Service marks as indicators for knowledge-based services

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Terms like Information/Knowledge Society or Information Economy, even though sometimes used inflationary to a huge number of concepts and macro phenomena, imply that knowledge increasingly becomes the source of economic growth and social welfare. Especially approaches based on the post-industrial paradigm of information society highlight the relevance of services in the shift from pure industrial to post-industrial knowledge economy. One of the main aspects of such approaches suggested by Bell (1973) and a legion of followers is the emergence of the service sector as pillar of economic growth and employment. The patent system, at least at European level, does not account for protection of services as innovations. In simple terms, a patent can not be filed for innovations in services.[1] This raises questions on how to protect the Intellectual Property embedded in services using procedures of registration of these rights at a legitimate authority. One means of achieving protection is the filing of a trademark. In contrast to a patent, usually protecting a concept for the solution of a technical problem, or copyrights, protecting the concrete realisation of a concept from exact replication, the protective mechanism of a trademark is very closely related to the protection of products or services in market segments. In contrast to copyrights, which do not have to be centrally registered but are automatically attributed to the originator, trademarks have to be actively registered at national, regional or international organisations.[2] The aim of this paper is to elaborate on trademarks as quantitative basis for the measurement of innovation in service industries. The paper covers a wide range of methods how such indicators can be build from the most abstract levels of services as such down to more refined and granular measurements of services related to information and communication technology, financial services etc.. Moreover, potential problems of these indicators

[1] Some might argue that in the light of the debate about patents granted for computer implemented innovations or business models contradict this fact. Still, a discussion of these issues is out of scope of this work. A European study covering the aspects of patents in service industries has been conducted by (Blind et al. 2004).

[2] In the United States it is also possible to register a Copyright. In the European Union and Asian countries such a possibility is not given. Copyrights are thereby less suited as quantitative indicators as they are available in databases at international level.

are discussed relating to prior endeavours of using trademarks as innovation indicators and in the light of the results from recent research. As outcome, the paper will present a concept how to operationalise trade marks as innovation indicators for knowledge-intensive services, in particular ICT-related services.

Introduction

In contrast to the enormous number of publications and studies analyzing innovation output utilizing patents as quantitative indicators, the number of studies using trademarks as innovation indicators is comparably low. In 1998 Rogers concluded that there is almost "no research into trademarks or designs" (Rogers 1998:17) as indicators of innovation[3]. The increasing relevance of the service sector in industrialized countries along with the availability of databases has recently led to an increase in the number of studies using trademarks as innovation indicators (see (Gatrell, Ceh 2003); (Mendonca et al. 2004); (Schmoch 2003a), also (2003b), (2002; Schmoch, Gauch 2004); (Gauch 2005); (Jensen, Webster 2004)). Mendonca et al. (2004) sum up three reasons why trademarks are of interest for social sciences like innovation research. First, the appropriation of economic returns of the product or service the trademark is filed for. Second, the cultural aspect of trademarks as part of globalized culture. And finally third, trademarks as source for quantitative and qualitative data on socio-economic activities (Mendonca et al. 2004:1386). In their analysis (2004) provide a profound analysis of different measures related to trademarks for different areas on aggregate level. Unfortunately the analysis does not include keyword approaches to further break down the relative broad Nice Classification. The approach to restrict the demarcation to classes is, even though pragmatic, not suited to provide in-depth analysis of knowledge based services. Moreover the analysis is limited to either pure product or pure service trademarks, neglecting the possibility of co-classification of trademarks in product and service classes. The argument to restrict the analysis to Community Trademarks is implicitly based on the assumption that the structure of trademark filings is independent from the countries the trademarks are originated from. This is not the case and will be discussed at a later point in this work. The argument of comparableness for Community Trademark applications is negligible as the examination process at the OHIM and the WIPO is similar and barriers to registering a trademark due to examination are, compared to patent examination processes, rather low in nature. The analysis of Gatrell & Ceh (2003) is also not suited for shedding a deeper insight into the analysis of knowledge based services as innovation indicators as the analysis is more aimed at the understanding of regional disparities in the United States using data on aggregate level. The analysis, aimed at understanding dynamics of regional economic condition in the US is too broad to account for the analysis of knowledge based services, since it does not account for sectoral differences or different classes of trademarks and is generally more suited for intranational analysis, rather than international analysis of innovation dynamics.

[3] It has to be noted, that Rogers' conceptualizes trademarks and IPR in general as input indicators. In our work IPR and trademarks are treated as output indicators.

Trademarks facilitate protection of descriptive elements (signs) of products and services, e.g. words, shapes, colours or even sounds. In reference to indicators of innovation the relevant functions of trademarks are twofold.[4] First, the registration of a trademark is a marketing measure to position and introduce new products and services to a market segment. Second, the registration of a trademark is at the same time aimed at protection of this innovation by prohibiting competitors of using the same sign for a product or service in a market segment. Integrating the aspect of appropriation of economic returns put forward by (Mendonca et al. 2004) and the twofold function of trademarks in the innovation process it can be assumed that companies mainly use trademarks for new products or services. This is strengthened by the fact that the registration of a trademark is not for free, but include registration and renewal fees as well as the cost incurred for juridical support by lawyers. The decision to register a trademark is thereby economic in nature and hence rational in reasoning. This is especially relevant as the registration of a trademark does not incur that the name, the pictogram or sound has not been used in the past in some other market context. Relevant is that is has not been used in a specific market segment and that is distinguishable from other representations in other markets.[5] Still, regarding the cost argument above, it is plausible to assume, that companies primarily decide to file a trademark for innovations in products and services as those have a higher chance of economic returns. This view is consistent with Economides (1987) proposing that the effects of technological innovations are "likely to result in a new trademarked product rather than a publicly announced alteration of the composition of the old trademarked product" (Economides 1987:8)

