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Collaboration for Innovation in Services

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Collaboration for Innovation in Services

Abstract

The research was motivated by the importance of inter-firm collaboration within service innovation. Inter-firm collaboration covers a broad range of organizational combinations of various sizes and motivations in various levels of formal agreements. The book chapter will explore the choice of different partners and knowledge sources for enabling co-operative innovation activities following the approach of loosely-coupled and institutional networks. The empirical results show different collaborative behavior within different service industries.

Key Words:

innovation management, service innovation, collaboration

Collaboration for Innovation in Services

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1 Executive Summary

1.1 Research question

The literature to date has analyzed collaboration between high-techs, start-ups and incumbents, between suppliers and clients, and more unusually between competitors (Miotti and Sachwald 2003). Additionally, for the purpose of improved innovativeness, firms also ally with universities, public research institutes, and private research institutes (e.g. Teece 1989). However, only a slowly growing number of studies have analyzed innovation in service industries. The reasons reside in a strong tradition of innovation research that promotes new technologies and tangible artifacts whilst most services industries are rarely considered to undertake formal research and development (R&D) processes or produce technically improved material objects (Miles 2007). The gap of substantial findings escalated further when extending this underdeveloped research to studies in service related collaborative innovation activities.

The paper focuses on the microeconomic level and aims to analyze the so-called service peculiarities and, in particular, the role and importance of collaborative service innovation. Based on empirical results from the German Community Innovation Survey the choice of different partners and knowledge sources for enabling co-operative innovation activities are investigated. Additionally, the research explores different collaborative behavior within different service industries and focus on collaboration between service innovators and research institutes. The purpose is to show service-specific innovation collaboration behavior and to proof the hypothesis that traditional R&D oriented trajectories are not applicable and used within service industries.

1.2 Theoretical Background

Coming from systems theory, the paper follows a conceptual approach proposed by Sundbo and Gallouj (2000). Their analysis result in a differentiation of two innovation sub-systems: the “institutional” and “loosely-coupled” systems. The institutional innovation system is a rational system with a limited series of pattern-based relationships between different actors through which knowledge and ideas for innovations are diffused. In an institutional innovation system these patterns are often long-term collaborations between actors and are often formalized through contracts.

Instead, a loosely-coupled innovation system is not a fixed (contract-based) constellation between actors. As consequence, the integration of external knowledge is less formalized and institutionalized, and the knowledge diffusion process does not follow a “straight line”. Sundbo and Gallouj (2000) conclude that much of the service sector can be found within the loosely-coupled system because of the lack of coherence

in terms of technological and professional trajectories as well as the weak science-base.

1.3 Methodology and Data Base

The survey was carried out in 2003 by the Centre for European Economic Research as well as the Institute for Applied Social Sciences. The survey was postal and voluntary. The sampling included firms with 10 and more employees and was confined to 22 different industries from manufacturing and services in Germany, with sampling stratified by firm size, by sector, and by location (East or West Germany). For the analysis of collaborative arrangements, the analysis was restricted to the sample of 864 service firms that claimed to have been engaged in innovation activities.

1.4 Main results

The paper can show that a high importance of collaborative arrangements in general can be analyzed. Service innovators collaborate in loosely-coupled network structures, however, the difference between services and manufacturing is lower than expected. Surprisingly is the importance of universities as knowledge sources and collaborative partner for service innovators. These findings contradict previous research results on innovation pattern of service companies and needs to be analyzed further.

In general, loosely-coupled collaboration and external knowledge sourcing strategies foster research collaborations with universities. It can be assumed that service innovators which are engaged in loosely-coupled innovation activities have a strong focus on knowledge building and learning capabilities which also require a strong internal knowledge generation process through own research and development capabilities.

2 Introduction

According to Chandler (1990) it is assumed that companies with their various combinations of abilities and strategies can be regarded as key actors of innovation and technological change. This change is the result of knowledge generation and learning within organizations as well as between organizations based on collaborative arrangements. Often, new technologies and know-how are generated through the interaction of companies and their environment and are developed further internally (Dosi 1988).

Especially, the flexibility and value creation potential of inter-firm collaboration has accelerated a growing number of alliances during the past decade (e.g. Hansen and Nohria 2004). Benefits in terms of innovation through collaboration encouraged increasing research and development (R&D) partnerships in diverse sectors (Chakravorti 2004, Ritter and Gemünden 2003).

The literature to date has analyzed collaboration between high-techs, start-ups and incumbents, between suppliers and clients, and more unusually between competitors (Miotti and Sachwald 2003). Additionally, for the purpose of improved innovativeness, firms also ally with universities, public research institutes, and private research institutes (e.g. Teece 1989).

