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Business services as actors of knowledge transformation: the role of KIBS in regional and national innovation systems

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Abstract

Over the last years, there has been a significant increase in the attention paid to the activities of knowledge-intensive business services (KIBS). KIBS produce and diffuse knowledge, which is crucial for innovation processes. The paper gives an overview of the role and function of KIBS in innovation systems and their knowledge production, transformation and diffusion activities. Focusing on innovation interactions between manufacturing small- and medium-sized enterprises (SMEs) and KIBS, the empirical analyses grasps KIBS position in five regional contexts. The analysis leads to the conclusion that innovation activities link SMEs and KIBS through the process of knowledge generation and diffusion.

Keywords: Knowledge-intensive business services (KIBS); Regional innovation system; Knowledge transformation; Knowledge diffusion; Interaction

1. Introduction

The development, over past decades, of the activities of knowledge-intensive business services (KIBS) may be interpreted as one of the marking trends of recent economic evolution in industrialised countries. In fact, the increasing importance of knowledge-intensive services constitutes one of the characteristics of the raise of the so-called "knowledge economy". Though the quantitative expansion of these activities leaves no doubt (for instance, in terms of sales volume or of number of people employed), the influence of KIBS on knowledge generation and circulation within the economy still needs to be further explored.

The paper aims at contributing to a better understanding of the role and functions of KIBS in innovation systems. The central issue of the paper deals with the production and diffusion of knowledge by KIBS. Consequently, attention is paid to the meaning of knowledge codification for KIBS as well as to the role knowledge cycles play in the interactions between KIBS and their clients. In this respect, the paper investigates innovation-related interactions between KIBS and manufacturing small- and medium-sized enterprises (SMEs). The hypothesis is put forward that this type of interactions stimulates the generation and diffusion of knowledge within innovation systems, at both national and regional levels.

The contribution is organised along two sections. The first section provides a theoretical framework to the reflection in exploring especially the relations between KIBS and innovation systems. The second section is devoted to empirical evidence. The investigation follows a methodology based on the examination of firm samples located in five different regions in France and Germany. Finally, the concluding section stresses remarkable facts and implications, especially in terms of innovation and regional policies.

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2. Innovation systems and KIBS: a theoretical framework

2.1. The role of KIBS in innovation systems

Innovation is to an increasing extent grasped as an interactive and evolutionary process. Due to its complexity, single firms, especially SMEs, are supposed to innovate in co-operation with other firms which enables all partners to optimally use their own internal knowledge resources and to combine them with specific competencies of their partners. In such a case, the chain-linked model proposed by Kline and Rosenberg (1986) for one innovating firm is then to be expanded to several firms. Central in this model is the importance devoted to interactive knowledge development. Every stage of the innovation process is linked to the other stages and feeds the knowledge base of the firm. The knowledge involved in innovation activities can be tacit or codified [1] and it can be generated within the firm or be acquired from external sources such as network partners, for instance. Knowledge is not of a rigid nature, it can be transformed, stored and communicated. Viewing the firm as a knowledge-creating entity, Nonaka (1994) and Nonaka et al. (2000) illustrate the knowledge transformation processes that might occur within firms and develop a knowledge-creation function that indicates knowledge-creation capabilities of the firm. In this respect, these authors try to demonstrate that the knowledge conversion process involves both tacit and codified knowledge (Nonaka et al., 2000, p. 11). Since the extension of knowledge is considered as a pre-requisite for successful innovations, innovative activity is thus related to the expansion of both tacit and codified knowledge components. Consequently, innovation can be understood as a cycle involving interactions between tacit and codified knowledge.