Even though trademarks can theoretically be assumed suitable for quantitative analysis of the output of innovation activity, practical requirements have to be satisfied to make trademarks usable as quantitative indicators for innovation. Those requirements have been assembled and discussed by Schmoch (2003b). The requirements include the a) relationship between trademark filings and innovation in terms of correlation between both, b) a certain amount of registrations, to achieve statistical relevance and c) variation across countries in the number of registrations to allow for cross-country analysis. Furthermore to allow for sectoral analysis between countries in terms of competitiveness the registrations must be d) classifiable into subgroups e.g. product or service fields. Finally to conclude analysis using trademarks as indicators consistent e) databases must be available to extract relevant information

[4] Other functions of trademarks can be identified like the long-term generation and stabilization of trust of consumers towards companies. The mechanism is thereby based on marketing activities of companies. Our focus, as it is limited to trademarks as innovation indicators, is more towards the registration of trademarks and not subsequent branding or advertisement activities of companies. For the relevance of trademarks as mechanisms of trust refer to (Hellmann 2003). It should thereby be differentiated between the branding aspect, as subsequent activity to the application and the innovation aspect of trademarks, which is aimed at the preceeding innovation activity before the application of a trademark.

[5] The trademark "Boss" for example is used in the textile sector, the production of musical instruments, office requisites and many others. All these trademarks are owned by different companies.

from, including for example time of registration, application country or applicant to just name a few relevant pieces of information. Schmoch (2003b) concludes that all those criteria are met by trademarks and are thereby suitable as quantitative innovation indicators.

Methodology and Limitations of Trademark Analysis

Accepting the idea of trademarks as suitable indicators for innovation output in products and, even more importantly, in service industries, it is mandatory to identify methods and limitations for trademarks as innovation indicators. In general descriptive quantitative methods from other fields of S&T research, like patent analysis and bibliometric analysis, can to some extent be applied to trademarks. Still special aspects of trademarks have to be taken into account. These aspects include: a) availability of data in different databases. b) the different possibilities to file for trademark protection above national level by a centralized procedure and limitations for certain countries to chose from those procedures, c) aspects of application and registration processes and d) certain properties of classifications available for trademark registrations.

A number of databases exist for trademarks. Some of those databases are organized around web-based interfaces accessible via web browsers. Even though these types of databases are valuable for practitioners like lawyers they are not optimally suited for broad statistical analysis, especially in the case of long-term analysis including multiple fields and countries. Alternative databases are available as commandline databases that are accessed via a command shell. Those databases have the advantage, that searches can be conducted via predefined search strategies in the form of batch files extracting the relevant information that is needed to conduct analysis in a much shorter time. For quantitative trademark analysis, databases from two providers are relevant. Regarding the pooling of trademarks from different offices it is advisable to use databases for both modes of supranational trademark applications form the same provider. One of the providers is STN International. STN provides two databases, IRMAS and EUMAS, covering International Registrations (IRMAS) and Community trademarks (EUMAS).The other provider of suitable database access is Questel Orbit. The databases provided by Questel Orbit are EMMARK, covering Community Trademarks and WOMARK, covering International Registrations. Both databases are comparable in scope and quality. The subsequent analyses have been conducted using the IRMAS and EUMAS databases. Unfortunately IRMAS and EUMAS have been discontinued lately in the fall of 2004. There is no indication that using the databases provided by Questel Orbit should yield substantially different results. The results should thereby be reconstructable using the WOMARK and EMMARK databases from Questel Orbit.

In practice protection for trademarks in a multitude of countries using a centralized registration procedure is achieved in two different ways, either by filing a Community Trademark at the OHIM (Office for Harmonisation in the Internal Market) or by applying for an "International Registrations" at the WIPO (World Intellectual

Property Office) in terms of the Madrid Protocol (MMA).[6] Both provide for protection in a different set of countries. In the case of community trademarks (CTM or CT-marks) protection is automatically provided for all member states of the European Union. In case of the International Registration (IR-mark) a set of designated states has to be chosen by the applicant. Protection of IR-marks is only achieved in those designated states. The choice of designated states is not possible in case of CTM filings. In both cases trademarks filed at national organisations remain unaffected. For the analysis of trademarks as innovation indicators this distinction is relevant as some countries are not members of the MMA and can thereby not file International Registrations at the WIPO. These countries include important industry nations like some Scandinavian states, Great Britain, Japan, the United States of America and Canada. Even though it could be argued, that this problem could be circumvented by limiting the analysis to Community Trademarks, Schmoch & Gauch (2004) could show, that such a limitation leads to distorted results. For international comparative analysis this means that the registrations of both CT-marks and IR-marks can be pooled by summing up the applications for both.[7] This is reasonable as both modes of registration lead to the same results; the protection in a number of countries while at the same time transaction costs are higher for filing a trademark in each of these countries separately. The resulting "meta-office" reflects a realistic picture of the structure of trademark applications of analyzed countries and provides for a practical basis for the further analyses.[8] The advantages of this approach also comprises certain trade-offs. Since the registration of Community Trademarks has been possible since 1996 and the Madrid Protocol inhibited certain important Asian and Scandinavian countries as well as the US and the UK from filing IR-marks at the WIPO, the pooling of IR-marks and CT-marks results in a trend break. The extent of this trend break is described in figure 1.

