4.3.5.2.1 Company Characteristics

The company is a non-profit organisation for contract research in all fields of the engineering sciences. More than 50 institutes and establishments with more than 9,000 employees in the home country and around the world offer their research services to industry and government. The total turnover amounted to more than € 700 m in the year 2000.

The research and development activities at more than 50 institutes are grouped into eight focal fields, with the respective work areas:

- Materials technology, component behaviour
- Production technology, manufacturing engineering
- Information and communications technology
- Microelectronics, microsystems technology
- Sensor systems, testing technology
- Process technology
- Energy and building technology, environmental and health research
- Technical and economic studies, information transfer

The corporation constantly strives to strengthen its reputation as a desirable business partner. It not only continues to improve the quality and customer-orientation of its research, but expands its own expertise through collaborative partnerships in the home country and abroad. Co-operations among the institutes are formed, based on the requirements of specific research objectives.

4.3.5.2.2 Innovation Strategy/Activities

The research society is committed to its role as an innovative driving force behind industry. In the course of contract research and application-oriented basic research, the institutes constantly pursue new developments which are implemented as marketable products. One third of all expenses are devoted to innovation activities and one quarter of all personnel works on product and process innovation internally. As a result, around 20% of the total turnover has been obtained with research services introduced in the last three years.

The innovation activities of the research organisation are manifold. On the one hand, research and experimental development is performed in-house. On the other

hand, research and development is conducted jointly with its clients, mainly companies, and the suppliers of semi-products. Furthermore, close contacts exist to other public research institutes and universities. It is important to note that the regular surveying of patent literature is of high relevance for the organisation.

The important objectives of product innovations are numerous. The organisation seeks successfully to replace existing mature services. Furthermore, it reacts to the innovation cycles in its technology fields. Finally, the service quality is continually enhanced. Also of high importance are the improvement of the flexibility and the speed of internal business processes and the reduction of labour costs in general. The major obstacles to innovation are, on the one hand, high costs for research and development and, on the other hand, a significant lack of qualified personnel.

4.3.5.2.3 Challenges and Protection Strategies

In relation to the other obstacles for innovation, the inappropriate means of protection of innovation and their non-exclusive appropriation are of high importance. The objects of protection are both hardware and software. The organisation has an explicit protection strategy. In every research institute, a patent manager is responsible for observing the ongoing research activities and checking if innovations are emerging which are relevant for patent protection. In addition, the headquarter runs a patent department which pro-actively supports the patent manager in the institutes.

In contract research, it is difficult to balance own intellectual property rights and the interests of the clients in industry. Therefore, the organisation strives for unquestionable and transparent protection of its own intellectual property rights from the very beginning of the projects, in order to be able to use this knowledge in further projects and not to threaten the core business. However, the IPR strategy is also influenced by the cost dimension of its application and enforcement, the market relevance of the protected knowledge and the ability to trace infringements.

The organisation uses both all available formal and informal protection strategies. Consequently, the IPR activities are very important compared to the other business instruments, which are dominated by product quality and client orientation. The most important formal protection strategy is the application of patents. In 1999, the organisation applied for more than 400 patents. Apparently, the organisation possesses written patent guidelines, which are presented in the Intranet.

The majority of the patents are related to processes, and to a lesser extent to products. Furthermore, the patents are mainly related to the organisation's products and services and only in one third of the cases to internal process innovations. For half of all innovations, a patent has been applied for in the past. All patents are exploited by the organisation itself; and one third has been successfully exploited. In addition, an increasing number of around one quarter of the patents is licensed to other com-

panies. Two thirds of the patents are applied for in Germany. An application at the European Patent Office is of secondary priority.

The main motives for patenting are the improvement of own competitiveness by securing exclusive use of valuable knowledge and of the own position in R&D co-operations or in other inter-firm negotiations (e.g. cross-licensing), the increase of the company's revenues by generating licensing income, and the protection of possible future technologies. An aggressive use of patenting in order to block competitors' patenting activities is not intended by the company. In general, the organisation claims a high effectiveness of its patenting system, especially compared to other non-profit research institutions, and reports only small problems.

Besides patents, the registration of trademarks is already a very important protection strategy, which will gain importance in the future. More than 50 trademarks have been registered in the last years with a bias to domestic registration. 30% of the trademarks concern service products, 50% software, and only 20% manufacturing products. Although no explicit trademark strategy exists and the awareness of its importance is less developed compared to the benefits of patents, the project managers are also responsible for the registration of trademarks. Whereas protection is a motive of less importance for trademarking, the support for the visibility in the market and for the corporate identity are the major reasons. Finally, even copyrights are actively used in the area of software licensing because patent protection is not available.

4.3.5.2.4 Success by Protection Strategies

This large organisation for contract or applied research is an intermediary between basic research institutes and companies from industry. In order to be innovative, it anticipates the latest trends in science and technology and tries to apply these insights in projects for companies and the public sector. The interest of the customers is to claim intellectual property rights on the contents elaborated in the contracted research projects. However, this knowledge represents the key assets of the organisation. Therefore, it has successfully developed a sophisticated system of formal intellectual property rights systems and informal protection tools. Depending on the features of the products or services provided, patents, trademarks and even copyrights are applied. The sensitivity and awareness concerning these various instruments have caused a major increase of licensing income and even of business start-ups whose core asset has been a portfolio of well defined patents.

4.3.5.3 Software Developer: A Holistic View of an Intellectual Property Strategy (Case II)

4.3.5.3.1 Company Characteristics

The company was created in 1999 out of a previous company, that was a bespoke software development house for key IT companies in their domestic market. The company sells software encryption products that facilitate secure data transmission that improve business security, efficiency and reduce communication costs. Its main product is TalkXML. It allows existing systems and people to communicate securely using XML. The company is headquartered in a small member state, but has offices in another member state and the USA. It employs about 40 people.

4.3.5.3.2 Innovation Strategy/Activities

The company puts a great deal of emphasis on taking a long-term view of commercial and technological changes and gaining as much information as possible to help take a suitable forward look. The company seeks to establish a long-term forward look into its technologies and commercial prospects.

The company's innovation is shaped by the fact that its products are integrated with hardware and software solutions provided by other companies. In particular it has a set of core technology partners whom it closely works with. The company also has solution partners, who use its products to build secure business networks for their clients. Lastly, the company also has what it calls its channel partners, who extend the client network for its products.

It is crucial that the company works with these companies and that these companies have access to the company's technologies, but without of course these partner companies gaining core know-how and IP (see below). These relationships have to be carefully managed and supervised in terms of information sharing and knowledge transfer. It is wary of overly-democratic "knowledge-sharing" culture prevalent among junior and any IT employees.

4.3.5.3.3 Challenges and Protection Strategies

There is a strong emphasis on taking a holistic view of IP strategy. The company is extremely careful about its software source code, its primary asset, and has special source code handling mechanisms. No one is allowed off the company's premises with source code and core workers have a specific contract covering commercial protection of the source code and related software.

For companies using the company's products (which is vital to its business; see above), the company ensures that these other companies do not need to use source code (unless this is not possible); instead the company gets round this by sending ring-fenced library files. The company ensures that the agreement between the two parties states that the other company does not need the source code. It allows 'permitted acts' to its software, but care again is taken about reverse engineering or de-compiling the software code. The company closely monitors the use of its software and in the signing of contracts.