However, only a slowly growing number of studies have analyzed innovation in service industries. The reasons reside in a strong tradition of innovation research that promotes new technologies and tangible artifacts whilst most services industries are rarely considered to undertake formal R&D processes or produce technically improved material objects (Miles 2007). The gap of substantial findings escalated further when extending this underdeveloped research to studies in service related collaborative or co-operative innovation activities.

The following paper focuses on the microeconomic level. Based on empirical results from the German Community Innovation Survey (CIS) the choice of different partners and knowledge sources for enabling collaborative innovation activities are investigated. Additionally, the research explores different collaborative behavior within different service industries and focus on collaboration between service innovators and research institutes. The purpose is to show service-specific innovation collaboration behavior and to proof the hypothesis that traditional R&D and research oriented trajectories are not applicable and used within service industries.

3 Theoretical analysis on collaborative systems

3.1 Traditional systems approach

In the field of innovation research the definition of the term “system” is based on the considerations by the structural-functionalistic school, as mainly represented by Parsons (1976). Here a company, a region, an economy, a science, general regulative frame settings and the like are understood as systems. Carlsson, Jacobsson, Holmén, and Rickne (2002) define systems “*as a set of interrelated components working toward a common objective*” (p. 234). The common from this perspective is that systems comprise components, relationships, and attributes. Components are seen as the operating parts of a system like individual actors or organizations, they can also be physical or technological artifacts or institutions, such as laws or social norms. Relationships are the links between the components, involving market and non-market links, feedback loops and transfer of technological and non-technological knowledge. Attributes characterize the components, relationships and therefore the whole system. For example, the capabilities to generate, diffuse, and utilize technologies, knowledge or competencies to identify and exploit business opportunities could be defined as attributes.

The aim, the specific achievement, and the function of a system can be analyzed. Interesting findings can be generated through the determination of the elements that enable specific processes, the analysis of exchange relations within and between the systems as well as the system behavior and its position in a larger context. Smith (1997) points out that within the frame of knowledge generation different system approaches exist. In addition, there is a growing tendency to define innovations per se as systemic. Ropohl (1998) sees this development as an extension of the system horizon where, for example, innovators of the car may also consider the traffic system or the concept of mobility at the center of their innovation activities. Similarly, Majer and Stahmer (1996) make a connection between service provision and systems marked not by material categories but by periods of time. This generates the chance for additional compensation for material goods with, for example, a focus on quality of life issues. The management of this growing complexity is important and adds further dimensions, such as the integration of time (e.g. the entire life cycle), more qualifications, interdisciplinary methods, collaborative organizational arrangements and new values within the innovation system (Hipp 2000).

3.2 Institutional and loosely-coupled systems

Sundbo and Gallouj (2000) follow a situational approach in identifying and combining driving forces that constitute a system. Their analysis result in a differentiation of two innovation sub-systems: the “institutional” and “loosely-coupled” systems. The distinction between the two systems is based on the level of collaboration patterns. The institutional innovation system is a rational system with a limited series of pattern-based relationships between different actors through which knowledge and ideas for innovations are diffused. In an institutional innovation system these patterns are often long-term collaborations between actors and are often formalized through contracts. Companies using traditional innovation and research and development (R&D) patterns and formal intellectual property mechanisms or those that base their activities on long term contracts should be located within this system. For that reason, the strong traditional and institutionalized pattern approach is more common in manufacturing firms than for services.

Instead, a loosely-coupled innovation system is not a fixed constellation between actors; in fact it can take numerous forms. Sundbo and Gallouj (2000) summarize that environments that are more competition oriented can be characterized as loosely-coupled systems. As consequence, firms collaborate less, the integration of external knowledge is less formalized and institutionalized, and the diffusion process does not follow a “straight line”. *“This innovation system cannot be understood theoretically from a coherent explanatory model ... because of the loose coupling of all elements and non-fixed behavioural patterns and traditions”* (Sundbo and Gallouj 2000, p. 61). Several weak patterns exist in parallel and although it is not possible to predict which pattern will be chosen, relationships can be explained and some rules can be formulated. Sundbo and Gallouj (2000) conclude that much of the service sector can be found within the loosely-coupled system because of the lack of coherence in terms of technological and professional trajectories as well as the weak science-base. Hence, innovations are often quick, customer-oriented, and practical in nature. Therefore, the management of collaboration with different actors coming from different industries and which are changing relatively quickly over time are especially important and difficult for service.