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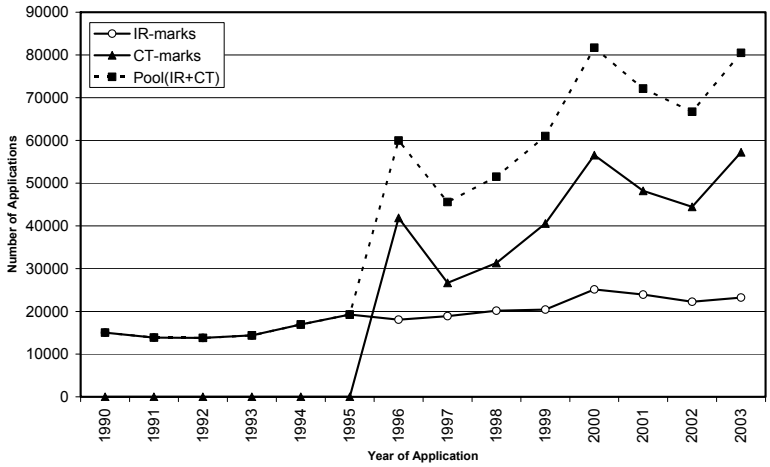
[6] There are also other means of obtaining protection in certain sets of countries, like the Benelux mark, with protection in Belgium, the Netherlands and Luxembourg, the O.A.P.I mark, valid in 15 african countries and the ARIPO mark, initially providing protection for three and later 14 african countires. (see. Bugdahl 1998:131). For practical reasons the above proposed measures of trademark registration, namely the International Registration and the Community Trademark are the most suitable for comparative international analysis.

[7] In a seperate analysis the amount of overlap was analyzed for the first quarter of the year 2003 using Suisse application data. The ratio of overlap is around 0.3 percent of all fillings and can thereby be neglected for pragmatic reasons.

[8] The pooling of applications of trademarks and the resulting meta-office yield different, but as discussed above more realistic results. It should be noted that the analyses of (Mendonca et al. 2004) are limited to CTM data. It is very much to be expected that by using the method of pooling different results can be expected.

Figure 1: Number of supranational trademark applications between 1990 and 2003 for International Registrations (IR-marks) and Community Trademarks (CT-marks).

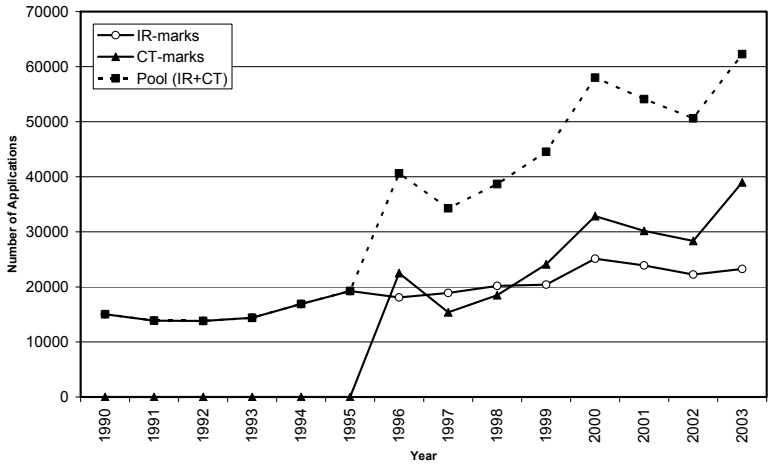


Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

Taking into account that the filing of supranational trademarks was not possible for the above mentioned countries another analysis was conducted to estimate the extent of the trend break that is caused by the applications of the countries that were not able to file for an international trademark by a centralized procedure. In Figure 2 the same calculations have been done like shown in figure 1, excluding Sweden, the United Kingdom and the United States of America from the calculations.

The exclusion of the countries that are not part of the Madrid Protocol puts the trend break of the pooled applications into another perspective and relativises its extent. Still the trend break between 1995 and 1996 is clearly visible. It is thereby useful to limit the timeframe of analysis using this approach to 1996 to present including a margin accounting for the time lag between application of a trademark and its disclosure. In contrast to patents as indicators of innovation, the process from application to disclosure of a trademark is comparably short leading to a shorter time lag and a clearer picture regarding the actual status of trademark activity. While analyses of PCT and EU patent applications have to include an 18 month margin the analysis of trademark registrations and applications requires a much smaller margin. Even though there are no official disclosure dates for trademarks as is the case for patent applications, the actual number of applications can be analyzed with a margin of six month after which nearly all the filings appear in accessible databases (Schmoch 2002).

Figure 2: Figure 1: Number of supranational trademark applications between 1990 and 2003 for International Registrations (IR-marks) and Community Trademarks (CT-marks) with german origin.



Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

In the available commercial databases suitable as information base for statistical analysis two types of classifications are available, the Vienna Classification and the Nice Classification. The former can only be applied to trademarks that have a figurative element and does not provide the information necessary to differentiate between product or service trademarks. It is thereby not suited for quantitative analysis of product and service trademarks. The Nice Classification in principle provides such a possibility. The seventh edition of the nice classification consists of 42 classes in total of which 34 are classes for products and 8 are classes for services. In the eighth revision of the Nice Classification of 2002 the Nice Class 42 (other services) was split into the classes 42 to 45, where class 42 describes trademarks for scientific and research services as well as services related to Information technology, the class 43 relates to services in hotel and restaurant industry, class 44 relates to medical services and class 45 to social, community and personal services. Since the analysis conducted in this work is also aiming at long-term analysis of trends in trademark applications and trademarks are not classified backwards it is mandatory to use the seventh version of the Nice Classification sacrificing the additional information provided by the differentiation of service classes of the eighth edition of the Nice Classification. Since the distribution of trademarks over all product classes is very skewed depending on the fact that some products are aimed at large consumer markets or specific expert groups is not useful to consider all product classes of the Nice classification in the analysis. Therefore only those product classes are used that have a technological reference. In contrast to the International Patent Classification (IPC) used to classify patents, which is organized in a hierarchical style including sections, classes and subclasses as well as main groups and subgroups, the Nice Classification is a non-hierarchical classification. This is problematic as the level of

disaggregation is in consequence rather low. This problem can be circumvented using keywords. The proper use of classification and keywords in trademark analysis will be discussed later by a concrete example of information technology and related services. It is possible to apply general labels to Nice classes or groups of Nice classes according to the main focus of the content of these classes (see also Schmoch (2003a)). The tables 1 and 2 give an overview of those labels and the relevant Nice classes they represent.

Table 1: Definition of technological-oriented product trademark fields based on Nice Classes

Label	*Nice Class*
Chemistry	1, 2, 3, 4, 13
Pharmacy	5
Metal Products	6
Machinery	7, 8
Electronics	9, 14
Medical Technology	10
Electrical Devices	11
Vehicles	12

Table 1: Definition of service oriented trademark fields based on Nice Classes

Label	*Nice Class*
Management	35
Finance	36
Repair	37
Telecommunications	38
Transport	39
Material Treatment	40
Entertainment	41
Other services	42 (43, 44, 45)

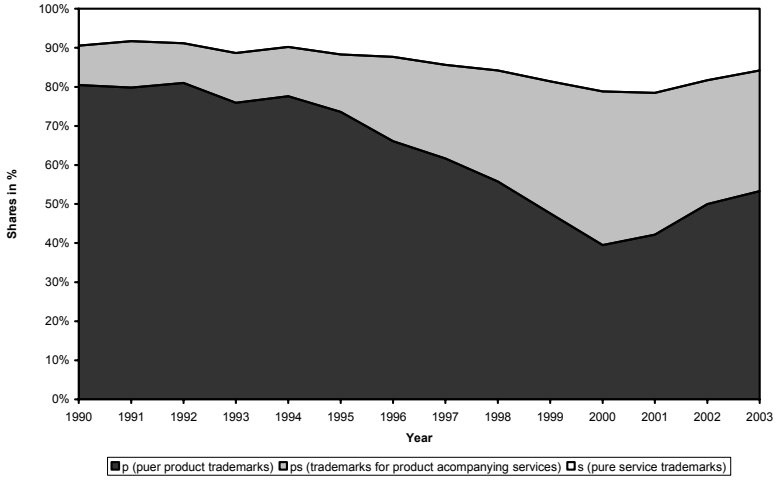
General Results of the Trademark Analysis

To fully comprehend the analysis of knowledge based services using trademarks as indicators, the results from more general quantitative analyses have to be taken into account. These general results provide an interpretative frame, the proverbial big picture, to later allow for a proper interpretation of the analysis of knowledge-based

services using trademark indicators and prevent misinterpretation or rash policy recommendations based on the given data. In the following a broad overview of general results will be presented.

As trademarks can be filed to a multitude of classes and there is no limitation to file a trademark in both service and product classes it is possible to analyze the shares of either pure product (p) or pure service (s) trademarks and the overlap generated by trademarks that are filed in product classes as well as service classes. These trademarks broadly represent product accompanying services (ps). Figure 3 shows the amount of either of these shares between 1990 and 2003 in case of supranational trademark filings at the OHIM and the WIPO with german origin. Since only shares are analyzed, the limitation of analysis to the timeframe of 1996 to present can be neglected in this case, assuming that the structure of distribution of classes and trademark filings is independent of the chosen application procedure but dependent on the overall market situations and innovation activity at each point in time.

Figure 3: Share of pure product and service trademarks and mixed product/service trademarks between 1990 and 2004 with german origin



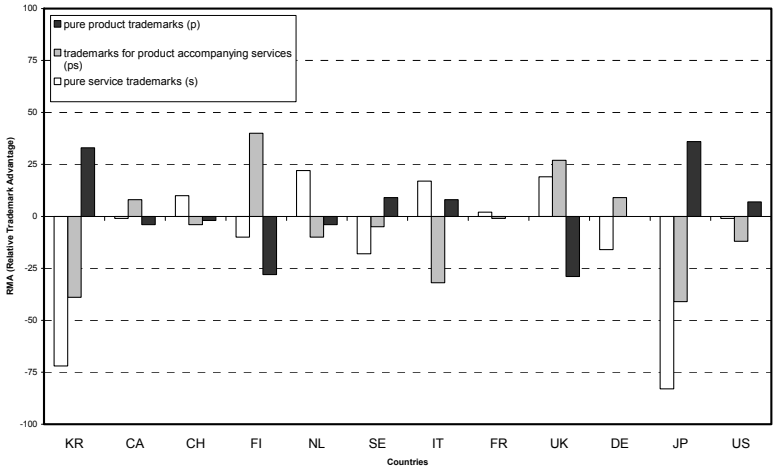
Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

The most striking fact to be observed is the decline of the share of trademarks for product accompanying services after the apex of the overall economic situation in 2000. While in the year 2000 the share of german trademarks for product accompanying services was at 39.3 percent the share gradually declined to 30.9 percent in the year 2003. That poses the probing question if this is a phenomenon limited to the German case. A subsequent analysis was conducted to answer this question. Accounting for the high share of german trademark applications of CT-marks as well as IR-marks the overall share of the three types of trademarks were computed excluding Germany in the calculations. The results reveal comparable

trends on international level.[9] The decline of share of pure service trademarks and trademarks for product accompanying services is thereby an international phenomenon and not limited to the german case.

