

Der Open-Access-Publikationsserver der ZBW – Leibniz-Informationzentrum Wirtschaft  
*The Open Access Publication Server of the ZBW – Leibniz Information Centre for Economics*

Hipp, Christiane B.; Herstatt, Cornelius

## Working Paper

# Patterns of innovation and protection activities within service companies: Results from a German study on service-intensive companies

Working Papers / Technologie- und Innovationsmanagement, Technische Universität Hamburg-Harburg, No. 45

### Provided in cooperation with:

Technische Universität Hamburg-Harburg (TUHH)

Suggested citation: Hipp, Christiane B.; Herstatt, Cornelius (2006) : Patterns of innovation and protection activities within service companies: Results from a German study on service-intensive companies, Working Papers / Technologie- und Innovationsmanagement, Technische Universität Hamburg-Harburg, No. 45, <http://hdl.handle.net/10419/55444>

### Nutzungsbedingungen:

Die ZBW räumt Ihnen als Nutzerin/Nutzer das unentgeltliche, räumlich unbeschränkte und zeitlich auf die Dauer des Schutzrechts beschränkte einfache Recht ein, das ausgewählte Werk im Rahmen der unter

→ <http://www.econstor.eu/dspace/Nutzungsbedingungen> nachzulesenden vollständigen Nutzungsbedingungen zu vervielfältigen, mit denen die Nutzerin/der Nutzer sich durch die erste Nutzung einverstanden erklärt.

### Terms of use:

*The ZBW grants you, the user, the non-exclusive right to use the selected work free of charge, territorially unrestricted and within the time limit of the term of the property rights according to the terms specified at*

→ <http://www.econstor.eu/dspace/Nutzungsbedingungen>  
*By the first use of the selected work the user agrees and declares to comply with these terms of use.*

---

# Technologie- und Innovationsmanagement

---

## Working Paper No. 45

PATTERNS OF INNOVATION AND PROTECTION ACTIVITIES  
WITHIN SERVICE COMPANIES

RESULTS FROM A GERMAN STUDY ON SERVICE-INTENSIVE  
COMPANIES

CHRISTIANE B. HIPPE

*Brandenburg University of Technology Cottbus, P.O. Box 10 13 44,  
Cottbus, D-03013, Germany  
hippe@tu-cottbus.de  
<http://www.tu-cottbus.de/personalmanagement>*

CORNELIUS HERSTATT

*Hamburg University of Technology, Schwarzenbergstr. 95  
Hamburg, D-21073, Germany  
c.herstatt@tu-harburg.de*



**Technische Universität Hamburg-Harburg**

Schwarzenbergstr. 95, D-21073 Hamburg-Harburg  
Tel.: +49 (0)40 42878-3777; Fax: +49 (0)40 42878-2867  
[www.tuhh.de/tim](http://www.tuhh.de/tim)

## Abstract

There is an increasing number of researchers conducting empirical and theoretical investigations to better understand innovation and protection activities of service companies. In fact, previous analyses reveal that the protection topic is difficult to study, particularly when using traditional measurement concepts like patents. Thus, a different analytical conceptual frame has been developed in order to investigate deeper knowledge about service innovation protection and corporate strategic behaviours.

*Keywords:* Service innovation; Protection strategies; Service companies; Study; Germany

# PATTERNS OF INNOVATION AND PROTECTION ACTIVITIES WITHIN SERVICE COMPANIES

## RESULTS FROM A GERMAN STUDY ON SERVICE-INTENSIVE COMPANIES

### **1 Introduction**

The study at hand focuses on service peculiarities as numerous authors have assumed that different service peculiarities influence the use of innovation and intellectual property protection approaches [Tether and Metcalfe (2004)]. Many of these peculiarities describe service innovations as part of larger systems that are fluid, loosely-coupled, and short-term oriented, highlighting dynamic change and only reflecting a situation at a certain period of time [Sundbo and Gallouj (2000)]. This explains why protection activities orient more around the actual requirements of the firm rather than around pre-defined rules. From this ‘fluidity’ standpoint it is clear why traditional intellectual property rights (IPR) mechanisms (e.g. patents), which are integrated into rigid, institutional, regulatory and national frameworks, will be of less relevance and why a variety of more fluid protection activities and strategies will predominate the institutional and technological peculiarities and also the organisational, strategic, and managerial agendas.