4 Collaborative arrangements for innovation in the service industries

4.1 Increasing importance of collaborative arrangements for innovation

Inter-firm collaboration covers a broad range of organizational combinations of various sizes, shapes, motivations in various levels of formal agreements (Borys and Jemison 1989). Explanations as to why firms form inter-organizational linkages centre either on the pattern of prior linkages that influences a firms' choice of future partners or on incentives to collaborations (Ahuja 2000). Findings by structural sociologists inspired the view that the ability of firms to form networks relies on their historical position or experiences within a network (Gulati and Gargiulo 1999). A huge stream of literature from different viewpoints has investigated and explained firms' incentives to collaborate (Ahuja 2000). Generally, incentives come from the numerous and flexible possibilities to merge tangible and intangible resources (Kogut and Zander 1992).

The different authors agree that innovations in collaborative or network structures help to cushion technological and market insecurities and dynamic change (Dodgson 1996, Tether 2002). A network organization is the ideal form for coping more easily with increasing complexity and shorter product cycles (Carl and Kiesel 1996, Rothwell 1994). This form of organization can be viewed as a mixture between market and hierarchy (Imai and Baba 1991) as it allows companies the opportunity to focus on its core competencies and still remain flexible for new learning processes (Rammert 1997, Nonaka and Takeuchi 1995).

Also according to Potts and Mandeville (2007) business collaboration has become a key segment of corporate strategy to cope with dynamic technological change and risk of lock-in of scarce resources. From an evolutionary point of view, innovation collaborations are routines developed because of internal and external pressure. The generation of knowledge is based on a mixture of imitation and internal learning processes that change under the influence of a dynamic environment and changing internal characteristics (Niosi 1996).

Especially external partners with their complementary expert knowledge can give considerable innovative impulses (Kaufmann and Tödtling 2001). Niosi (1996) regards the turbulent environment and the growing complexity caused by the new, technologically determined paradigm as the cause and driving force of new collective forms of learning. The developing theory of collaborative innovations is based on the assumption that technology is a quasi-public good and that learning mostly takes place locally. The new conditions force companies to collaborate, thus, to trade externalities

(knowledge) and develop new forms of collective learning that develop in addition to the traditional learning processes (like internal research and development). This process can be interpreted as a routine that companies integrate in their existing behavioral patterns.

Dahlander and Wallin (2006) summarize the recent developments along the open innovation paradigm proposed by Chesbrough (2003). They argue that firms need to rethink on traditional forms of knowledge ownership and to open up themselves in new forms of networked innovation projects. Now, innovation activities are much less hierarchically organized. The network of relationships between the firm and its external environment can play a dominant role in shaping innovative performance (Laursen and Salter 2006).

4.2 The role of services in innovation network structures

The service sector as a whole is a very heterogeneous system that hardly can be described by a single theory (Rubalcaba and Gago 2003). Therefore, various service-specific criteria have to be considered to describe innovation behavior in services adequately. One major characteristic of services discussed in the literature relates to the “intangibility” of the service output (Hipp 2008). Intangibility hinders the storing, transfer, and transportation (e.g. for trading), and creates difficulties in the demonstration of the output, in advance, to potential clients. In addition, intangibility hampers the employment of traditional instruments to protect innovations within the formal intellectual property system. With ongoing improvements of information and communication technologies, firms can – to a certain extent – relegate limitations of intangibility.

The increasing tradability of services and innovations in the field of communications and information technology promotes decentralization, specialization, and thus the division of labor in service and industrial activities. In addition, there are new forms of flexibility and process parallelization (e.g. automobile industry) that are based on demanding network structures. In those networks, services take over the functions of logistics, planning, controlling, co-ordinating, and monitoring. The system's complexity and the many different network actors require new forms of governance structures, which essentially are carried out by these service companies.

Especially, knowledge intensive service businesses play an important role as knowledge brokers in collaborative or network activities (Hipp 1999). They, for example, absorb knowledge from their environment and place it at their partners' and customers' disposal for their innovation activities (e.g. engineering companies, consultancies). Service-providing companies can also be active as network operators and establish,

especially after the deregulation of the telecommunications market, new value added services based on physical and mobile communication networks. Thus, they enable and support networking and communication of diffused companies or parts of companies. Also Potts and Mandeville (2007) emphasize that today services can be better understood as networks rather than as “producing” systems. In this respect, services can be seen as the increasing complexity of an evolving network rather than as the shifting-out of a company-internal function through, for example, outsourcing or off-shoring.