Another question regarding the structure of pure product or service trademarks and trademarks for product accompanying services relies to differences on international level regarding the relative differences in the propensity to file either of the mentioned types. These questions can be answered by calculating specialization indices.[10] Specialization indices reflect the relative over- or respectively under-specialization of a given country in reference to all trademark applications worldwide or in reference to the sum of applications of a relevant subset of countries. The interpretation of the extent of over- or under-specialization has, according to the nature of the index, always has to be done in context of the reference applied and the set of countries used. Overspecialization thereby can also be the result of activities of countries in a field in which all other countries in the subset are not engaging in.[11] Specialization indices can graphically be represented in the form of specialization profiles for countries in the manner of figure 4.

Figure 4: Specialisation of EU and IR trademarks for selected countries of product, service and product/service trademarks in 2002/2003



Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

[9] The calculations revealed a decline in the share of product accompanying services from 33.6 percent in 2000 to 27.5 percent in 2003.

[10] The specialization incex RMA (Relative Mark Advantage) is calculates as follows: $S_{ij} = 100 \tanh \ln [(M_{ij} / \Sigma_i M_{ij}) / (\Sigma_j M_j / \Sigma_{ij} M_{ij})]$

[11] The interpretation of over-specialization as "good" or under-specialization as "bad" is thereby wrong. A country can be heavily over-specialized in a field that is declining in importance in the worldwide trend, leading to reduced activity of other countries in this field.

In Figure 4 the specialization profiles of 12 countries are shown. The reference hereby is the sum of all applications of this subset of countries. The first striking fact in this case is the high extent of under-specialization of the Asian countries Korea and Japan. This is partly due to the fact that it is more complicated to export intangible services than export physical products. The incentive to apply for a trademark for services should thereby be lower, resulting in a disproportionate higher amount of trademarks filed for products. Similar arguments can be applied for the under-specialization of trademark applications for product accompanying services with korean or japanese origin. Another important case is the high over-specialization of Finland in trademark for product accompanying services. This might partly be explainable by the strong focus of Finland on the field of Telecommunication, which promotes the amalgamation of products and services. Regarding pure service trademarks only the United Kingdom, the Netherlands, Sweden and Switzerland are positively specialized. Interestingly the United Kingdom is at the same time under-specialized in pure product trademarks. Germany, along with Finland and the United Kingdom, is positively specialized in trademark for product accompanying services. Still the extent of positive specialization of trademark for product accompanying services in the German case is not as distinctive as is the case for the United Kingdom or Finland.[12]

Trademark applications can also be analyzed on a more detailed level using specialization indices. Table 3 lists the results of computing specialization indices for the above used set of 12 countries for the different areas provided in table 2 for the years 2002/2003. The analysis of pure service and mixed product-service trademarks for each country provides valuable information on the orientation of the analyzed countries for the different application fields. Even though it is not possible to assess all kinds of knowledge-based services using this level of abstraction it is nevertheless possible for some fields like Business Management, Financial Services and services in telecommunication. Moreover it is possible to judge the relevance of these fields for either pure services or services in conjunction with products by differentiating between pure service trademarks and mixed product-service trademarks. Overall the strong negative specialization of the United States and the Asian countries is noticeable. This has to be interpreted with the limitations of export of services for these countries already discussed above. In the field of pure service trademarks in Telecommunication Finland, Italy and France are all strongly and positively specialized. The same accounts for those countries in case of mixed product-service trademarks in telecommunications with the exception of Italy which is moderately negatively specialized. Reasons for the under-specialization of Italy for mixed product-service trademarks might be the high demand for telecommunications services in Italy which is not counterpointed by an effect on the producing sector of telecommunication goods. Regarding the consistently negative specializations for Italy this might also be a general phenomenon for Italy and low spill-over effects between producing and the service sector. In cases of pure service trademarks for

[12] It has to be noted that german trademark applications hold a high share of the overall amount of applications at both offices. Thereby the impact on the reference is higher and the specialisation indices are less pronounced.

financial services the highest positive specialization figures are occupied by Switzerland and Italy, with the United Kingdom and the Netherlands accounting for more moderate positive specializations. Interestingly in case of mixed-product service trademarks the United Kingdom shows the highest degree of positive specialization. The specialization indices for pure Service trademarks for Management services are closely related to those of financial services. As was the case in financial services Switzerland, the Netherlands and the United Kingdom play a dominant role according to their positive specializations. The exception of this case is Italy which takes up a strong position in financial services but is characterized by a minor positive specialization in management services. For the german case the most evident result is the overall positive specialization of product-service trademarks with high scores in transport services, financial services and repair.[13] For pure service trademarks only transport services and services in material treatment are moderately positive specialized. The strong positive specializations in mixed product-service trademarks is consistent with the findings of

[13] This is also the case for mixed product-service trademarks in medical technology, vehicles and mechanical engineering. For a comprehensive overview refer to Gauch (2005).