The company uses a number of other ways to protect its IP. It generates a clear 'document trail' for its research and development work, so that this can stand up in defence in law court. It deposits its source code with a National Computer Centre and keeps lengthy histories of its development work and audit trails so that it can use this to validate that it has done this work. In terms of copyright it will insert dummy code to prove that the work originates with the company. This is a very useful mechanism.

It also uses patents and currently has ten. Its main value is for potential (non-informed) investors as a way of accrediting its research base. However, for small companies they have little value unless you can afford to protect them and this is very costly in terms of litigation. The company has also to be careful not to have too general application areas in the patent. A wider application may seem good, but leaves you open to constant infringement and policing issues. This is all very costly, especially for small firms with limited resources. The value of patenting as an IP mechanism is therefore very low to the company.

Trademarking is undertaken in collaboration with the marketing department. The company currently has 12 trademarks (existing or currently being registered). It is a commercial issue in terms of protecting the name of the company and the use of a number of supporting trademarks.

The company uses Non Disclosure Agreements (NDAs) and trade secrecy extensively and has comprehensive procedures about how to store and share confidential information. This requires careful training and people management so that staff are clear about the procedures in place and the implications to the company of not following them. The company also spends considerable time finding out what companies are dealing with. This vetting is carefully undertaken and checks are made to see areas of likely competition and infringement.

4.3.5.3.4 Success by Protection Strategies

For a small company, this company has a very active and sophisticated IP strategy, based on its holistic view of IP. It has a portfolio of mechanisms which it deploys to ensure that its IP remains protected. No one single IP mechanisms is relied upon to

protect the company's knowledge assets. The company employs a specialist law firm for its IPR and licensing activities and uses further patent and trademark attorneys split between two firms. Its whole strategy is not to allow IP to leak out wherever and imposes procedures to reduce the likelihood of this happening.

The holistic use of IPR has so far not generated significant revenues. However, IPR secures the survival of the company in a very competitive environment with manifold threats of IPR infringement.

4.3.5.4 Small Company Providing Technical Services: A Strategic Selective Mix of Protection Tools

4.3.5.4.1 Company Characteristics

The company's main activity is an engineering and development service in the area of machines for street cleaning and other special vehicles. It was founded in 1996 and has meanwhile eight employees in two affiliates. The total turnover amounts to €0.9 m., the profit is almost 10% of its turnover. Due to the fact that the company serves a very tight niche market, there is no real competitor.

4.3.5.4.2 Innovation Strategy/Activities

The technological dimension is crucial for the company's business. Consequently, one quarter of the turnover is spent for R&D and innovation activities. Furthermore, the company has developed an explicit innovation strategy, which includes the systematic analysis of the market, the competitors and the perception of the needs of its customers, which define the priorities for innovation. In addition, all employees are invited to contribute to innovations. The most important innovation activities are R&D co-operation with clients, followed by the acquisition of software and other technologies. Moreover, training of the employees, which is directly linked to technological innovations, is a key element in the whole range of innovation activities. Finally, the continuous screening of patent literature is already very important and will gain further importance in the future.

In order to better fit the expectations and needs of the possible customers, the major objectives of innovation activities are directed to the replacement and improvement of existing services. The company strives also to extend of the markets served and of the service range, including an optimisation of the existing service chain. Eventually, the fulfilment of existing standards and regulations is important for the company. The objectives of the process innovations are the improvement of internal business processes and indirectly the reduction of labour costs. This comprehensive innovation strategy is very successful, since 50% of the turnover is obtained with services introduced in the last two years. The company seeks to maintain this ratio in the future.

4.3.5.4.3 Challenges and Protection Strategies

Due to the fact that the high costs of IPR protection are a major obstacle for innovations, the company is aware of the protection problem and has developed a protection strategy. The company already holds ten patents, all on products, and one trademark on the name of a sweeping machine. Consequently, patents are very important as a protection tool. In addition, the informal means of secrecy, long-term

labour contracts, the development of complex product designs and especially lead time advantage and customer relationship management are of high importance. The most crucial factors in the future will be the links to the customers and the strong commitments of the labour force codified by contracts.

The company applies for patents for all inventions made in the most important European markets. Then, all companies which buy the products of the company, obtain licenses for the patents relevant for the respective products. The main motives for patenting are the improvement of its competitiveness by the exclusive use of its knowledge and the prohibition of copying by competitors. Furthermore, patents are also of strategic use for the company in order to block the activities of possible competitors (actually: in order to oblige the customers to buy the licence for the machine and not to copy it), to raise licensing revenues and to improve its position in R&D co-operations and its technological image. For internal benchmarking in R&D, patents are used as one indicator.

Despite the sophisticated and strategic use of patents, the company emphasises that patenting is a necessary, but not really effective protection means, since it is too expensive for a small company to win an infringement case against a large competitor. Therefore, the main impediment to patent are the high cost of defending a patent in court. For the future, the company calls for the introduction of the Community patent in order to reduce the application costs significantly.

Trademarks are of little importance for the company, but they are used to increase its visibility in the market and to foster its corporate identity.

4.3.5.4.4 Success by Protection Strategies

This young engineering and development company has already developed a sophisticated innovation strategy based on sophisticated inventions, which contributes obviously to its success. This very small company is very aware of the costs and benefits of patents as a means for protecting its knowledge base. Almost every product contains patent protected specifications, for which the buyers have to acquire licenses. Due to the limited effectiveness of patents as protection strategy, all the available informal protection strategies supplement the formal mechanisms.

The promising development of this small "knowledge intensive business service" was supported by the existing IPR regime. Patents improve its competitiveness by the exclusive use of its knowledge and the prohibition of copying by competitors. They are also used to block the activities of possible competitors and customers. Finally, they help to raise licensing revenues and to improve its position in R&D co-operations.

4.3.5.5 Very Small Manufacturer of High-technology: Sufficient Protection Without Formal Intellectual Property Rights

4.3.5.5.1 Company Characteristics

The firm was founded in 1996 and currently employs four employees. The company's current turnover of over 300,000 € includes a small exports component (8%) and expansion of overseas business is expected in the short-term. The company achieved break-even in 2000 and a modest profit is forecast for the financial year 2001.

The firm's activities include the design and production of water and air quality sensors, 'electric fishing' equipment, and data-logging devices (for environmental sensors and other applications). The company also provides consultancy and training in relation to the above and a 'data-interpretation' service for purchasers of its monitoring and 'logging' equipment.

The firm has four members of staff, each of whom is qualified to post graduate level in engineering or technology-related disciplines. The company enjoys very close links with a local university and is located within its campus business park (a company director is employed by the institution on a part-time basis). Academic research (in the fields of environmental science and electronic engineering) contributes significantly to innovation and product development and the company has a strong record of transforming university-generated ideas into commercial offerings.

In addition to serving markets in the private sector (especially civil engineering and landscaping businesses), the firm boasts a substantial client-base among governmental agencies, research establishments and Higher Education Institutions. Whilst the market for the company's products (especially data-logging equipment) is expanding apace, new entrants to the field - some from overseas - are swelling the ranks of the competition very rapidly.

4.3.5.5.2 Innovation Strategy/Activities

Innovation is led by both technological development and detailed assessment of market needs. Market scanning is a key activity and the company enjoys very close links with its actual and potential client base (two members of staff devote a large proportion of their energies to research concerning client needs and market trends). Whilst the main drivers for innovation relate to the maintenance of competitive edge and the extension (and improvement) of product range, the key goals for such activity reside in the development of high quality and versatile (but inexpensive) offerings.