Tether, Miles, Blind, Hipp, de Liso, and Cainelli (2000) – focusing on collaborative innovation projects – found that 26% of the innovating service firms in Europe are engaged in collaborative arrangements to develop innovations – compared to 28% in manufacturing. Therefore, service firms are collaborating at nearly the same intensity as manufacturing firms. However, Tether, Miles, Blind, Hipp, de Liso, and Cainelli (2000) can also show that there is a broad variety between different countries and industries. In a more recent article Tether and Tajar (2008) argue, based on empirical results from the Community Innovation Survey (CIS), that the most significant source of innovative ideas is still internal research and development and that about a quarter of European's innovators are engaged in cooperative arrangements. This proportion is higher in high-tech manufacturing, and lower for services. Main partner for innovators are customers and suppliers. Universities are less important; however, especially high-tech manufacturing companies show some significant and positive relationship while low technology-intensive services show a significantly negative relationship with universities (Tether 2002).

These empirical findings contradict to a certain extent the more theoretical considerations towards a “network” economy described above. The reason for this can be seen on the one hand in a possible dominance of loosely-coupled network systems, especially for service innovators; and these loosely-coupled systems are difficult to analyze empirically. On the other hand barriers of collaborative innovation activities still exist, which hamper a further development towards open or network innovations.

First there is uncertainty in obtaining information regarding the competencies and requirements of the partners before the co-operative arrangement advances (Gulati and Gargiulo 1999). Second uncertainty emerges from incomplete information concerning the reliability of potential partners (Coase 1937, Williamson 1975). Uncontrolled and unwanted knowledge-spillovers might appear – especially in knowledge-intensive innovation networks or if common service innovations base on intangibles which are hard to control and protect.

Furthermore, unpredictable changes in the environment induce adjustments of the actors' behavior that modify their contribution to collaboration and which cannot be regulated in advance. For that reason most collaborative contracts are imperfect (Williamson 1989). Thus, service firms face the dilemma that on the one hand collaborative innovation offers a great potential to profit from specialized knowledge, technical, and financial resources. But on the other hand companies can hardly predict exact efforts and expenses before the collaborative project itself has been finished.

These barriers hamper especially loosely-coupled service innovators because intangibles and knowledge-spillovers are often hard to control and might be one reason for the empirically unexpected low proportion of collaborative service innovators. However, also some methodological problems might arise since most of the empirical studies ask for institutional collaborative arrangements.

5 Empirical analysis

5.1 Data base

The loosely-coupled innovation system has been identified as appropriate for service innovators. However, the previous theoretical analysis as well as the first empirical results from the Community Innovation Survey (CIS) can show that there are some limits and barriers for collaboration in services. For the purpose of this analysis the CIS III undertaken in 2003 for Germany has been chosen because special attention has been laid on the analysis of different internal and external sources for innovation instead of inquiring highly institutionalized innovation forms of collaboration.

The survey was carried out in 2003 for the German Ministry of Education and Research by the Centre for European Economic Research as well as the Institute for Applied Social Sciences and according to the Community Innovation Survey, a common and highly standardized European survey on innovation activities. The survey was postal and voluntary. The sampling included firms with 10 and more employees and was confined to 22 different industries from manufacturing and services, with sampling stratified by firm size, by sector, and by location (East or West Germany). The service companies analyzed are coming from nine different service industries like wholesale trade, retail trade, transportation, banking/insurance, telecommunication, technical services, business services, and other services. The sample is dominated by technical (20 per cent) and transport (18 per cent) services. 68 per cent of the service firms have less than 50 employees while 12 per cent of the sampling has 250 or more employees (see Figure 1). Around 62 per cent of the service companies are located in West Germany while the other 38 per cent of the sample is located in East Germany.