Table 3: Specialization profiles in pure service trademarks and mixed product-service trademarks for selected countries in 2002/2003

	US	JP	DE	GB	FR	IT	SE	NL	FI	CH	CA	KR
						pure service trademarks (s)						
Management	-13	-90	-2	13	-2	6	-30	44	-23	17	-9	-97
Finance	-19	-87	-12	21	-20	41	-31	19	-50	36	0	-83
Repair	-51	-71	2	32	13	-27	4	43	67	17	-34	-100
Telecommunications	-46	-93	-14	-35	59	55	-21	-57	39	5	-20	-74
Transport	-48	-75	12	33	12	-9	-2	42	3	-15	-81	-98
Material Treatment	-29	-50	9	5	23	0	-4	26	-48	-9	8	-100
Entertainment	-14	-84	-8	19	20	6	-12	3	-6	16	-18	-86
Other services	-16	-83	-2	18	3	15	-22	20	5	13	-16	-63
						mixed product-service trademarks (ps)						
Management	-35	-72	18	33	4	-32	-27	5	-6	11	-25	-15
Finance	-34	-80	27	40	-21	-32	-31	-56	-18	28	-35	-81
Repair	-60	-24	25	18	7	-21	27	-9	56	9	22	-100
Telecommunications	-47	-75	14	17	46	-19	-21	-46	34	-3	-35	-57
Transport	-75	-93	30	22	25	-20	-18	-16	-2	32	-15	-91
Material Treatment	-44	-65	11	18	23	-48	-14	-35	59	50	44	-100
Entertainment	-12	-17	-1	43	5	-40	-33	-30	26	8	-9	-52
Other services	-23	-54	24	17	0	-45	-2	-23	40	12	7	-72

Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

the general trademark analysis. The analysis of knowledge-based services using trademarks is not limited to the utilization of Nice Classes. Using more advanced techniques of linking keywords and Nice Classes a higher depth of focus can be achieved allowing for a more comprehensive understanding of knowledge-based services that can not be clearly identified using the Nice Classification. In the concluding part of this work, such an approach will be used to analyze information technology and related services as an example for knowledge-based services.

Analysis of Knowledge based Services using Trademarks – the Case of Information Technology Services

One of the most prominent factors of Information Society is the emergence of the Information Technology sector, either by the transformation of work through the use of IT, the change of modes of communication, or the change in social structure towards a network society. The case of Information Technology and related services thereby is a prime example for knowledge-based services. Services regarding IT are not limited to software production. Also other aspects like maintenance and administration of servers, computer networks or workstations, consulting for companies regarding choice of hard- and software or elaborate Information Technology strategies, cross-sectoral services like Information technology services in the light of medical instruments, nanotechnology or biotechnology or technologies bridging the shores of product (hardware) and service provision (software) like in the case of embedded systems in which software is hardwired in hardware devices are part of the pool of possible application fields of IT. Altogether it can not be denied that Information Technology is growing in importance for technological capacity and competitiveness of countries. In the following the analysis of innovation in knowledge based services using trademarks will exemplarily be conducted using Information Technology related services as one type of knowledge based Services.[14] The use of trademark data regarding information technology and related services provides a measure based on Intellectual Property Rights as output that could otherwise not be established on comparative European level.

The analysis will be organized in the way to start at a very abstract level of analysis and gradually reducing abstraction to provide for an adequate depth of focus needed to draw relevant and consolidated conclusions for policy. When attempting to analyse IT related trademarks two problems have to be solved beforehand in order to allow for meaningful conclusions. The first problem results from the high level of aggregation of classes in the Nice Classification, which has already been discussed above. The second relates to changes of the Nice Classification in the year 2002. As mentioned above the Nice Classification as such only provides for a low degree of disaggregation. IT related trademarks can not be identified focusing only on Nice Classes. The consequence is that analyses of IT related trademarks have to include additional keywords in the search queries. Apart from choosing one or more classes

[14] Other studies using similar methods have been conducted for financial services and information technology services in Switzerland (Schmoch, Gauch 2004).

that represent the underlying product or service of the relevant trademark, applicants also have to provide a short description of their trademark in written form. Those keywords are mostly chosen form a public list provided by the World Intellectual Property Office (WIPO). The list provides a very comprehensive overview of keywords to describe products or services in a multitude of languages. Even though the use of this list is not mandatory it is often recommended to use it by national as well as international and regional offices as it shortens the examination process. It is thereby plausible to use the keywords from this list to identify information technology and related trademarks.[15] In the course of revision of the Nice Classification in 2002 certain kinds of problems emerge in definitely identifying certain knowledge based services using Nice classes and keywords including information technology services. The first problem results from the fact that trademarks are not backwards classified. That means that trademarks that have been filed using the seventh edition of the Nice Classification will not be reclassified to suit the eight edition of the Nice classification of 2002. While in the seventh edition of the Nice classification information technology services was part of the service class 42, a class that had the character of a residual class including all services not classified otherwise, the eighth revision of the Nice classification this class was split into four new classes ranging from 42 to 45. Still information technology services, classified in class 42, are not explicitly identifiable as other services relating to research and scientific services and legal services are also part of this class. To circumvent both problems the keyword catalogue defined using the WIPO recommendation list were applied to the clustered classes 42 and higher to allow for long-term analyses. The results of the analysis of the trend of trademark applications for information technology and related services between 1996 and 2003 for Germany and worldwide using the above described method is illustrated in Figure 5.