According to a director, the company's innovation process is organised in a contingent and ad hoc manner and its development strategy is evolving continuously. Approximately 30% of expenditure (excluding salary costs) is dedicated to innovation and all members of staff are involved in the design and development process. Whilst some personnel focus primarily upon the refinement of hardware and supporting software, others are engaged in continuous product testing and re-design. In total, two-thirds of staff hours are dedicated to innovation and related activities.

Radical ideas occur infrequently and most innovative effort is focused around the development of products that either complement or extend the company's existing range. 'New' devices frequently represent iterations of standard products and these are commonly targeted at specific market segments and specialist user groups.

Collaborative innovation (with technology suppliers) is rare. Where this has been attempted, such collaboration has been experienced as a negative encounter. In contrast, collaboration with clients is common and many customers are involved intimately in the product design process (the modification of semi-standard products to meet user's specific needs is an important feature of the business).

4.3.5.5.3 Challenges and Protection Strategies

Although the protection of intellectual property is an issue of second ranking importance for the company (others including innovative capability, competitive advantage, market expansion, pricing, and client service enjoy priority status), it is perceived as a significant concern and a policy for its protection has been built progressively via round table discussions and consultations with business advisors. Whilst many of the main (formal) instruments of protection have been considered at some time, most have been rejected on the grounds of cost or limited efficacy.

Patenting is perceived to be both prohibitively expensive and an inappropriate means of protection: high costs and rapid rates of technological change (coupled with a desire to guard the secrecy of detailed designs) have implied that the company has eschewed patenting in favour of more suitable forms of control.

Whilst the firm does not register trademarks, since cost is a major impediment, the company name or product logo appears on all components and equipment. The company insists upon displaying its name prominently on all products in the belief that this will assist in leveraging visibility (and hence further trade) at end-user level.

Copyright is not a central component in the firm's protection strategy, but is used to indicate its authorship of specific designs and programmes and to reinforce profile and visibility in the market. Copyright is commonly applied in the case of software and consultancy reports (although rights in the latter are often reluctantly ceded to

commissioning agencies). As copying and distribution of firm-generated product is believed to be uncommon (and technically challenging), copyright is of limited benefit as a protective mechanism.

The digital 'code' that is embedded in the firm's products is crucial to their functionality: such code has a major value for the company and its development is frequently expensive and resource-intensive. 'Code' defines the functional characteristics and performance parameters of a specific item of equipment and is therefore extremely important (it is also commonly the factor that differentiates the potential of one firm's product from that of another). Protection is afforded by the utilisation of 'write-protected' micro-chips - these ensure that embedded code cannot be 'read-back' by potential imitators or competitors.

'Firmware' is also used to cement the co-dependence of software and hardware, thereby ensuring that purchasers cannot utilise the latter without simultaneously deploying complementary - i.e., authentic and firm-generated - software. All of the firm's equipment is software dependent and is inoperable unless used in conjunction with the bespoke (and protected) operating programmes that are supplied by the organisation.

Additional shielding of the firm's products from 'reverse engineering' is provided by the protective coatings that are applied in order to 'weatherproof' monitoring and data-logging equipment. Such coatings imply that it is almost impossible for competitors to penetrate 'sealed unit' devices and thus reveal their construction and component configurations.

The manufacture of company products has recently been outsourced and this has required renewed attention to issues of IP protection. Contracts with manufacturers stipulate a requirement for confidentiality and all suppliers of complementary services and technologies (e.g., distributors and sensor manufacturers) are made aware of the need to ensure the security of product designs and configurations.

For the firm - a company that supplies relatively sophisticated micro-electronic devices and supporting operating systems - 'physical' (and technological) means of protecting IP are at least as important as formal and legal instruments. Computer code is the core component (and locus of IP/expertise) in the company's offerings and it is this that requires most rigorous protection. Other company outputs (consultancy reports etc.) are less easy to protect and 'copyright' law - although frequently a preferred instrument in relation to published materials - has been found wanting in significant respects.

4.3.5.5.4 Success by Protection Strategies

The firm operates in a rapidly expanding but highly competitive market. Its current position appears to be strong and the company boast some key sources of competitive advantage (e.g., competence in core areas of technological development, high quality but inexpensive products, high-levels of customer support, strong links with its client base, and access to complementary assets). The market for data-logging devices is growing exponentially and many new applications for such products have been identified. Business and growth strategy entails the development of high-quality, inexpensive, reliable and user-friendly equipment and this is to be complemented by the extension and enhancement of end-user services.

Expense has constituted an important barrier to the use of formal instruments for IP protection: the company is young and its resource are applied principally to innovation and to the commoditisation of new products. Whereas to date the protection of IP has been successful and assured primarily via the deployment of physical or technological barriers to imitation, the company's aim to expand the 'consultancy and services' components of its business will require more careful consideration of appropriate instruments. To remain competitive, the company must bundle additional and high-value services with its products. Such services (e.g., consultancy, data-interpretation, training etc.) add value to and increase the functionality of technological artefacts and it is these 'intangible' components of the company's offerings (rather than its physical products) that will require ever greater protection in the future. Consequently, the company has to adjust its appropriate mix of informal protection instruments – adequate for the current framework – to the upcoming challenges.

4.3.5.6 Large Media Content Developer and Broadcasting Company: Formal Protection Tools to Generate Revenue

4.3.5.6.1 Company Characteristics

The firm is a media content developer, mainly for television and radio. It also broadcasts its media content, as well as being engaged in interactive Web services. If media content creation is regarded as 'manufacturing' and broadcasting is regarded as a service, then manufacturing accounts for circa 80% and broadcasting for 20% of the firm's activity. The firm, which is slightly more than seventy years old, is regarded as among the very largest media and broadcasting firms in Europe (and perhaps in the world), with just about 25,000 employed (mainly nationally).

Although the company is independent, it provides a *public service* to the nation in which it is located, being the main firm creating and delivering media content mainly to its nation, but it is also broadcasting its content world-wide (either directly or via licence). Due to its public service character it is completely publicly regulated, mainly in order to safeguard the public interests. However, it is still able to appropriate on a more competitive basis from private users at home, as well as from both public and private users abroad. Increasingly the firm is looking for such arrangements in order to increase its royalties.

The firm regards itself as very superior to other firms in creating first-class media content, but it finds the competition in broadcasting increasingly difficult (i) due to the rapidly evolving new forms of media delivery, including digital technology and (ii) due to the many newcomers to the field, as well as (iii) due to an increasingly aggressive IPR behaviour of the very large established firms. However, the firm has no intention to downsize its broadcasting activities as it finds it important to control both media content and broadcasting (i.e. be on all fronts). Consequently, the firm sees that a merger or joint venture may finally solve the problem. (Also, many firms which are strong in broadcasting are looking for good content creators.)

4.3.5.6.2 Innovation Strategy/Activities

The innovation strategy is explicit, and formulated and implemented by an executive committee consisting of a high board of directors from different units, such as engineering unit, R&D unit, business unit, new media unit etc.

Innovation strategy is to always be 'all platforms' within the company including innovating in programmes, new media, new methods of delivery content (including text, graphics, radio, video), new types of services (wrap phones). Also organisational innovation - internally as well as externally – is important.

The firm has many research and development programmes running with public institutions (such as universities). It is also active in publicly funded research projects, funded by international sources (e.g. EU projects), as well as nationally (e.g. national research council projects).