The study analyses data from a German study on intellectual property management of service-intensive companies (“Harburg Study”). A questionnaire for in-depth interviews has been developed — based on literature analysis on innovation in services and intellectual property rights. In total, case studies of over 20 service-intensive corporations located in Germany are carried out. In addition, a short version of the questionnaire has been sent to several hundred service-intensive companies in Germany. Elaborated insights into the strategy of protecting innovations of service-intensive companies are derived qualitatively and quantitatively.

The empirical analysis presented in this paper reveals, that service-intensive companies use vastly different and elaborate protection strategies. Five different strategy types were developed. For companies following a formal protection strategy patents, trademarks, and copyrights are of high importance. All

other strategy types focus on different informal means like secrecy and first-to-market activities, external or internal lock-in strategies, or a complex design approach.

The outcomes contribute to a better understanding of the service innovation activities with a specific focus on informal protection instruments and strategies. For example, in emerging Asian markets for which an institutional setting does not provide sufficient protection enforcement and therefore formal protection strategies are of less relevance, this study can contribute to better understand other alternative protection possibilities and strategies.

## **2 Rationale of an Intellectual Property System for Service Innovation**

The analysis of intellectual property rights within the manufacturing sector has been largely studied and covers a wide range of different topics and disciplines. In contrast, the research findings for the service sector are generally weak across all possible disciplines, such as economics, law, business administration, social sciences and engineering [Miles *et al.* (2000)]. In particular, the theoretical debate is almost non-existent.

Some of the first research on intellectual property rights and innovation activities in services was conducted by Andersen and Howells [2000]; this was followed by Miles *et al.* [2000], Blind *et al.* [2003], and Hipp and Grupp [2005]. Andersen and Howells [2000] particularly analysed the theoretical issues surrounding the rationale for protecting innovation in services and concluded that there are no differences between the rationale of manufacturing and service organisations. They do, however, highlight moral, ethical and economic features that are of significant relevance to IPR for service innovation:

- Human rights and business ethics: The basic moral reason for the existence of an IPR system is that people should own their own creativity and the right to obtain some reward from their creative output. Therefore, the law provides remedies against people who appropriate the ideas of another person.
- Consumer ethics: From this perspective, IPR systems function as a kind of protection mechanism; they protect consumers against confusion between products and quality as well as deception in the marketplace.

- Incentives to creativity: Arrow [1962] argued that property rights are useful for invention and R&D investment; however it is also argued that other approaches, such as direct government investment activities, are more effective. Despite this debate, it is generally accepted that the existing patent system does provide some benefits (although not enough).
- Increase competition: IPR mechanisms can help to secure R&D investment, as they can create a monopoly-like situation, which protects against new market entrants. Thus, through registration of IPR a dynamic environment of protection and promoting can be created, which could support economic prosperity, employment and a healthy competitive environment with an innovative focus.
- Order: an adequate and competitive science and technology system on the national level also includes an adopted and functioning IPR system.
- Increased information: A patent system facilitates knowledge-spillovers and technological change world-wide because patents provide immediate information to competitors even though they cannot use it directly for commercial purposes.
- Better advice: Analysis of an IPR system offers trends and information for policy makers concerning technological developments, new technical fields and generates insights into the promising potential of technological convergence.
- Uniformity: A national protection system brings in equal rights and reliability to everybody. This uniformity also makes it possible to promote cross-country trade in IPR.

Andersen and Howells [2000] argue that the patents and trademark systems are different from nation to nation. In the US and the UK the system is based on economic features and an economic rationale, while the German system has a clear order and is based on a moral rationale. Special problems with intellectual property protection are attributed to companies investing in emerging markets like China [Haley (2000)]. However, service innovations are neglected by all national IPR systems; which might create, if one was to follow the above described rationales, disadvantages for economies and societies. This neglect is further compounded by a lack of detailed empirical findings about the use of different formal and informal means of protection within service-intensive companies. Hence, it is not yet possible to make clear statements,

either under ethical or economical rationales, about the weaknesses of the existing IPR systems or recommendations for adapting these prevailing structures.