Figure 5: Trend of IR and EU trademarks for the ICT-related services for germany and worldwide (1996=100)

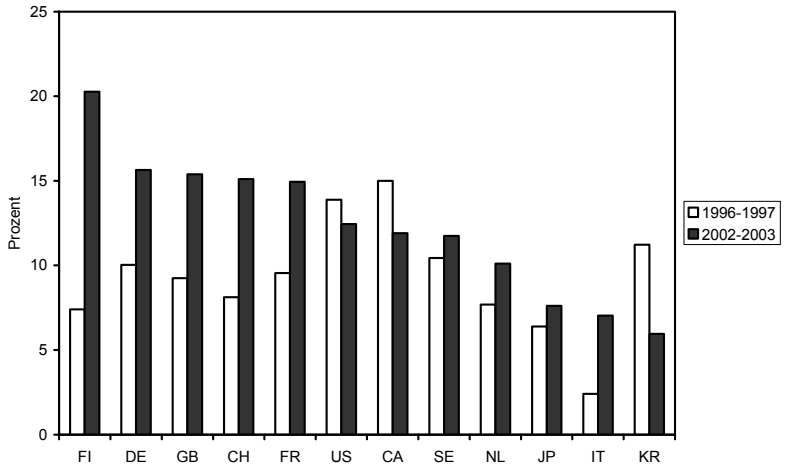
[15] A similar procedure can be applied to other forms of knowledge based services.

Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

Both the worldwide and the german trend of applications for trademarks for information technology and related services increased strongly between 1996 and 2000, followed by a drop between 2000 and 2002. This decline stopped between 2002 and 2003 and even shows a slightly positive trend development. Remarkably the trend of german trademark applications was slightly above the worldwide trend between 1997 and 2002. However the differences are only marginal between both trends.

Analyzing the share of trademark applications relating to information technology of all trademark applications for a set of countries it is possible to build a ranking. Figure 6 illustrates the shares for the two time periods 1996/1997 and 2002/2003 for the twelve countries used in the preceding analyses above. The reason to take two years as basis for the analysis is based on the fact that a sufficient absolute number of trademark applications have to be used to yield statistically firm results.

Figure 6: Shares of ICT related trademarks for selected countries for 1996/1997 and 2002/2003 by total



Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

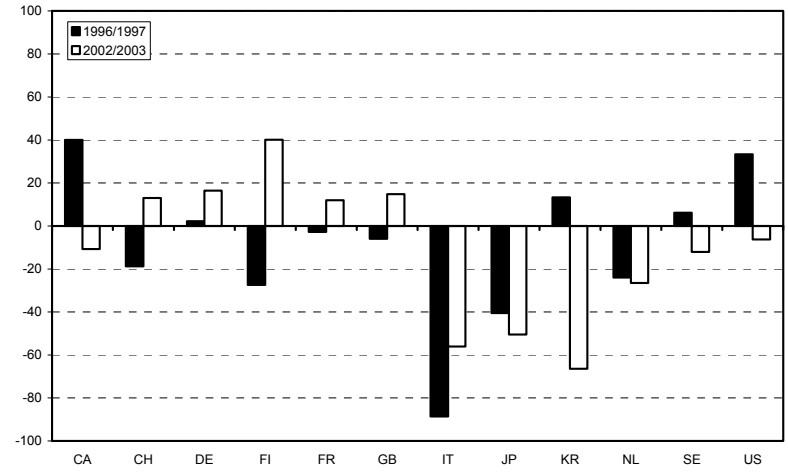
Almost all countries in the set experienced a growth in the share of information technology related trademarks between the periods of 1996/1997 and 2002/2003. Interestingly the only countries that show a decline in this share are those with the highest initial share in 1996/1997, namely Canada, Korea and the United States of America. Interestingly the other Asian country in the set, Japan, experienced a slight increase in share. Apart from Japan all the non-european countries experienced a decline in share. All European countries at the same time experienced a growth in share with Italy and Finland accounting for the highest increase in share over time. Finland by far scores highest in terms of share of applications information technology trademarks. Still in the case of Finland and Canada and especially for Korea it has to be noted that the absolute number of finish trademarks is rather low, thereby

interpretations regarding the precursor role of Finland have to be carefully contextualized.

To put the above data into context a specialization profile of the twelve countries was constructed using the RMA index already mentioned above. This method yields the advantage to further identify if a shift of the shares described in figure over time leads to a shift in over- or under-specialization of a country between the two timeframes.

The interpretation of the specialization profile of the twelve countries provides for a much clearer picture. Even though we noticed, that Italy experienced the highest growth of share of information technology service trademarks between 1996/1997 and 2002/2003 the specialization profile shows, that Italy is still heavily under-specialised. The decline in share of the United States Korea and Canada between the two timeframes resulted in an under-specialization even though for the United States and Canada the extent of under-specialization is rather with -6 in the case of the United States and -11 in the case of Canada.

Figure 7: Specialisation of EU and IR ICT related trademarks for selected countries for 1996/1997 and 2002/2003

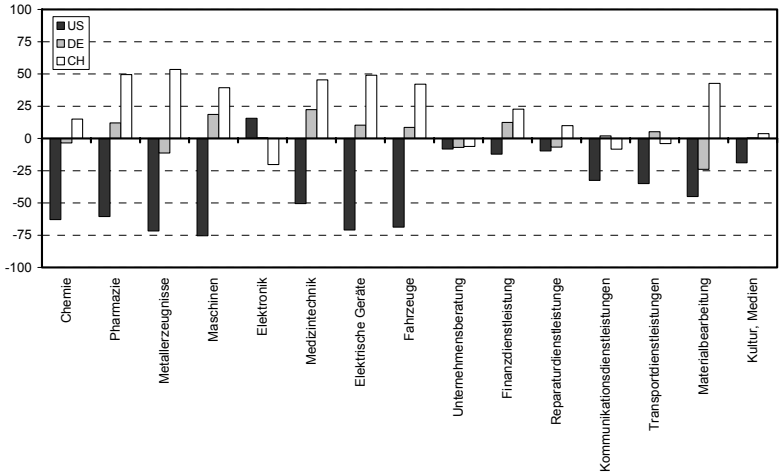


Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

In the case of Finland the increase in share resulted in a shift from under-specialization of -27 to an over-specialization of +40. As in the above case the interpretation of this shift is limited by the fact that the overall number of trademark applications with Finland as origin is rather low. Germany, characterized by a slight over-specialization in 1996/1997 could further stabilize its position in information technology and related services resulting in an over-specialization of +16 in 2002/2003 placing it in a position comparable to Switzerland, France and the United Kingdom.