4.3.5.6.3 Challenges and Protection Strategies

In the whole company context the firm emphasises that IPR do not solely define the strategy of the entire company, as there are so many puzzles and issues to take care of, such as content, creativity and quality of new media creation, as well as the overall management of the organisation, etc. Hence, lots of different capabilities need to co-exist and come together, in order to be competitive and successful. However, IPR activities are planned and linked to the overall strategy of the firm at a high level (through the high board of directors linking all units)

Patents are not central for the whole company context, but they have an important competitive role to play, especially in relation to ways of delivering and receiving media content. Often patents are obtained mainly for licensing in order to increase the revenue income from royalties (25% of current patent portfolio is currently licensed). Also, as one of the world's largest producers of copyrightable media material, copyrights are fundamental for the way value is created and appropriated in the firm. The same is true for trademarks to a certain extent.

IPR are also valuable for the company in general, as it finds it important to be (i) a part of setting standards in controlling ways of delivering and receiving media content (here hardware in relation to broadcast and electronic technologies are central, rather than IT technologies as traditionally understood) (mainly protected by patents), just as it is important for the company to be (ii) good in its main activity of content or media creation (mainly protected by copyrights and trademarks). As mentioned above, the firm has a policy of always being at 'all platforms'.

4.3.5.6.4 Success by Protection Strategies

Due to the public character of the services the firm provide, the firm cannot act as a normal commercial firm reacting to special market signals in order to maximise revenue. That is, the firm is responsible for innovating media content representing a broad range of the public interests, even if this does not maximise its revenue. There is an organised bottom-up strategy in which the individual and the national regions can express their opinion regarding the content and quality of the public service the firm provide.

The fact that a maximising revenue strategy in media content and broadcasting is not possible has become a more serious problem or phenomenon in a globalised

world, where this firm is competing against many new and differently organised firms providing of popular media content (e.g. live football games as well as new movies). The other firms (often pay per-view media and broadcasting firms) are escalating permission-to-broadcast prices by bidding higher prices.

However, although the firm cannot appropriate from public users in its home country (due to the public service phenomenon), it can appropriate from national commercial businesses (e.g. information bureaus) that use their services, as well as appropriate from both public and private users abroad. Increasingly, the firm looks at how to appropriate from abroad (i.e. outside its national domain), as well as looking at how it can appropriate from non-public broadcasting sources such as books and other merchandise related to their media content.

It became evident how difficult it is for publicly regulated national media content providers in the new economy. However, it is possible to stay in the game by maximising its value driven intellectual capital using all its means. This firm finds itself in a situation in which its competitive position and spheres can be sustained by looking outside its public domain.

5. Future Challenges and Policy Considerations for the IPR Regime in the Service Industries

The service sector is characterised by some special features and influenced by some major trends, which have also an impact on the importance and role of IPR. These characteristics and trends will be described and their challenges for IPR aspects will be worked out in the following Sections 5.1 and 5.2. Both these general features and these more future-oriented aspects serve as a background for considerations regarding IPR policies. This background is enriched by the criticisms raised and the suggestions made by the analysed case studies. Consequently, we are able to formulate policy considerations in the final Chapter 5.3.

5.1 General Characteristics of the Service Sector

The case studies confirm the tremendous heterogeneity amongst services sectors and service companies, a result well known from the relevant literature and conducted empirical analyses, like CIS (Tether et al. 2000).

The large diversity exists in the activities undertaken by service firms, as well as in the knowledge bases upon which they rely for both their daily business and their more future-oriented innovative activities. Compared to the manufacturing sector, this diversity seems to be even greater.

It is not sufficient to define services just in a negative sense, (i.e., not manufacturing). A step towards a fuller understanding is the grouping or classification of the main services sectors in terms of their activities. Although there are sufficient differences between these service sectors, a sectoral approach, even if more differentiated than in official statistics, is also limited due to the great diversity that exists even at the narrower sectoral level. Furthermore, within one sector we find a few large and often multinational companies besides a significant number of medium-sized regional or niche players, and a large number of small and micro-businesses active in highly localised markets.

As in other recent studies (like Tether et al. 2000 and Evangelista 2000), the case studies challenge the view of services not being innovative. Since we have a bias towards larger and more innovative companies, it is no surprise that almost all of our companies are engaged in innovative activities. Nevertheless, differences between sectors can be detected. Companies in the emerging software and media sector report stronger innovation-related activities compared to companies active in more mature sectors, like the banking, wholesale and retail sectors. And R&D-related services are innovative per se.

Regarding the performance of R&D in the narrower sense, service companies do often not engage in R&D. The most widely undertaken innovation-related activities were the acquisition of machinery and equipment, the acquisition of other external technologies (including software), and training of staff, all directly in relation to innovation. This illustrates the general importance of bought-in technologies to innovation in service enterprises, as well as the importance of enhancing the skills of the personnel within the enterprises (in relation to the adopted technologies).

The aims of innovation for service companies are manifold, including the improvement of the quality of the services offered, the extension of their service range and opening new markets. In comparison to rather process-related aims of innovation, like an improved internal flexibility and the reduction of labour costs, it appears that most service firms primarily aimed to use innovation to improve or extend the services they provide, whilst process-related considerations are also important, but secondary. Although improving processes and increasing efficiency gain in importance with the maturing of emerging service sectors, when the massive growth of the whole market decreases or stagnates.

Before turning to the protection strategies and activities, it is important to note that internal process knowledge, which is crucial for providing services, is obviously the most valuable asset for the service companies. Since the provision of many services relies on ICT, software is a further important asset necessary to be protected. Furthermore, for the majority of all companies, it is important to safeguard the unique skills of their staff.

Protection instruments in general do not enjoy highest priority for most of the companies. Regarding their ranking four instruments are significantly above average in importance. The most important protection means are trademarks, which are effectively the only formal protection means of high importance across the board of different service sectors. The other three protection tools with a ranking above average are all informal: secrecy, customer relationship management and gaining lead time advantages. Both the case studies and the quantitative analysis of the patenting activities of large European service companies confirm the very limited significance of patents. Only in technical hardware-related services, are patents used in a frequency and intensity comparable with the manufacturing sector. The database analyses disclose furthermore, that especially telecommunication companies have applied for a significant number of patents. Consequently, patent protection by service companies focuses on ICT. All other technologies are of minor importance.

These general features of the service sector have to be taken into account regarding the shaping of an IPR regime in future. In the next section, some major challenges for the IPR regime relevant for the service sector will be presented, before in the last section respective policy considerations will be developed also based on the criticisms raised on the existing IPR regime.

5.2 General Trends in the Service Sector and Policy Challenges

We start out with a general feature of the service sector, its heterogeneity, which will become more significant, since a stronger division of labour will also lead to a stronger specialisation within the service sector. The **heterogeneity of the service sector** requires that the IPR policies have to be shaped in a way which corresponds to this high diversity on the one hand, but also avoiding a fragmentation of the general IPR regime into many sectoral sub-regimes. Whereas the need for differentiation finds support among the relevant companies and from an economic point of view, lawyers and the legal system are in favour of one harmonised system.

Closely connected to the general heterogeneity of service companies is their **wide range of innovation activities**, which are also more likely to become broader in the future. It covers the intramural performance of R&D in selected cases, R&D collaborations with different groups of partners, and – most important – the simple sourcing of technology and software. If service companies are technology providers, like technical services or software developers, IPR schemes have to be developed which allow them to appropriate adequate revenues for their provided services. Since service companies are mainly technology users, also their interests as technology buyer and user have to be taken into account. Consequently, balanced solutions have to be found between the interests of service companies as technology provider and service companies as technology users.