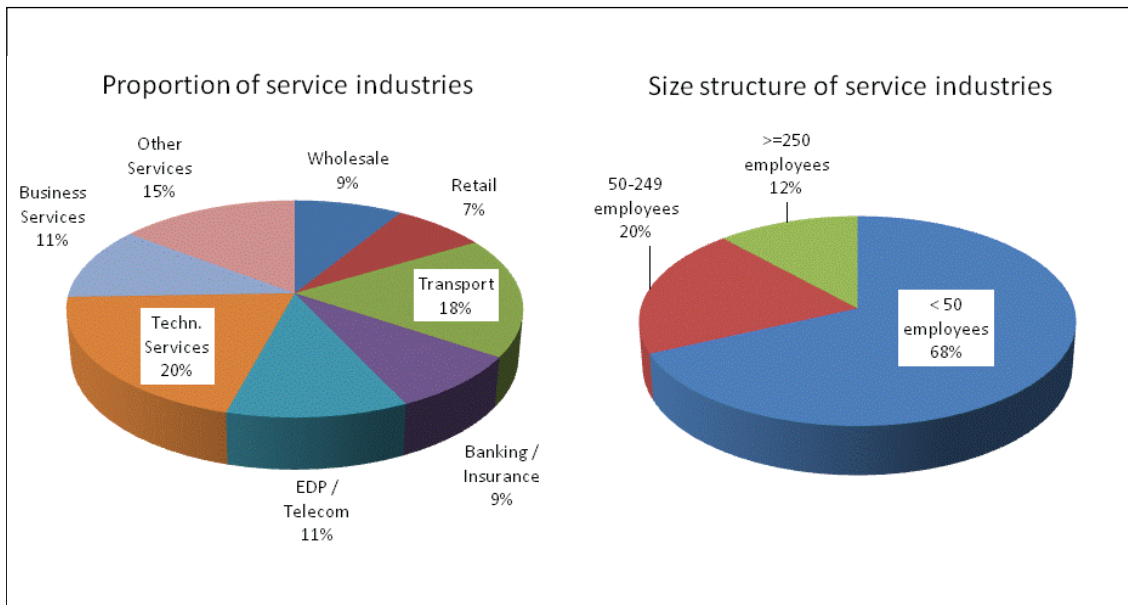


Figure 1: Overview of the data base
Data source: Mannheim Innovation Panel 2003 (CIS III – Germany)

In total of 3,967 firms responded to the survey for manufacturing and services together – of which 2,272 have been classified as innovators. For the analysis of collaborative arrangements in the service industries, the analysis was restricted to the sample of 864 service firms that claimed to have been engaged in innovation activities. The question seven of the questionnaire asked: *“Did your corporation have any collaborative arrangements on innovation activities with other enterprises or institutions between 2000 and 2002?”* A definition of “innovation collaboration” was also provided: *“Innovation collaboration means active participation in joint R&D and other innovation projects with other companies or non-profit organizations. It does not necessarily imply that both partners derive immediate commercial benefits from the venture. Pure contracting out of work, where there is no active participation is not regarded as collaboration”*. 770 of these service innovators have answered the question on innovation collaboration. More than half of the innovative service firms have no collaborative arrangements to foster innovation activities while around 42 per cent of the innovative service firms provided details on co-operative arrangements – compared to around 40 per cent in manufacturing. Above average are technical services with 61 per cent, telecommunication and electronic data processing (EDP) with 53 per cent and business services with 44 per cent of collaborating firms. Retail trade has the lowest proportion of collaborative firms with 16 per cent. Compared to the previously described results offered by Tether (2002), German service and manufacturing innovators show much higher collaborative activities than companies from other European countries.

5.2 Data analysis and discussion of results

In the following analysis the empirical results are focused on innovators only. The question nine of the questionnaire especially asked for loosely-coupled collaboration activities in terms of the importance of external knowledge sources which have been indispensable for the innovation activities between 2000 and 2002. Additionally it has been asked if product and / or process innovations have been fostered by the external knowledge sources. The results are summarized in Table 1.

	FOSTERING PRODUCT INNOVATION	FOSTERING PROCESS INNOVATION
Service industries		
Customers as knowledge sources for innovation	48%	11%
Competitors as knowledge sources for innovation	21%	7%
Science base as knowledge sources for innovation	17%	4%
Suppliers as knowledge sources for innovation	16%	6%
Law and regulation as knowledge sources for innovation	21%	7%
Manufacturing industries (without mining / food)		
Customers as knowledge sources for innovation	58%	14%
Competitors as knowledge sources for innovation	23%	7%
Science base as knowledge sources for innovation	13%	5%
Suppliers as knowledge sources for innovation	17%	8%
Law and regulation as knowledge sources for innovation	15%	5%

Table 1: Knowledge sources for innovation activities
Data source: Mannheim Innovation Panel 2003 (CIS III – Germany)

For services as well as manufacturing companies customers are the main knowledge source for product and process innovations. However, customers are – surprisingly – much more important for manufacturing (58 per cent) than for the service sector in general (48 per cent). Here, the well-documented close relationship of service companies with their customers would have expected a different result. Law and regulation are – together with competitors – the second most important external knowledge sources for service product and process innovations. For manufacturing the second and third most important sources are competitors and suppliers; both, for product and process innovations. These results are also surprising since competitors are not the preferred collaboration partners according to the danger of horizontal knowledge spillovers (Kaiser 2000). However, within the loosely-coupled system, knowledge can be transferred more easily but with less deepness and danger of losing

competitive advantages – for example just via collaborative benchmarking analyses. Another unexpected result is the relatively high percentage of companies getting ideas and knowledge from science base. Here, 17% of the service innovators have indicated this knowledge source as crucial for their product innovations.