Those that focus on the notion that prevailing systems offer weak protection mechanisms for service innovation, agree that successful service concepts (which are not also dependent on deeper procedural or organisational changes) are rapidly copied by rivals. They claim that while the innovation effort of a service-intensive firm introduces new services to maintain dynamism and to better address customers' needs, a significant amount of this effort is allocated to processes and back office functions, which make the firm's operations less imitable. However, this "process bias" to innovation activities may not be typical across the whole service sector. For example, the German service sector displays no dominance of process innovations. Moreover, where services are complex and/or poorly defined (and where they require substantial input from the user), the nature and quality of the service provided is likely to be the primary source of competitiveness, not the invisible process in the back office.

Recent evidence suggests that service firms do not necessarily rate the lack of effective intellectual property rights as a major hurdle in innovation (see, for example, Haley [2000]). This could reflect the fact that they use other mechanisms, such as secrecy, and short cycle times, closely coupled with new service innovations that involve complex and tacit forms of work organisation [Andersen and Howells (2000)]. This generates a hypothesis that would predict that the intellectual property strategies of successful service innovators would be substantially different, more complex and less regulatory dependent than the formal protection strategies adopted by innovation focused manufacturing firms.

### **3 Concept of typologies and taxonomies as direction for the analysis of intellectual property patterns in services**

Innovation processes both within and across organizations, industries and sectors are often complex and display significant differences. An analytical approach that links the different possible levels of analysis and tackles this complexity and diversity is a structure known as a typology or taxonomy. This promising approach has been regularly used in world class innovation research (e.g. Pavitt, [1984]), where

investigators study and interpret the subject to identify classifications and “types” which show specific, internally homogeneous characteristics, such as innovation processes, strategies and behaviours. These characteristics, classifications or types can be derived conceptually (typology) or empirically (taxonomy) [Bailey (1994)].

Authors in service business and management economics make great use of typological models, particularly as they better represent the various manifestations of industrial sectors (e.g. Lakshmanan [1987]; Soete and Miozzo [1989]; Gadrey [1992]; Gallouj and Gallouj [1997]; Silvestrou *et al.* [1992]; Sundbo [1997]; Evangelista and Savona [1998]; Sundbo and Gallouj [2000]; Hollenstein [2003]). Overall, the most striking finding is the tremendous diversity that is repeatedly found within the population of service firms and this diversity is reflected in a very broad variety of different typology concepts. There are some trends, which reflect some service peculiarities, but there is also immense variation which can not put together. Whilst useful as starting points, simple taxonomies may mislead us into expecting much more homogeneity within classes or sectors than is actually the case. The diversity amongst service firms requires the integration of additional levels of analysis, which should be guided and described according to concrete research questions. This would most likely require a detailed analysis of data-sets, such as that undertaken by Evangelista and Savona [1998]. This analysis highlights, that it certainly makes no sense to analyze services as a homogeneous whole an argument also supported by Tether, Hipp and Miles [2001].

All the typology and taxonomy contributions are useful in distinguishing types of services with regard to different activities and arrangements. As ever, there is the danger of oversimplification, for there are a number of innovation trajectories in services, which are unevenly distributed across service sectors and service firms [Tether and Metcalfe (2004)]. But the strength of the typologies is that they emphasize diversity, both in relation to the activities of firms, and in relation to the nature and purpose of their innovation activities. This diversity is also associated with different patterns of innovation with respect to firm size and because of this diversity it is difficult to generalize about intellectual property management and activities.



Perhaps the most significant weakness of the typologies in relation to services is their technology focus in a narrow sense. When non-technological change is overlooked, a privileged role is given to information communication technologies (ICTs) (for example, see Barras [1986], [1990] and Quinn [1988]). This is understandable, given the wave of ICT introduction into services since the 1980s. But there is a danger that services and their dynamics will become so closely associated with the application of ICTs that other forms of change, and strategic choices, become overlooked. In addition, almost none of the described typologies take into consideration the role of intellectual property rights within the innovation process nor discuss implications for imitation or protection strategies for specific innovation types.