The **frequent R&D collaborations** undertaken by service companies are a third dimension with relevance for IPR policies. Within these collaborations companies with diverging IPR interests and experiences congregate. IPR policy has to provide frame conditions which foster fruitful collaborations, make arguments less likely and provide solutions in case of conflict. Since service companies are often in relation to manufacturing companies inexperienced in IPR issues and not well equipped with an broad IPR portfolio, mechanisms for balancing this unequal relationship have also to be considered.

A further challenge for IPR policy in general stems from the special situation of **SMEs**. This dimension is also of relevance for the manufacturing sector, but the vast majority of very small or even micro companies, including the increasing number of free-lancers, in most of the service sectors makes a public policy intervention even more necessary. Since the majority of these very small entities has no resources to deal actively with IPR issues, a **distinction between active use of IPR**, like the application for patents, and **passive IPR strategies**, dealing defensively with others' IPR, has to be taken into account in shaping IPR policies. Many policy initiatives focus just on the promotion of the active use of IPR and neglect the second dimension, although both in the manufacturing and the service sector the minority of companies actively deal with patents. One example of a defensive strategy

is the early disclosure of information about innovations, which makes the application of patents by third parties more difficult and may therefore be an effective instrument to prevent competitors from appropriating own inventions. A passive strategy cannot be followed regarding trademarks and one has to register to avoid competitors making use of product or service names that are not registered as trademarks or brands.

Besides the passive use of IPR by SMEs, service companies trying to acquire **venture capital** have to present collateral, especially nowadays after the doom of the new economy. Since the major asset of many small companies is not physical capital, like machinery, but human capital embodied in their employees, they have major problem to gain the confidence of the venture capitalists. One solution to this problem are patents, which are often considered as sufficient security by venture capitalists. Among the other available IPR, only very popular trademarks may be accepted, since they possess a value of its own and are even traded by brokers. Therefore, start-up companies have besides the above dimension of passive use also an interest to use IPR, especially patents, actively until they gain a sufficient reputation regarding lending institutions, like banks.

Many service sectors have experienced and still go through a phase of **deregulation and privatisation**. This has caused severe frictions in the respective markets and in the long run an increased competitive pressure. Whereas in the area before deregulation, there was only little need to rely also on IPR to protect market shares, nowadays all of a company's assets are taken into account in order to secure competitiveness. This means both that all future activities are accompanied – if sensible – by the use of IPR and that existing assets are – if possible – codified and protected by IPR ex post. Since some of the deregulated companies have been state-owned monopolies, constellations can occur where these companies misuse these assets – collected under a regulated regime – to protect their market shares in the present and fight off potential market entrants. This special aspect has also to be taken into account in IPR policy.

The increasing **use of ICT** has also major impacts on IPR. On the one hand, ICT may leverage existing IPR on intangibles by the fast and cheap world-wide distribution and realisation of large economies of scale. On the other hand, the distribution of intangible assets via ICT infrastructures are endangered by not-legitimised copying destroying the economic value of IPR for the owner. And the world-wide enforcement of IPR is either impossible or accompanied by high and risky legal costs.

In the traditional older economics literature, services are often presented as the typical case of non-tradables due to their close relationship to their clients' location. Meanwhile an **internationalisation of services** has taken place and some services are provided by multinational companies based in numerous countries, like the case of fast food chains. On the other hand, on the base of sophisticated information

technologies service companies are able to offer spatial decentralised assistance, like telephone call centres supporting banks and insurance companies. The major challenge for IPR policy regarding this development is the involvement of rules from different national IPR regimes. This further internationalisation of services calls for also a harmonisation of both IPR law and – even more important – its real implementation. Since although de jure harmonised patent and trademark regimes exist in Europe, there are still significant differences regarding their implementation.

Finally, within service companies problems regarding the appropriation of revenues from knowledge and innovation may arise. Since many knowledge intensive business services rely crucially on the **skills of highly qualified personnel**, often just loosely connected to the firm as independent free-lancers. The latter are able to appropriate the revenues of their knowledge base and skills by increasing their claims in wage negotiations and do not have to rely on formal IPR. In contrast service companies have – as often pointed out – less means to do so. Therefore, the knowledge assets of service companies are not only threatened by competitors, but also by their own employees who erode the knowledge base, if they leave the company. The problem is even aggravated, if they start to work for a competitive company. Consequently, IPR policy has also to take this internal imbalance of means into account, which is less severe in traditional manufacturing companies, which are still able to protect their technological base by patents.

All these features and trends in the service sector have already been established, but will continue to develop and increase in importance. The overwhelming relevance of software has meanwhile even led to a change in the IPR regime, at least in the United States. And Europe follows the US example already in de facto granting software patents. In the following final section, adjustments or changes in the current IPR regime will be considered, taking into account also the priorities and concerns expressed by the companies analysed in the case studies.

5.3 Policy Considerations

Besides the general features and trends observed in the service sector and reported in the case studies, we have also collected critical comments on the current IPR regime and its different instruments and have asked for recommendations regarding adjustments and changes. In the following Table 5.3-1, these results are summarised on a sectoral level. Bearing in mind the very small number of observations we cannot claim to have collected a representative picture, although some significant patterns can be identified.

Trademarks in general do not cause significant problems. In very rare cases administrative or juridical problems are reported. However, their effectiveness regarding the protection of innovations is also limited, which explains the rather low degree of conflicts and problems. **Copyright protection** is only relevant for some service sectors. Regarding the classification of services according to their knowledge regime, only two service sectors, namely the media content providers and the software developing companies, can adequately protect their products by copyright. Therefore, they experience two major problems, which are confirmed by some financial service providers. First, they complain about the limited protection provided by copyrights and the costly and often impossible enforcement. Second, both service sectors are to a high degree internationalised, in the sense that both the production of their services relies very often on input from services companies located in different countries and their distribution aims to reach customers world-wide. Consequently, these companies are confronted with different national IPR regimes, both on the input and the output edge. Due to differences between national copyright systems and their implementation, companies suffer from these inconsistencies and the massive difficulties to enforce copyrights if infringement occurs.

Finally, **patents** cause two kind of problems. The first one is linked with their scope, the second one with their current implementation. For some service sectors patents are not at all relevant, since their new products, services, tacit and even codified knowledge is not patentable. Some companies take this situation as granted and have no ambitions to extend the scope of patents, since they question the effectiveness of patents for their business or they admit a low level of knowledge about patents in general. Other companies complain about the disadvantage in comparison to the manufacturing sector or to companies located in other IPR regimes, like in the case of software. Companies which are more experienced regarding patents belong to the latter group, because they have their origin in the manufacturing sector or they provide very hardware-related services.