Traditionally, a phase model and some division of labor between different actors are assumed for all kinds of innovation activities. Basic knowledge is firstly created by some research institutes (fundamental research). Companies as well as some applied research organizations use this knowledge and transfer it into applicable products and technologies before these products and applications diffuse into the market or other companies (Schmoch 1997). Altogether, innovation researchers come to the conclusion that a purely process oriented approach does not suffice with respect to immediacy in describing the structures and sequences of the whole innovation process (Hipp 2000). Criticized are thus the deterministic sequences of the individual phases, the dominance of science and technology, as well as the insufficient consideration of the complex innovation relevant environment in combination with the action strategies of individual actors. The traditional innovation concepts are applied by bigger companies in the manufacturing sector consciously planning their innovation processes and having a much higher affinity to science-based, technology-oriented research. For the service sector, which is dominated by smaller companies and characterized by other specific features, new concepts are needed (Hipp 1999).

However, in many studies on knowledge- and technology-intensive service firms it is highlighted that especially high-tech services follow a more manufacturing innovation pattern integrating also research institutes into their network structures. Table 2 summarizes some descriptive results supporting the existing findings to a certain extend.

One main surprise is that the research system is linked with the service sector to a high extent. Informal contacts with research institutions are mostly important for manufacturing as well as for service companies. More than half of the service companies have some form of loosely-coupled knowledge exchange with universities (“informal contacts”). However, more formal agreements are less important – but also for manufacturing firms. Here, consulting through research institutions (43%) and joint thesis (42%) are coming second while for service firms joint thesis are ranked second (42%) and then followed by joint research (28%). Licensing and limited personnel exchange is of least importance, either for the manufacturing sector as well as for service firms. These last two different forms of collaboration need a strong fit in terms of knowledge flow (licensing) and joint knowledge development (personnel exchange). Both forms also require some institutional arrangements like contracts (licensing) and

non-disclosure agreements and agreements on joint developed exploitation of knowledge (personnel exchange) which might explain the barriers of application and the low percentage of joint use.

Going more into industry-specific network arrangements, Table 2 also shows that different network behavior with research institutions can be observed within different service industries. The most intensive collaboration activities exist with Technical Services, Business Services as well as Telecommunication and IT Services. For Technical Services are – apart informal contacts – joint research and joint thesis are mostly important. The same order of importance can be observed for Telecommunication / IT Services as well as for Business Services. These industries show an even higher percentage of collaborative arrangements in many respects than the average manufacturing firm.

	Joint research with r.i.	Contract research with r.i.	Joint theses with r.i.	Licensing from r.i.	Limited personnel exchange with r.i.	Qualification of personnel in research institutions	Consulting through research institutions	Informal contacts with r.i.
Manufacturing (without mining / food)	31%	30%	42%	14%	10%	25%	43%	62%
Services (all)	28%	22%	42%	11%	13%	24%	27%	57%
Wholesale	6%	9%	19%	4%	4%	13%	13%	35%
Retail	7%	9%	22%	7%	7%	16%	9%	36%
Transport	8%	16%	29%	5%	5%	18%	20%	36%
Banking/ Insurance	11%	12%	37%	7%	7%	20%	11%	42%
Telecom / EDP	37%	17%	47%	12%	12%	23%	25%	61%
Techn. Services	50%	40%	59%	19%	22%	34%	42%	79%
Busin. Services	29%	20%	52%	6%	13%	25%	26%	66%
Other Services	16%	16%	25%	8%	10%	25%	34%	42%

Table 2: Joint innovation activities with research institutions (R.I.) like universities
Data source: Mannheim Innovation Panel 2003 (CIS III – Germany)

Following the network approach further, Table 3 gives an overview of the propensity of interlinkages between the above described loosely-coupled knowledge sources supporting product innovations and the more institutionalized forms of interaction with research institutes. In addition, the internal aspects of own knowledge creation capabilities are integrated into the models (“own R&D activities”) following the concepts of absorptive capacity (Cohen and Levinthal 1990) and the strong interaction with

internal and external knowledge generation and learning (Dosi 1988). In addition the models are controlled for industry and size. One German peculiarity still is the difference between East and West German companies in terms of innovation performance and productivity which has been controlled for as well (see variable “East Germany”).