Just Sundbo [1997] made a real contribution to the role of IPR within service innovation types when discussing imitation and diffusion probabilities. Based on case studies, interviews and questionnaires of about 84 important innovations in Denmark, he developed a taxonomy of service companies utilizing management and organization of innovation processes as attributes. He identified three types, some of which are subdivided further. The first type (“A-type: top strategic organization”) combines especially large and medium sized companies directed by strategic management or a top manager as entrepreneur. Typically, these companies are structured, hierarchical organizations with clearly defined goals and strategies. Examples can be found in finance and tourism. Innovation processes, too, are determined by this strategy, i.e. the market situation and predefined goals are the starting point for innovation activities. These activities are directed and accompanied by top management supported by other organizational units. Of lesser importance for this type are external networks (cause: fear for imitation), and involving the customer. Public research plays only a minor role, too. However, informal networks within the company and in the external environment accelerate the diffusion of new ideas. The second type (“B-type: network organization”) is represented by small, not hugely innovative, locally present companies, co-operating with large organizations. These large companies assume both innovation and marketing for the smaller ones (e.g. trade in a franchise system). A third type (“C-type: professional organization”) consists, for example, of management and financial consulting companies based on highly qualified personnel with large areas of responsibility. These companies show a tendency towards increasing

modularization of service products and processes. In addition, there is a growing strategic orientation leading to larger organizations and institutionalized innovation processes. This approach might be a first starting point to link typology analysis with IPR activities within the service sector. However, a problem of indicator building remains, since the traditional approach to innovation surveys does not provide satisfactory input to this kind of analysis.

#### **4 Survey Methodology**

The “Harburg Study” of service-intensive companies was initiated in 2004 by the Department of Technology and Innovation Management of the Harburg Technical University. The purpose of this study was to get a better understanding of protection activities of service-intensive companies. To ensure comparability with other innovation surveys (e.g. The Mannheimer Innovation Panels, and the European Study on “Patents in the Service Industry”) well tested measurement concepts and questions were adopted; moreover, additional, complementing questions were added to test some additional hypotheses.

The sample was taken from the Hoppenstedt database; 1,000 firms were randomly selected from the 200,000 companies listed on the records. After a pre-test with 5 companies the questionnaire was finalised and distributed in mid 2004. In total, the questionnaire comprised of 5 pages and 18 questions. However, as with many surveys, response rates became a dominant issue. By early 2005, ninety-nine useable responses were received (a return rate of approximately 10%); this data was entered into the data base.

The sample includes a range of company sizes: over half of all responses came from companies with less than 50 employees. Slightly more than 20 per cent of the participating service firms had between 50 and 149 employees whilst one quarter had 150 or more employees.

To control for industry effects, categories of industry clusters were built. That means, the industries represented by numbers 28 to 45, in the ISIC industry classifications, were combined to form the cluster known as the ‘Manufacturing sector’; it represented 21% of the sample. Retail trade, Transportation, Banking, and Insurance were combined to form the ‘Infrastructure-intensive’ industry class, contributing 12% of the firms to the sample. Telecommunications, Media corporations and Computer and Software

services (industry classification numbers 64, 92 and 72 respectively) were combined to form the 'IT and media' dominated industry cluster, which represented 32% of the firms within the sample. 'R&D companies' totaled 10% and the remaining 24% of 'Other business services' formed their own industry class.

The questionnaire contained sections on intellectual property protection and innovation activities as well as questions to probe the different knowledge assets required to deliver the competitive advantage of the companies involved. Traditional R&D activities and formal protection mechanisms were features in the process but did not dominate the agenda. Instead, the results of discussions with company leaders during the pre-test phase ensured that a broader analysis was chosen. For example, a list of different formal and informal protection instruments was presented to the participants; these ranged from patents to Internet domains (see Table 1).

— Insert Table 1 —

The long list of possible protection activities can be organised to reflect different categories of companies. In fact the typology concept, based on index building, was applied in this research (see Rossiter [2002]) and five different strategy types were developed accordingly. For companies utilising a formal IPR strategy, patents, trademarks, and copyrights were shown to be of high importance. All other strategy types focus on the use of different informal mechanisms such as secrecy, first-to-market activities, external or internal lock-in strategies, and the use of complex design.