Table 5.3-1: Problems with different IPR, Critique and Recommendations reported in the Case Studies

	Problems with Patents	Problems with Trade-marks	Problems with Copy-rights	General Critique on the IPR regime	Recommendations
Retail and Wholesale Sector	<ul style="list-style-type: none"> new services and tacit knowledge is not patentable 	<ul style="list-style-type: none"> just minor juridical and administrative problems 	<ul style="list-style-type: none"> not relevant 	<ul style="list-style-type: none"> costly and complicated patent application process obstacles by too many patents issued for products with little innovative content 	<ul style="list-style-type: none"> simplification of patent application and trademark registration processes
Transport Services	<ul style="list-style-type: none"> significant lack of knowledge processes and tacit knowledge are not patentable 	<ul style="list-style-type: none"> administrative and costs issues in general no problems 	<ul style="list-style-type: none"> not relevant 	<ul style="list-style-type: none"> international differences 	<ul style="list-style-type: none"> international harmonisation of national IPR systems
Communication Infrastructure (CI) and Media Content (MC) Services	<ul style="list-style-type: none"> high costs and low effectiveness (CI) 	<ul style="list-style-type: none"> in general no problems 	<ul style="list-style-type: none"> differences between national frameworks (MC) 	<ul style="list-style-type: none"> lack of an international standardisation of the IPR (i.e. patent regime)(CI) postponement of the introduction of the European Community Patent (CI) limited applicability of the existing IPR system to their business (MC) 	<ul style="list-style-type: none"> standardised and even centralised IPR system extension of the patent protection (software and even business patents) (MC)

Table 5.3-1 continued

Financial Sector	<ul style="list-style-type: none"> new products and services are not patentable 	<ul style="list-style-type: none"> in general no problems 	<ul style="list-style-type: none"> coverage of protection is limited different national legislations cause additional effort 	<ul style="list-style-type: none"> limited applicability of IPR in the financial sector differences among the national IPR regimes 	<ul style="list-style-type: none"> international standardisation of the national IPR regimes extension of the current IPR to new Web-based developments
Software Sector	<ul style="list-style-type: none"> software is in principle not patentable effectiveness of protection questioned high cost and time-consuming application procedures 	<ul style="list-style-type: none"> just minor juridical and administrative problems 	<ul style="list-style-type: none"> problems with monitoring infringements and enforcing of copyright protection limited effectiveness of copyright protection 	<ul style="list-style-type: none"> juridical uncertainty about software patents differences among the national IPR regimes differences between national jurisdictions regarding copyright lacking registration of copyrights 	<ul style="list-style-type: none"> some companies call for introduction of software patents development of new, but not specified instruments introduction of the European Community Patent
Business Services	<ul style="list-style-type: none"> products and services not patentable effectiveness of protection questioned due to lack of knowledge and resources assistance required 	<ul style="list-style-type: none"> low effectiveness regarding protection of innovations sometimes administrative problems 	<ul style="list-style-type: none"> mostly not relevant 	<ul style="list-style-type: none"> limited protection of software and "business methods" no international harmonisation expensive and slow system and problems to control infringement but: also satisfaction 	<ul style="list-style-type: none"> introduction of the European Community Patent extension of the current IPR regime towards intangibles simplified fast track procedures
Manufacturing Sector	<ul style="list-style-type: none"> high costs and low effectiveness 	<ul style="list-style-type: none"> just minor juridical and administrative problems low effectiveness regarding protection of innovations 	<ul style="list-style-type: none"> not relevant 	<ul style="list-style-type: none"> lack of a European Community Patent and a European Patent Court reluctance regarding the introduction of software patents 	<ul style="list-style-type: none"> introduction of the European Community Patent introduction of a European Patent Court introduction of software patents

Critique directed to the implementation of the patent system is raised by service companies actively using patents, like some hardware-related business services, transport and communication infrastructure providers and manufacturing companies also providing product-related services. Besides high cost and time for patent applications and prosecution of granted patents, the effectiveness of patent protection in general is also sometimes questioned.

Having in mind these critical perceptions of the analysed service companies and the general IPR-relevant trends in the service sector, the following suggestions directed to future IPR regimes can be derived.

In order to solve the problem of heterogeneous national patent systems and differences in the applications, a harmonisation at least in the European Union should be reached by the introduction of the European Community Patent, as it was already announced at the Lisbon Summit 2000. Furthermore, for the solution of patent conflicts within the European Union it is under discussion to introduce a European Patent Court, which would not only decrease legal costs and insecurity, but would also increase the effectiveness of patent protection and hence the attractiveness of the patent system in general, especially for small and medium enterprises.

Whereas a harmonisation within Europe can be legitimised also by the completion of the internal market, a conformity between the US and the European patent systems is ambivalent. Especially regarding the introduction of software patents, which means following the US example, an intensive debate is ongoing and contradicting positions exist. On the one hand, especially large software companies and companies with their origin in the manufacturing sector argue that the possibility to patent software inventions would allow them to catch up with their US competitors. On the other hand the critical voices stress that the additional legal costs, caused by the need to screen existing patents and by a higher likelihood of litigations, may create negative incentives for innovation activities leading to an erosion of competitiveness of the European software sector in the long run.

From the legal perspective, a harmonised situation corresponds to legal clarity. From an economic point of view, one has to answer the question whether the advantages of competition between different IPR regimes surpass the additional transaction costs caused by the differences between the various regimes. Furthermore, the positive aspects of competition between IPR systems can lead to a similar situation like in the dumping of social and labour standards in order to attract physical capital. Whereas we observe a race to the bottom, regarding IPR we may perceive a race to the top in the sense of a massive expansion of the IPR and especially the patent scope. At the end of this game, all involved parties will be worse off compared to the initial situation, because in the end the positive incentive and disclo-

sure⁶⁶ effects of IPR will be overruled by the massive increase of transaction costs. Summarising the observations and the theoretical considerations, an expansion of the patent scope to software has to take into account all the different, often contradicting aspects.

Besides the introduction of software patents sometimes it is suggested to develop new forms of IPR better suited for services. Here again, one can apply the general argument explained above. The introduction of new forms of IPR may generate additional incentives to innovate for the relevant service companies. However, the current IPR system already causes significant costs for its users. The more intangible and tacit the objects of protection are, the higher the costs for their application or registration will be and the more difficult their prosecution. Furthermore, we have stressed the heterogeneity of the service sector, the underlying knowledge regimes and the business models. In order to take the approach of new forms of IPR seriously, one could recommend sector-specific or knowledge-regime-specific solutions. However, this would create a further heterogeneity, less legal clarity and even more information and transaction costs. Consequently, one should be very careful with the development and the implementation of new IPR and should focus on the existing ones.

Below the level of legal changes, there are a number of starting points to improve the existing system. Most important appears to be to increase knowledge about the IPR regime among service companies. The case studies revealed a clear need to learn more about the patent system. The knowledge deficit is particularly obvious in the area of SMEs and some southern Member States. Besides initiatives to raise the awareness about the IPR regime, in particular SME measures should be initiated to systematically reduce the costs for application and enforcement of IPR, especially patents, which are often criticised, should be implemented. Here the creation of a kind of central complaint and consultancy institution could help, to which the enterprises and above all independent developers could turn, who feel themselves threatened by IPR, especially patents, in their innovation activities.