This approach is rooted in neo-Schumpeterian or evolutionary economics which view innovation as an evolutionary process based on knowledge. [2] Knowledge cycles leading to innovation result, at least partly, from interactions between different categories of actors. Additionally, innovation processes are localised in the sense that they are rooted in specific contexts with specific experiences, core competencies and specific knowledge bases. Innovations are thus embedded in specific social, economic, political and cultural contexts, they are context-dependent and have a systemic character. Edquist (1997, p. 13) defines systems with respect to innovation activities as "complexes of elements or components, which mutually condition and constrain one another, so that the whole complex works together, with some reasonably clearly defined overall function", whereas Lundvall (1992, p. 2) emphasises once again the importance of knowledge and learning: "(. . .) a system of innovation is constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge". Being in its first stage conceptualised on the national level (for instance, Freeman, 1987 as well as Lundvall, 1988, 1992), this approach is also helpful in order to explore regional innovation systems (Cooke et al., 1996; Cooke, 1998).

Turning to the role KIBS potentially play such systems, the first question to be raised relates to the nature of those firms. KIBS may be defined as "consultancy" firms in a broad sense, more generally "KIBS can be described as firms performing, mainly for other firms, services encompassing a high intellectual value-added" (Muller, 2001, p. 2). [3] Nevertheless, this general definition does not reflect the diversity of KIBS forms and activities. In this respect, it is

[1] Codified or explicit knowledge "(. . .) is objective and rational knowledge and can be expressed in such forms as data, scientific formulas, specific actions and manuals". Tacit knowledge "(. . .) is subjective and experiential and hard to formalise. Belief, perspective, mental models, ideas and ideals are examples of tacit knowledge" (Nonaka et al., 2000, p. 5). Cowan et al. (2000) discuss the question of 'codifiability' which is closely related to the subject of tacitness of knowledge parts, arguing that the process of codification (and therefore the degree of tacitness of a given amount of knowledge) depends highly on incentives, possibilities and the social processes related to codification.

[2] Notably Nelson and Winter (1974, 1975, 1977) and Freeman (1982). The issues of knowledge and learning and their crucial importance for modern economies is discussed by Lundvall (1992), Lundvall and Johnson (1994), among others.

[3] Over the last years, several research projects focused at KIBS, their activities and their role in the innovation context. For instance, the KISINN project (Wood, 1998), the SI4S project (Miles and Boden, 1998), the RISE project (Hales, 1999), all supported by the European Commission, DG Research, targeted socio-economic research. In parallel, the Community Innovation Survey provided the opportunity to get further insight into KIBS activities (for instance, Evangelista and Savona, 1998).

Table 1
The two main categories of KIBS[a]

KIBS I: traditional professional services, liable to be intensive users of new technology	Marketing/advertising Training (other than in new technologies) Design (other than that involving new technologies) Some financial services (e.g. securities and stock-market-related activities) Office services (other than those involving new office equipment, and excluding 'physical' services like cleaning) Building services (e.g. architecture, surveying, construction engineering) Management consultancy (other than that involving new technology) Accounting and book-keeping Legal services Environmental services (not involving new technology, e.g. environmental law, and not based on old technology, e.g. elementary waste disposal services)
KIBS II: new technology-based KIBS	Computer networks/telematics Some telecommunications (especially new business services) Software Other computer-related services, e.g. facilities management Training in new technologies Design involving new technologies Office services involving new office equipment Building services (centrally involving new IT equipment such as building energy management systems) Management consultancy involving new technology Technical engineering Environmental services involving new technology R&D consultancy and high-tech boutiques

[a] Adapted from Miles et al. (1994, pp. 19–20).

worthwhile to turn to Miles et al. (1994) who identify two main KIBS categories, quoted KIBS I and KIBS II (Table 1). The authors establish a separation between "traditional professional services" liable to be intensive users of new technology (such as marketing, advertising and so on) on the one hand and "new technology-based KIBS" (such as software design and other computer-related activities) on the other hand. To a certain extent, these categories overlap the distinction which is commonly employed (for instance, Koschatzky and Zenker, 1999) between (i) advisory services (such as legal activities, book-keeping and auditing activities, market research, business and management activities) and (ii) technical services (such as computer-related activities, engineering and architectural activities, technical testing and analysis).