## **5 First Descriptive Empirical Results**

Of the 99 companies that participated in the survey almost half focused their protection activities on an internal lock-in strategy, followed by activities relating to secrecy and first-to-market strategies (see Table 2). Twenty-nine per cent of the firms concentrated on a complex design strategy while 27% of the corporations lock-in their customers and suppliers. Only 6% of the firms adopt a formal IPR strategy, this segment of firms was mostly dominated by the ICT and Media cluster. A surprising finding was that none of the Manufacturing firms utilised a purely formal IPR strategy; a complex combination of strategies was

more relevant to this industry category. An internal lock-in strategy was of most importance to the ICT and Media sector, the Consultancy industry and the R&D companies. The latter of these categories was very active in IP protection, with all of the companies from this sector utilising at least one protection strategy. Retail, Transportation, Banking and Insurance firms had the lowest levels of protection activities, yet internal and external lock-in strategies proved to be of most importance.

— Insert Table 2 —

However, these different protection types are not mutually independent — companies often followed different protection strategies in parallel. The empirical analysis of the sample shows that 24% of the companies did not use any protection instruments at all; 23% of the firms used just one, while 45% follow more than one type of protection strategy. Most dominant is the combination of the secrecy and first-to-market strategy with the internal lock-in strategy.

## **6 Innovation activities and the use of protection strategies**

It is assumed that innovation activities require protection mechanisms to ensure monopolistic structures and the opportunity for companies to deliver a return from their innovation investments. Macro economic arguments propose that formal mechanisms are best placed to ensure optimal investment levels into R&D and knowledge generation activities; this, it is said, will guarantee technical and economical progress. The following probit model (Table 3) presented empirical results that compare how the protection types are used in relation to the different innovation activities.

- Insert Table 3 -

The companies following a formal IPR strategy had a higher propensity to acquire software and a lower propensity to buy-in external R&D, machines or other supplies. Also the analysis of patent applications was negatively correlated with the use of a formal IPR strategy, an inconsistency that has no clear explanation. However, it can be summarized that software-sourcing firms were more likely to utilize a formal IPR strategy.

Firms with a secrecy and first-to-market strategy were more likely to acquire machines or supplies, use or takeover licenses, and train their employees in connection with their innovation projects. Of less

importance in this context were internal R&D, acquisition of external R&D and the analysis of patent applications. In sum, the use of a secrecy and first-to-market strategy is very much related to a strategy of supplier-dominated and demand-oriented knowledge building.

The acquisition of machines and supplies as well as the turnover of smaller service companies are the dominating innovation activities of service-intensive firms showing an external lock-in strategy. This is congruent with the network orientation of this grouping and it can be assumed that the knowledge-sourcing strategy of these firms revolves more around buying knowledge in, rather than building knowledge internally. The low importance of in-house training and education supports this assumption.

Unfortunately, the data does not expose very much about the interrelation between the specific innovations activities of service-intensive firms that use a complex design strategy. The only exception was regarding training and education and patent analysis, which were significantly less important to this category of businesses compared to others. This could explain why these firms tend to prefer safe incremental innovations based on design feature improvements, rather than radical innovations based on substantial development processes.

Analysis of those that mainly utilized the last remaining type of protection strategy, the internal lock-in strategy, showed that these companies tend to favour the acquisition of software and that other external knowledge-sourcing activities are significantly less important. This supports the notion that the knowledge and capabilities of in-house employees, which cannot be easily substituted, is of high importance to these firms.

## **7 Conclusions**

The study at hand analyzed how service-intensive innovation activities are correlated with protection strategies. Previous innovation surveys have shown that service firms do not use formal protection mechanisms, yet they fail to show what these firms are doing instead to protect their innovation results from imitation and uncontrolled knowledge-spillovers.

Traditionally, the service sector's innovation and knowledge protection approaches are perceived as less sophisticated when compared to their manufacturing counterparts. However, service-intensive firms

no longer focus on innovation through the use of acquired technologies; in fact, they are becoming an ever more important locus for innovative activity within the emerging “knowledge economy”.

The protection of innovation and knowledge within both the manufacturing and service-intensive industries is important; it helps to guarantee monopolistic structures in order to achieve an adequate return on investment into innovation activities. During this study it became clear that the well established patent system, which attends to the needs of the manufacturing and science based sectors, is not as effective for the service sector nor always the only protection strategy for manufacturing companies. Many firms from both sectors struggle adopting this formal protection approach and fail to leverage the same levels of dividends.