Finally, possibilities for simplifications should be identified and realised within the patent and trademark system. In the case of copyright, sometimes it is suggested to introduce – at least – a voluntary registration, like in the US. This would centralise efforts already undertaken by service companies, mostly software developers to deposit proofs for their inventions at their legal consultants. Legal security will also be improved by this centralisation, if the registration procedure follows standardised and transparent guidelines. Furthermore, if the data is made accessible by the re-

⁶⁶ The disclosure of technical knowledge through the patent system is already insufficiently exploited by service and even manufacturing companies. Therefore, the disclosure of additional information will not generate additional benefits. The information overflow already causes significant costs, which may even be higher than the benefits from the information sources screened.

spective institution, this institutional innovation may also provide the disclosure function of IPR. Finally, the databases would also allow statistical analyses and consequently the development of innovation indicators.⁶⁷

This leads to the final point of innovation indicators, which serve policy-makers as one source of information if priorities in policy-making have to be set. One main objective of the study was to prove whether patents are an adequate and feasible indicator for innovations in the service sector. From the literature review, the quantitative analysis, the case studies and CIS survey it can clearly be stated that patents are an innovation indicator only of limited value for the service sector in general, but adequate for specific service sectors, like telecommunication. First, just above 5% of service companies apply for patents and there is no observable trend towards a higher share, although in the last few years applications for software patents have significantly risen.⁶⁸ Furthermore, the shares of applicants between service sectors are rather skewed. On the one hand, hardware-related service companies are as likely to apply for patents as manufacturers, whereas retail and whole sale companies or banks and insurance in general do not apply for patents at all. This extreme variance cannot be observed in the manufacturing sector, which allows patents to be a more powerful innovation indicator. Finally, the patent applications of large service companies focus strongly on ICT-related fields of technology. Summarising these observations and deriving a final conclusion, one should be very careful to use patents as innovation indicator for the service sector in general. However, for technology- or hardware-related service sectors patents may service as an (output-oriented) innovation indicator even, for international comparisons.

Regarding alternative innovation indicators, trademarks should not be forgotten. The share of service companies registering trademarks is higher and not so heterogeneous as between service sectors. However, trademarks are often not directly linked to an innovation, but motivated by marketing reasons to increase the visibility of their services in the market or reflecting competitive strategies. Nevertheless, the registration of a trademark often has the function of supporting the introduction of a new service in the market. Therefore, trademark registration reflects innovation activities in a very market-related sense and not necessarily in a technology sense. And there are almost no hurdles regarding the innovation height. If one weighs the latter restrictions not too high, trademarks could replace patents as innovation indicators, especially in those service sectors with almost no patent applicants, and they may complement patents in the very few service sectors with significant patent ac-

⁶⁷ Andersen and Howells (2000) discuss the pros and cons of copyrights as indicators of innovation. Graham and Mowery (2002) observe in the US a decrease of copyright registration since the possibility to patent software, which give hints that this may be a reliable and valid indicator for innovation activities at least in the software sector.

⁶⁸ Cf. Blind et al. (2001).

tivities.⁶⁹ One challenge to future research is the integration of trademarks in the system of science, technology and economic indicators.

⁶⁹ Cf. the recent study of Schmoch (2002)

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Annex 1: 50 Large European Service Companies

VEBA AG
METRO AG
VIVENDI
CARREFOUR
DEUTSCHE TELEKOM AG
KONINKLIJKE AHOLD N.V.
HEWLETT-PACKARD EUROPE B.V.
SUEZ LYONNAISE DES EAUX
ELECTRICITE DE FRANCE SERVICE PUBLIC (E.D.F.)
ALDI
TESCO PLC
BRITISH TELECOMMUNICATIONS PUBLIC LIMITED COMPANY
FRANCE TELECOM
J SAINSBURY PLC
AUCHAN SA
MANNESMANN AG
TELEFONICA SA
DEUTSCHE POST AG
ENEL SPA
VIAG AG
PETROFINA
SOCIETE NATIONALE DES CHEMINS DE FER FRA (SNCF)
ARTEMIS
PINAULT PRINTEMPS REDOUTE
TELECOM ITALIA
REWE
DEUTSCHE BAHN AG
KINGFISHER PLC
BOUYGUES SA
GRUPO FERROVIAL SA
RALLYE SA
FRANZ HANIEL & CIE. GMBH
VITOL HOLDING B.V.
CASINO GUICHARD PERRACHON SA
LA POSTE
KARSTADT QUELLE AG
THYSSEN KRUPP INFORMATION SYSTEMS GMBH
ALSTOM SA
GEHE AG
MONTEDISON SPA
WPP GROUP PLC.
STINNES
ETABLISSEMENTS DELHAIZE FRERES ET CIE "LE LION"
CABLE AND WIRELESS PUBLIC LIMITED COMPANY
DEUTSCHE LUFTHANSA AG
BRITISH AIRWAYS PLC
OTTO VERSAND GMBH & CO.
ENDESA SA
ASDA GROUP LIMITED
MARKS AND SPENCER P.L.C. (M&S)

2.1.5 What is the size of your company/unit

- number of employees globally: _____ domestically _____
- turnover globally _____ domestically _____

2.2 *activity/market*

2.2.1 main business activity and market of your company/entity (NACE):

2.2.2 market structure/situation:

- number of important competitors home _____ abroad _____
- how many potential product imitators are there on your market _____
- how many market newcomers did you have within the last three years _____

(3) 2.2.3 how important is the technological dimension for the competition in your market?

(4) 2.2.4 overseas activities

- what share of your sales go abroad? where to?
- how international is your investments?

2.3 *What is the relative weight of service activity (proportion of turnover):* _____

3. Performance

3.1 *profit* 1999: _____(EURO)
 change in last five years _____ %
 expected in 2002 _____(EURO)

3.2 *market share* 1999: _____(EURO)
 change in last five years _____ %
 expected in 2002 _____(EURO)

2.4 *What innovation activities is your company/unit engaged in?
Please indicate the current and the future importance of these activities.
(alternative: open question)*

	not import.				very import.	will gain importance
Research and experimental development within the enterprise	?	?	?	?	?	?
R&D co-operation/joint venture with client	?	?	?	?	?	?
supplier	?	?	?	?	?	?
private technology provider	?	?	?	?	?	?
competitor	?	?	?	?	?	?
public research institute/university	?	?	?	?	?	?
Acquisition of R&D services	?	?	?	?	?	?
Acquisition of machinery and equipment linked to technological innovations	?	?	?	?	?	?
Acquisition of software and other technology linked to technological innovations	?	?	?	?	?	?
Acquisition of (smaller) companies	?	?	?	?	?	?
Licensing in	?	?	?	?	?	?
Training directly linked to technological innovations	?	?	?	?	?	?
Surveying patenting literature	?	?	?	?	?	?

2.5. *Objectives of innovations?*

How important are the following driving forces for your innovation activities (1: not important at all; 5: very important/main driving force)

Please indicate also, if the driving force will gain importance in the future?

(alternative: open question)

	not import.				very import.	will gain importance
<i>Product innovation</i>						
Replace existing, mature services	?	?	?	?	?	?
React to short innovation cycles of related products/services	?	?	?	?	?	?
React to innovation strategies of competitors	?	?	?	?	?	?
Improving service performance/quality	?	?	?	?	?	?

	not import.				very import.	will gain importance
<i>Product innovation (cont.)</i>						
Extend/complement service range	?	?	?	?	?	?
Optimise existing service chain	?	?	?	?	?	?
Open up new markets or increase market share	?	?	?	?	?	?
Fulfilling product regulations, standards	?	?	?	?	?	?

Process innovation

	not import.				very import.	will gain importance
<i>Process innovation</i>						
Improve internal business process flexibility/speed	?	?	?	?	?	?
Reduce labour costs	?	?	?	?	?	?
Fulfilling regulations standards for internal processes	?	?	?	?	?	?