It may be assumed that KIBS hold a specific position in innovation systems because they play a two-fold role. Firstly, they act as external knowledge source and contribute to innovations in their client firms and secondly, KIBS introduce internal innovations, provide mostly highly-qualified workplaces and contribute to economic performance and growth. As Czarnitzki and Spielkamp (2000, p. 26) underline it, KIBS can be considered as "bridges for innovation" since the following interactions can stressed.

- Business-related services purchase knowledge or equipment and investment goods from the manufacturing industry or other services (purchaser).
- Business-related services provide services or knowledge for companies in the manufacturing industry/service sector (provider).
- Business-related services deliver knowledge or services that are complementary to the manufacturing industry's products or to other services (partner).

In this respect, three common features of KIBS should be highlighted: (i) the knowledge-intensity of the service provided by KIBS for their clients (which distinguishes them from other types of services); (ii)

the function of consulting (which could be also expressed as problem-solving function); and (iii) the strongly interactive or client-related character of the service provided. Knowledge flows between KIBS and their partners are not unilateral: KIBS acquire knowledge from their clients which allows them in turn to offer client-specific solutions, but also to enhance their own knowledge base.

2.2. The production and diffusion of knowledge by KIBS

Typical knowledge processing within a KIBS consists, for instance, of the integration of external knowledge, the acquisition of available knowledge related to a specific problem and the elaboration of the codified knowledge corresponding to the specific need of the client firm. Exploring the linkages between KIBS and their clients, Strambach (2001) distinguishes three main stages in the process of knowledge production and diffusion by KIBS (Fig. 1). Besides the acquisition of knowledge, of tacit and codified types, the author points to a stage of knowledge recombination and finally the transfer of knowledge towards the client firm (diffusion). Fig. 1 illustrates the linkages between KIBS and their client firms in terms of knowledge acquisition and diffusion. A process of knowledge recombination takes place within the KIBS: knowledge gained from interactions with clients is combined with existing knowledge whereas additional knowledge is acquired and new knowledge is generated.

The acquisition of new knowledge takes place in contact with the client firms. This interaction-based generation of knowledge consists mainly in learning by trying to solve problems on behalf of the client firms. During the second stage, a recombination of the knowledge acquired previously is performed. This takes the form of a partial codification of the acquired knowledge, which in turn favours the mastering of this "newly created knowledge". To a certain extent, as underlined by Strambach (2001), this allows KIBS to create their own market. Finally, the application of