The empirical analysis presented in this paper reveals, at a high level, that service-intensive companies use vastly different and elaborate protection strategies. Five different strategy types were developed. For companies following a formal IPR strategy patents, trademarks, and copyrights are of high importance. All other strategy types focus on different informal means like secrecy and first-to-market activities, external or internal lock-in strategies, or a complex design approach.

Innovation activities themselves also influence the way in which companies handle the protection topic. The empirical investigation shows that the analysis of patent applications is strongly and negatively correlated with most protection mechanisms. A possible explanation for this phenomenon is that the companies surveyed simply use their patent analysis for inspiration or to obtain knowledge on the most competent actors in a specific field in order to target them for co-operative work or license applications. Thus, the acquisition of external knowledge appears to decrease the propensity to use formal and informal protection instruments. However, for many firms, the integration of externally generated knowledge is a complex task; for most it offers a method of combining outside knowledge with in-house R&D activities. Hence, employees with specialized competencies must be hired and retained.

The analysis can help to reassure companies when penetrating emerging markets for which formal protection mechanism are not legally or socially institutionalized. Other protection strategies exist, which can be applied either for manufacturing as well as service companies. Especially suited and promising are complex design strategies as well as the building up and combination of specialized knowledge. Thus,

other challenges have to be taken into consideration like the management of complexity, as well as an adequate knowledge and human resource management. If companies are able to find alternative ways of protection the potentials of emerging markets can be used for their own benefits and the danger of intellectual property theft can be reduced.

## 8 References

1. Andersen, B. and Howells, J. (2000). Intellectual property rights shaping innovation in services. *Knowledge and innovation in the new service economy*, eds. B. Andersen, J. Howells, R. Hull, I. Miles, and J. Roberts, Edward Elgar, Cheltenham.
2. Arrow, K. J. (1962). The economic implications of learning by doing. *Review of Economic Studies*, **29**(3): 155–173.
3. Bailey, K. D. (1994). *Typologies and taxonomies: An introduction to classification techniques*. Sage University Paper Series on Quantitative Applications in the Social Science, 07-102, Thousand Oaks et al.: Sage.
4. Barras, R. (1986). Towards a theory of innovation in services. *Research Policy*, **15**(4): 161–173.
5. Barras, R. (1990). Interactive innovation in financial and business services: The vanguard of the service revolution. *Research Policy*, **19**(3): 215–237.
6. Blind, K., Edler, J., Schmoch, U., Andersen, B., Howells, J., Miles, I. et al. (2003). *Patents in the service industries. Final report prepared for the European Commission*. Fraunhofer-ISI, Karlsruhe (EC Contract No ERBHPV2-CT-1999-06).
7. Evangelista, R. and Savona, M. (1998, October). *Patterns of innovation in services. The results of the Italian innovation survey*. Paper presented on the VIII Annual RESER Conference, Berlin.
8. Gadrey, J. (1992). *L'économie des services*. Paris: La Découverte.
9. Gallouj, C. and Gallouj, F. (1997). *EU-Projekt SI4S* (Internal working paper). Lille: IFRESI-CNRS.
10. Haley, G. T. (2000). Intellectual property rights and foreign direct investment in emerging markets. *Market Intelligence and Planning*, **18**(5): 273–280.
11. Hipp, C. and Grupp, H. (2005). Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research Policy*, **34**: 517–535.
12. Hollenstein, H. (2003). Innovation modes in the Swiss service sector: A cluster analysis based on firm-level data. *Research Policy*, **32**(5): 415–885.
13. Lakshmanan, T. (1987, June). *Technological and institutional innovation in the service sector*. Colloque „Recherche et développement, changement industriel et politique économique“, Université de Karlstad, Suède.
14. Miles, I., Andersen, B., Boden, M. and Howells, J. (2000). Service production and intellectual property. *International Journal of Technology Management*, **20**(2): 95–115.
15. Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory. *Research Policy*, **13**(6): 343–373.
16. Quinn, J. B. (1988). Technology in services: Past myths and future challenges. *Technology in service*, eds. B. R. Guile and J. B. Quinn, Washington, DC: National Academy Press.