2.6. *Obstacles for innovations*

2.6.1 What are your most important obstacles for innovation?

(9) 2.6.2 In relation to other obstacles for innovations (risks, inadequate staff, costs etc.), how important are the inappropriate means of
(possible alternative: open question)

- | | | | | | | |
|------------------------------|---|---|---|---|---|---|
| • protection of innovations | ? | ? | ? | ? | ? | ? |
| • of exclusive appropriation | ? | ? | ? | ? | ? | ? |

C. Strategies and activities to protect intellectual property

1. Object of protection

*In your general, overall efforts to protect knowledge, **what** are you protecting (not only codified knowledge protected by IPR, but general knowledge protected by all kinds of protection strategies)?*

For companies engaged in manufacturing: If possible, please indicate if the related activity is mostly related to service or to manufacturing business:

		activities mostly related to	
		service	manufacturing
IT-Hardware	?	?	?
IT-Software	?	?	?
other technology	?	?	?
internal process knowledge	?	?	?
unique skills of your staff	?	?	?
market knowledge	?	?	?
consumer relation	?	?	?
other?	?	?	?

2. Protection Strategies

*2.1 Do you have an explicit or implicit **strategy to protect** the critical knowledge embodied in your service products?*

2.1.1 If you **have** a strategy,

- Who formulates and implements this strategy?
- On which level and how are the IPR-activities linked to the innovation strategy and the overall strategy of the firm?
- In relation to marketing and R&D, how important is the IPR-strategy in your firm's innovation strategy?
- How does the special conditions of your market and product influence/determine your protection strategy?

(10) 2.1.2 If you **do not have** a strategy:

- Why not?
- Who decides on IPR-activities, and who implements these decision?

(11) 2.2 What factors determine and shape your general IPR considerations and actions?

2.3 Are you using one of the following protection tools, if yes, please indicate the relative importance (and – where possible – stocks for 1999):

	yes (stocks)	no	not very important	very important	will gain importance
patents	? _____	?	?	?	?
trademarks	? _____	?	?	?	?
copyrights			?	?	?
secrecy			?	?	?
long-term labour contracts					
to secure tacit knowledge			?	?	?
lead-time advantages (being the first in the market)			?	?	?
customers relations			?	?	?
exclusive contract with supplier, external experts			?	?	?
complex product design			?	?	?
embodying intangibles in products			?	?	?
others: specify _____			?	?	?

(12) 2.4 Please indicate the importance of your overall IPR-activities as well as other business assets/instruments?

	not import.				very im port.	will gain importance
IPR-activities (protection strategy)	?	?	?	?	?	?
product quality	?	?	?	?	?	?
adequate supply of products	?	?	?	?	?	?
client oriented products	?	?	?	?	?	?
general client service	?	?	?	?	?	?
high level of technology	?	?	?	?	?	?
pricing	?	?	?	?	?	?
other business activities (specify) _____	?	?	?	?	?	?

3. Patents

For the following set of questions, please indicate if there are differences between patents related to manufacturing products and those related to service products!

3.1 Patenting decision-making

3.1.1 Are there general (written) patent guidelines in your company?

3.1.2 How is the patenting process organised? Who decides on patent application?
(which level, how centralised)

3.1.3 How often does your top management discuss on patents?

3.2 Actual patenting activities

3.2.1 In the last three years, what is the share of patents that you apply for

in service related products _____

in manufacturing related products? _____

3.2.2 What is the share of patents that you apply for

product innovation _____

and for *internal process* innovation? _____

3.2.3 For what percentage of innovations did you make a patent application (approx.)? (*Changes in last three years*)

3.2.4 What percentage of patents do you exploit yourself, and what is the rate of success? (*Changes in last three years*)

3.2.5 What percentage is licensed to other companies? (*Changes in last three years*)

3.2.6 In general, how long do you keep a patent in force? (*changes in last three years*)

3.2.7 Informational activities within protection strategy. Does your company

- know and use patent information databases?
- observe the competitors patenting strategy
- regularly scan patenting activities in the market (globally, domestically)
- regularly scan its own patenting requirements and possibilities

3.2.8 Where did you apply for patents in the last three years? (Europe, home country, USA, Japan, other)

Has your patenting activity become more international?

3.3 *What are your main motives for patenting*

- improve competitiveness by securing exclusive use of valuable knowledge (defensive use)
- block competitors' patenting and application activities (offensive use)
- increase companies value generation of licensing income (or royalty generation)
- prevent competitors to copy your innovation
- improve the situation in R&D co-operation or in other inter-firm negotiations (cross licensing, joint ventures)
- to prevent patent infringement suits against your company
- protect possible future technologies (prophylactic)
- use as internal indicator for R&D effectiveness
- improve the technological image of the company
- other: specify

3.4 *Self-evaluation of patenting-activities*

3.4.1 How effective is patenting for your company? (importance for long-range market success)

3.4.2 How do you measure effectiveness?

3.5 *Problems with patenting activities*

3.5.1 What are the major impediments to use patents to protect your knowledge?

- new products are not patentable
- new processes are not patentable
- our major asset, tacit knowledge, is not patentable
- lack of knowledge on patenting
- cost of applying
- time of applying
- cost of defending a patent in court
- limits to the effectiveness of patents in preventing imitation
- Technological development is so rapid that patents become irrelevant
- the amount of information disclosed in the patent publication
- no risk of imitation
- not sure if it can be marketed
- too little support by the state
- negative experiences in the past
- other protection means more effective (if so: which?)

3.5.2 What kind of (legal) problems with competitors do you have in your patenting activities? Have these kinds of problems become bigger?

4. Other IPR-instruments

4.1 *Trademark*

4.1.1 If you do **not use** trademarks: why? (costs, effectiveness...)

If you **use** trademarks:

4.1.2 In the last three years, what is the share of trademarks you registered

for service products? _____
for manufacturing products? _____

4.1.3 trademark strategy and organisation

- Do you have general trademark principles? (explicit? formulated)
- How is the trademark process organised? Who decides on trademarks on which level?
- How often does the company leadership discuss/decide on trademark matters?
- How many trademarks did you register last year/last three years?
- What is trademarkable for your company?
- In which regions of the world did you register?
- How many trademarks are licensed to other companies? In which cases and why? (Why not?)

4.1.4 Motives for trademarking

(alternative: open question)

	not import.			very import.		will gain importance
increase value of company	?	?	?	?	?	?
visibility in the market	?	?	?	?	?	?
corporate identity	?	?	?	?	?	?
to counter a new trademark of competitor	?	?	?	?	?	?
protection of specific product	?	?	?	?	?	?
protection of specific knowledge/ technology	?	?	?	?	?	?
other (specify) _____	?	?	?	?	?	?

What relative role do trademarks have in your protection strategy?

4.1.5 What major problems do you encounter with your trademarking activity?

- administrative
- juridical (with competitors)
- inside the company

4.2 Copyrights

4.2.1. Role of copyrights and copyrights activities

What is the role of copyrights for your protection strategy / marketing strategy?

What kind of activities as for copyrights are you engaged in?

4.2.2 Motives for active copyrights policy

	not import.			very import.		will gain importance
organise property rights in the market	?	?	?	?	?	?
visibility in the market	?	?	?	?	?	?
corporate identity	?	?	?	?	?	?
protection of specific product	?	?	?	?	?	?
protection of specific knowledge/ technology	?	?	?	?	?	?
other (specify) _____	?	?	?	?	?	?

4.2.3 Impediments/problems with copyrights

- many law suits
- international diversity of copyright systems?
- many potential property owners/participators within the value chain
- etc....

4.3 Open discussion of other, informal protection strategies (see question 2.4 in Section C)

5 Assessment of the existing national /European patenting and trademark system

5.1 What is your basic critics as for your national and the European patenting/
IPR system?

5.2 What is your request as for an effective patenting/ IPR system in Europe?