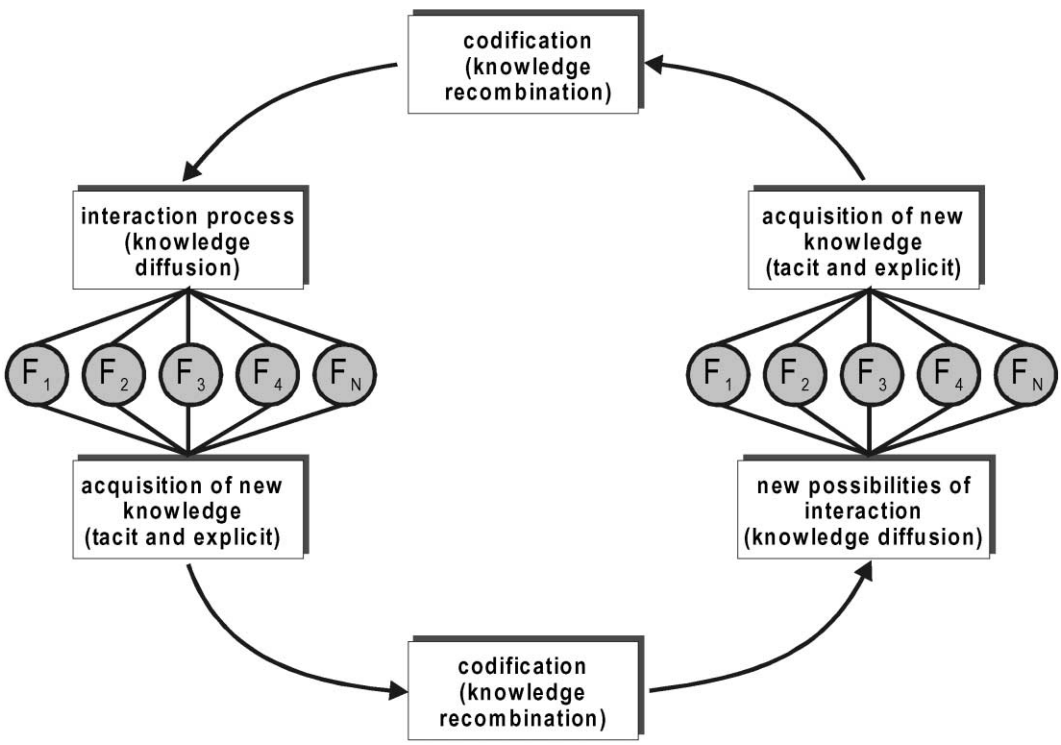

Fig. 1. Knowledge production and diffusion as a result of KIBS activities (F_1–F_N: client firms; adapted from Strambach, 2001, p. 64).

this knowledge under the form of new or enhanced services constitutes a partial transfer of knowledge from the KIBS to its client firms. As one may observe, the diffusion of knowledge is interrelated with new possibilities for interaction and knowledge generation. In conclusion, interactions with client firms might enhance KIBS knowledge bases through learning processes and lead to new possibilities of interactions. Knowledge processing by KIBS is thus coherent with the vision of knowledge appropriation proposed by Ancori et al. (2000, p. 267) according to whom: "(. . .) the appropriation of crude knowledge — i.e. its integration in one's cognitive context — is not the result of a transmission, but rather the result of a re-engineering process". Once codified, knowledge can be processed and sold in 'modules' to clients. Consequently, codification contributes to the divisibility of knowledge bodies. Finally, codification increases the overall knowledge base and, once distributed and incorporated in firms, actors' absorptive capacity. This in turn may lead to an increased knowledge-creation, further innovations and economic growth (Cohendet and Steinmueller, 2000). This vision is fully consistent with the findings of previous research (such as the SI4S project). In fact, as stressed by Hauknes (1998, p. 5): "the generation and diffusion of innovations rely more and more upon new technological knowledge which is generated not only by learning processes implemented by internal research and development laboratories, but also and to a growing extent, by the daily interaction, communication and trading of information of learning firms among themselves and with other scientific institutions. KIBS firms play a major role in this context as qualified interfaces. KIBS firms in fact act more and more as bridges and converters between technological and business expertise and localised knowledge and capabilities, becoming problem-solving actors specialised in the provision of the complementary knowledge inputs allowing the generation of innovations".

In particular, interactions with KIBS may be of crucial importance for the support of innovating SMEs. In fact, SMEs trying to innovate are confronted with several obstacles. Kleinknecht (1989, p. 219) provides a list of possible problems which small manufacturing firms might experience in the innovation process. It appears that the most important limiting factors for SMEs are: (i) capital scarcity; (ii) lack of management qualification; and (iii) difficulties to obtain technical information and know-how required for innovation projects. Especially, the second and third points indicate that SMEs are confronted with specific limitations related to information flux and knowledge. And, as underlined by Cohendet and Steinmueller (2000, p. 195), the effective use of the growing ". . . information 'flux' is essential to the creation of organisational capabilities that provide the basis for organisational success". Additionally, as stressed by Bughin and Jacques (1994, pp. 654–655), failure to innovate is not only related to "bad luck", but seems to be linked with the inability of firms to respect what these authors call "key managerial principles". These "key principles" consist of: (i) efficiency of marketing and R&D; (ii) synergies between marketing and R&D; (iii) communication skills; (iv) managerial and organisational excellence; and (v) the protection of the innovation. In other words, it can be suggested that internal R&D alone (if any) is not sufficient for most SMEs in order to meet success in innovation. SMEs innovation capacities depend thus strongly on the access to external informational resources.[4] As a consequence, the capacity to combine external and internal sources may be interpreted as an improvement of "absorptive capacities" (in the meaning given by Cohen and Levinthal, 1989).