17. Rossiter, J. R. (2002). The C-OAR-SE procedure for scale development in marketing. *International Journal of Research in Marketing*, **19**(4): 305–335.
18. Silvestrou, R., Fitzgerald, L., Johnston, R. and Grant, C. (1992). Toward a classification of service processes. *International Journal of Service Industry Management*, **3**(3): 62–75.
19. Soete, L. and Miozzo, M. (1989). Trade and development in services: A technological perspective (Working Paper No. 89-031). Maastricht: MERIT.
20. Sundbo, J. (1997). Management of innovation in services. *The Service Industry Journal*, **17**(3): 432–455.
21. Sundbo, J. and Gallouj, F. (2000). Innovation as a loosely coupled system in services. *Innovation systems in the service economy*, eds. J. S. Metcalfe and I. Miles, Kluwer, Boston.
22. Tether, B. S., Hipp, C. and Miles, I. (2001). Standardisation and particularisation in services: Evidence from Germany. *Research Policy*, **30**(7): 1115–1138.
23. Tether, B.S. and Metcalfe, J.S. (2004). Systems of innovation in services. Sectoral systems of innovation. *Concepts, issues and analyses of six major sectors in Europe*, ed. F. Malerba, Cambridge University Press, Cambridge, UK.



Table 1. Overview of the indicator concept used in the Harburg Study.

Protection instruments	Types / Strategies
<ul style="list-style-type: none"> <li>• Patents</li> <li>• Trademarks</li> <li>• Copyrights</li> <li>• Design patents</li> <li>• Utility patents</li> </ul>	Formal IPR strategy
<ul style="list-style-type: none"> <li>• Secrecy</li> <li>• First-mover advantage (being first in the market with new products and services)</li> </ul>	Secrecy and first-to-market strategy
<ul style="list-style-type: none"> <li>• Long term labor contracts</li> </ul>	Internal lock-in strategy
<ul style="list-style-type: none"> <li>• Customer relationship</li> <li>• Exclusive contracts with suppliers, external experts</li> </ul>	External lock-in strategy
<ul style="list-style-type: none"> <li>• Complex product design</li> <li>• Integration and combination of tangible and intangible parts in new products and services</li> <li>• Cross-licensing</li> <li>• Internet-Domains</li> </ul>	Complex design strategy

Table 2 Distribution of protection strategy and industry.

Strategy	Total	Industry				
	N=99	Manu- facturing	Retail, Transport, Banking, Insurance	Telecom- muni- cation, Software, Media	R&D	Con- sultancy
Formal IPR strategy	6	0	17	67	17	0
Secrecy and first-to- market strategy	34	29	0	24	24	24
External lock-in strategy	27	22	11	26	15	26
Complex design strategy	29	41	3	21	21	14
Internal lock-in strategy	48	21	6	29	19	25

Data source: Harburg Study, own calculation and illustration.

Note: All numbers in per cent.

Table 3 Probit model showing the interrelation between protection strategy and innovation activities

	Formal IPR strategy	Secrecy and first-to- market strategy	External lock-in strategy	Complex design strategy	Internal lock- in strategy
Internal R&D	0.001	-0.002**	0.029	-0.007	0.000
Acquisition of external R&D	-0.316**	-0.003**	-0.003**	-0.064	-0.003**
Acquisition of machines and supplies	-0.001*	0.205+	0.004**	0.125	-0.003
Acquisition of software	0.315**	0.013	-0.032	-0.056	0.010+
Use or takeover of licenses	0.096	0.240+	0.181	0.102	0.041
Acquisition of smaller service companies	0.222	-0.068	0.224+	-0.025	-0.038
Training and education directly linked to innovation projects	-0.006	0.003**	-0.002**	-0.002**	-0.003*
Analysis of patent applications	-0.002**	-0.005**	-0.002**	-0.002**	-0.003**
Constant	-2.683**	-1.341*	-1.531**	-0.618*	0.005
Number of observations	97	97	97	97	97
Prob. > chi <sup>2</sup>	0.0000	0.0000	0.0000	0.0000	0.0000
Pseudo R <sup>2</sup>	0.1994	0.1610	0.1752	0.0948	0.0714

Data source: Harburg Study, own calculation and illustration.

Note: + = p < .10; \* = p < .05; \*\* = p < .01