Dependent variable (model i)	Joint research with r.i. (1)	Contract research with r.i. (2)	Joint theses with r.i. (3)	Licensing from r.i. (4)	Limited personnel exchange with r.i. (5)	Qualification of personnel in research institutions (6)	Consulting through research institutions (7)	Informal contacts with r.i. (8)
Customers as knowledge sources	.1485 (.119)	-.1270 (.131)	.0953 (.110)		-.1753 (.146)	.0850 (.118)	.0614 (.117)	.1050 (.113)
Competitors as knowledge sources	.1466 (.143)	.3100** (.147)	.2540* (.133)		.2793* (.170)	.0943 (.140)	.1788 (.139)	.1790 (.138)
Suppliers as knowledge sources for innovation	.2705* (.155)	.1596 (.162)	.0476 (.140)		.3567** (.170)	.2618* (.146)	.4175*** (.144)	-.0298 (.144)
Law and regulation as knowledge sources	.1150 (.134)	.1352 (.141)	.2337* (.124)		.1954 (.152)	.1635 (.131)	.1154 (.130)	.3258** (.132)
Own R&D activities	.3995*** (.080)	.2816*** (.082)	.2374*** (.078)		.0899 (.086)	.1581** (.076)	.2333*** (.078)	.3726*** (.083)
Wholesale	.1079 (.469)	.562 (.565)	.3126 (.388)		-.0009 (.518)	.3079 (.423)	-.4756 (.404)	.0759 (.335)
Retail	.4017 (.471)	.7575 (.563)	.1717 (.387)		.2511 (.484)	.5420 (.415)	-.3930 (.409)	.2327 (.344)
Transport	.1059 (.428)	.7207 (.522)	.2457 (.332)		-.3962 (.470)	.2514 (.372)	-.3597 (.331)	-.1963 (.300)
Banking / Insurance	.3722 (.415)	.4224 (.535)	.2607 (.333)		.0378 (.441)	.4289 (.372)	-.5728 (.350)	-.2104 (.303)
Telecom / EDP	1.0015*** (.375)	.7195 (.496)	.9088*** (.310)		.2242 (.400)	.3951** (.344)	-.1743 (.301)	.4792* (.278)
Techn. services	1.3660*** (.370)	1.5472*** (.488)	1.3058*** (.306)		.6800* (.384)	.8269* (.336)	.4274 (.293)	1.08361*** (.2731788)
Busin. services	.8386** (.394)	.9225* (.5121)	1.2222*** (.326)		.5061 (.417)	.6066* (.362)	-.0127 (.322)	.7974** (.301)
Other services	.6586 (.404)	.7770 (.522)	.2555 (.343)		.1486 (.426)	.5161 (.362)	.2444 (.318)	.0644 (.301)
Real estate					BASE			
<50 empl.					BASE			
50-249 empl.	-.2157 (.142)	-.0664 (.148)	.1834 (.132)		.0792394 (.1667162)	.0875591 (.1378569)	.0621 (.139)	.0948 (.131)
>=250 empl.	-.2311 (.193)	.3790* (.193)	1.0948*** (.174)		-.1083 (.240)	.4158** (.177)	.2693 (.178)	.8958*** (.177)
East Germany	.1738 (.116)	.2887** (.120)	.1244 (.111)		.3583*** (.130)	.2860** (.114)	.3632*** (.115)	.3523** (.114)
No of observations	703	692	700		693	696	692	706
Prob > chi ²	0.000	0.000	0.000	not significant	0.000	0.001	0.000	0.000
Pseudo R ²	0.172	0.123	0.139		0.086	0.053	0.102	0.1652

Standard errors in parentheses: * p<0.05, ** p<0.01, *** p<0.001

Table 3: Relationship between collaboration activities with research institutes (R. I.) and other forms of knowledge sources
Data source: Mannheim Innovation Panel 2003 (CIS III – Germany)

The results confirm that especially Telecommunication / IT as well as Technical and Business Services have a higher propensity to closer interact with research institutions. Joint thesis and joint research are of main importance here and the difference is highly significant compared to the base service industry. Also important is the finding that own R&D activities significantly rise the propensity to work together with universities on almost all institutional levels – supporting the hypothesis that the absorptive ability to integrate and further develop knowledge offered and diffused by research institutions is of importance. In addition the propensity to have closer contact with universities rises with firm size.