Information technology and related trademarks can also be analyzed in more detail. As both procedures of applying either a Community Trademark or an International Registrations allow for a trademark to be categorized in more than one Nice Class it is possible to analyze co-classification to other areas of products and services. The results of such an analysis provides further insight of the use of information technology services in other fields for certain countries. To compare the use of information technology services in other areas. Like in the above analyses the construction of specialization profiles process a meaningful method of analysis. In figure 8 the specialization indices for the timeframe 2002/2003 for the United States, Switzerland and Germany are compared for selected fields. The reference in this case are filings were more than one class was denoted by the applicant.

Figure 8: Specialisation of EU and IR ICT related trademarks co-classified in different trademark fields for the US, Switzerland and Germany for 2002/2003



Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

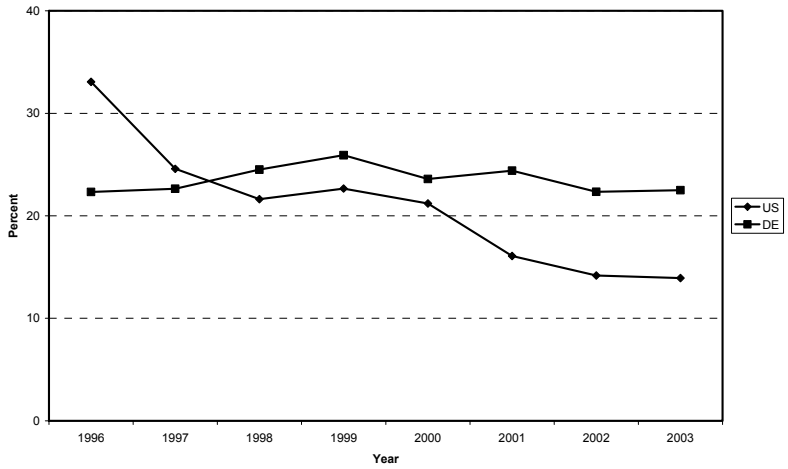
Germany clearly takes a middle position between the United States and Switzerland with the United States accounting for a more under-specialized profile in all areas and Switzerland with a slightly higher specialization profile. The only exceptions to this pattern are the area of Transport and Communication services in which Germany is slightly more positive specialized than Switzerland. Still those differences in specialization are marginal. More clear-cut differences can be observed for the fields of Material Treatment and Metal Products. In those two cases Germany is under-specialized while Switzerland is strongly positively specialized.

The strong under-specialization of the United States in nearly all areas except Electronics is contra intuitive. Interpreted in the light of the results from the general trademark analysis and the problems that apply for the asian countries and the United States this holds interesting conclusions for Germany and European internal market. Still the question of the high extent of under-specialization of the United States demands for a closer investigation. One question might be if the share of trademark

applications in information technology services from the United States to all trademark filings in information technology services for all countries has changed over time. Computation was done for the timeframe between 1996 and 2003 again using the approach of pooling Community Trademarks and International Registrations. The results are represented in figure 9.

The results show a constant decrease of the share of trademark applications for information technology services form the US, while the share of german trademark applications with reference to information technology services remains almost constant over time.

Figure 9: Share of EU and IR ICT related trademarks by total trademarks between 1996 and 2003 for Germany and the US



Source: EUMAS (STN), IRMAS (STN), Calculations of Fraunhofer ISI

Still it has to be noted, that applicants from the US were not able to file supranational trademarks in a centralized procedure before 1996. The high starting level in 1996 when 33 percent of all trademark applications in information technology services were originated in the United States might be due to catch up activities of applicants from the US. Still the overall downward trend is clearly visible and consistent for the whole timeframe between 1996 and 2003.

Discussion and Policy Implications

Trademarks prove as a valuable tool to measure the innovation output of services and product accompanying services in form of mixed product-service trademarks. As shown in this work relevant key questions can be answered by the statistical analysis of trademark applications on multiple levels of abstraction with overall shares of product, service and mixed trademarks as a general indicator for the structural

embeddedness of services in a country, analysis based on the Nice Classification as a middle layer of abstraction for a more detailed overview and finally the use of approaches linking keywords and Nice Classes to analyze special forms of knowledge-based services not distinguished by the Nice Classification. The latter method allows for very detailed analysis, but still has to be counterpointed by the former approaches to account for a thorough interpretative framework.

In the German case the overall results show, that especially at the borderline between product and services, the position of Germany is comparably well established. Still in the case of pure services there is potential for further improvements, especially in important knowledge-based fields like services in Communication technology in general or certain aspects of information technology services like information technology and related services in mechanical engineering and medical technology where Germany has already established a positive position. Still regarding the positive position in transport services on the whole the application of information technology services is rather under-specialized. With the current development in information technology in logistics (e.g. RFID) the potential for future services might be an interesting option for german service industry. On the whole the german service industry related to information technology services produced a constant share of innovations that led to trademark applications at the OHIM and WIPO between 1996 and 2003.

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