Interesting is that all kinds of different knowledge sources are significantly increasing the ability to work together with universities and that all significant results are positive. This means that existing and combined internal and external knowledge sourcing strategies also open up the propensity to have loosely and close (institutional) contact with research institutions. The results of the probit analysis further deepen the descriptive results previously presented. Interactions with suppliers and competitors strengthen the propensity to integrate research institutes via consulting contracts as well as via limited personnel exchange, qualification of personnel in universities and joint research. Also the interaction with competitors increases the propensity to have a limited personnel exchange with universities. In addition, contract research and joint thesis are more likely when getting innovative ideas from competitors. Surprisingly, customers as knowledge sources might be so “normal” that no significant different behavior with respect to research institutes can be observed. Unexpected is also the result that the headquarters’ location in East Germany fosters the propensity to cooperate and collaborate with universities. The reason for that might be some knowledge catching up processes in East Germany, locally concentrated public funded transfer projects bringing universities and companies together and other East German policy instruments to support personnel exchange and joint qualification.

6 Conclusions

Some main findings can be derived from the theoretical and empirical analysis and are summarized in the following. A high importance of collaborative arrangements in general can be analyzed, supporting the predicted and described network innovation paradigm of societies. These collaborations are extremely important for product innovations. On the aggregated level no significant difference between manufacturing and services can be observed.

Service innovators collaborate in loosely-coupled network structures, however, the difference between services and manufacturing is lower than expected. Both sectors

show similar loosely-coupled innovation behavior. The role of customers is mostly important for both sectors.

Surprisingly is the importance of universities as knowledge sources and collaborative partner for service innovators. Collaborations with universities are highly under-investigated. These findings contradict previous research results on innovation pattern of service companies. However, the reason for a possible increasing connectivity between service and universities needs to be analyzed further.

Different innovation pattern occur within service industries showing the heterogeneity of the service sector. Especially Telecommunication / IT, Technical and Business Services are highly engaged in a more “traditional” innovation system. If these innovation pattern really reflects a “standard” manufacturing innovation pattern this finding needs to be investigated in detail. The assumption is that also within manufacturing different innovation patterns exists and contrary hat some service peculiarities remain which drive and influence the innovation pattern of the Telecommunication / IT, Technical and Business Services.

The characteristics of the innovation activities of the other service industries like Wholesale, Retail, Transport, Banking / Insurance, and Other Services is still under-investigated. At least some informal contacts with universities exist; and these industries also work together with universities in a more institutionalized way. However, a specific pattern of innovation activities cannot be derived from the empirical findings. Some measurement problems based on the questions and the questionnaire might be still one reason for the missing possibility of analysis.

In general, loosely-coupled collaboration and external knowledge sourcing strategies foster research collaborations with universities. It can be assumed that service innovators which are engaged in loosely-coupled innovation activities have a strong focus on knowledge building and learning capabilities which also require a strong internal knowledge generation process through own research and development capabilities.

It can be accepted as result that the boundaries of the firm are becoming increasingly “fuzzy”. But a more detailed analysis is required to get insights into the network system with its components, relationships, and attributes – which are also changing over time. Some of the actors and knowledge sources within innovation collaboration have been analyzed in this paper in more detail and some service peculiarities have been discussed. But for collaborative arrangements the differences between manufacturing and services are less significant than previously assumed. Loosely-coupled and institutional network structures are important for both sectors. Though, some differences within service industries can be elaborated. While some service industries follow a more

manufacturing-based innovation pattern all other services industries show no specific innovation characteristics. The reason for this might be the still very traditional measurement approach of the Community Innovation Survey which has been used for the empirical analysis.

Tether and Tajar (2008) hypothesis that the existing innovation measurement system provided by national agencies as well as by the European Commission (definitions, questionnaires, surveys) has been historically focused on R&D based and technological product and process innovation based approaches. For that reason the collaborative practice – especially for service innovators – is much richer and more alive than shown by the existing measurement concepts. The two authors are underlining their arguments by showing that the Community Innovation Survey from 2005 finds as many innovators collaborating with university in Germany and Italy whilst in Austria and Spain the proportions collaborating with universities go above those collaborating with customers. These rather unlikely results can just be explained with measurement problems, for example based on a different interpretation of questions and definitions.

Measurement problems arise especially when analyzing the relationships and attributes of network structures in detail. Much more effort has to be undertaken to get some insights into the “black box” of innovation systems – especially for the non-technical service industries. Here, new forms of open innovation, the role of the internet as well as arguments from different disciplines like transaction cost theory, organizational theory, systems theory and evolutionary theory need to be taken into consideration.

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