This leads to consider KIBS as potential co-innovators for SMEs. In this respect, the concept of complementary innovation assets developed by Teece (1986) is helpful for characterising innovation-related interactions between SMEs and KIBS. Services provided by KIBS result from a highly interactive process in which KIBS perform a continuous adaptation

[4] Recent studies emphasise the phenomenon of "innovation without research", i.e. firms acquire external knowledge not necessarily generated within R&D processes. Cowan and van de Paal explain this and point to the situation of KIBS in this context: ". . . innovation and knowledge generation take place in many activities, many of them outside the formal R&D process. Both production (learning-by-doing) and consumption (learning-by-doing) have been stressed. A successful innovation system will develop mechanisms to take advantage of this "learning without formal research". A case in point is the service sector, which continues to grow in importance in all industrialised economies. In this sector, formal R&D plays a much less important role than it does in manufacturing. So this growth of services alone implies a growth in innovation without formal research" (European Commission, 2000, p. 13).

to their clients' needs. Strambach (1998, p. 4) underlines these complex relationships in declaring that "the purchase of knowledge-intensive services is not the same as the purchase of a standardised product or service. The exchange of knowledge products is associated with uncertainties and information asymmetries stemming from the special features of knowledge (. . .)". Systematising the functions KIBS can assume for their clients, Gadrey (1994) distinguishes the following three types of functions: (i) the detection and analysis of problems; (ii) the (abstract) establishment of a diagnosis; and (iii) the (concrete) participation in the problem-solving process. Summarising and integrating Teece's views of complementary innovation assets KIBS fulfil for their manufacturing clients, it can be concluded that KIBS assume a "bridge" or interface function between the environment and their clients and reinforce or catalyse the evolution and innovation capacities of their clients, especially SMEs. Going one step further, it can be suggested that KIBS play a role of co-innovators or even of "midwives" for SMEs (von Einem and Helmstädter, 1994, p. 2). Nevertheless, the impact of KIBS on SMEs innovation capacities is only one side of the story. In fact, KIBS may also benefit from their interactions with SMEs in terms of ability to innovate. In particular, since the development of KIBS knowledge base is intimately related to the activity they perform for their clients, it seems logical that their innovation capacities are influenced through those interactions. As a consequence, considering SMEs and KIBS together, the hypothesis of a virtuous circle (Fig. 2), can be expressed. In other words and to summarise: "it can be argued that interacting KIBS and SMEs mutually contribute to their respective innovation capacities, in a similar but not identical way. This mutual contribution is based on a "core sequence" which can be approximated with three "sub-sequences": (i) the interaction itself; (ii) the resulting knowledge base expansion; and (iii) the ensuing evolution of the firm. These three constituents of the whole phenomenon should not be seen in a linear perspective but as potentially inter-linked in a "knowledge-based loop" thanks to feed-back effects" (Muller, 2001, p. 129).

2.3. Proximity and territorial context of innovation

Since ICT facilitate communication, one could assume that knowledge would tend to be distributed homogeneously in space and that KIBS activities would tend to become more and more "footloose". Nevertheless, the opposite seems to be true: core regions appear as particularly favoured. The crucial point explaining this phenomenon is apparently related to the importance of face-to-face contacts and to the exchange of tacit knowledge. KIBS are confronted with the specific problems of their clients and thus they require most often direct contacts with them in order to conceive solutions by recombining existing knowledge and complementing it with knew inputs if necessary. A high share of these interactions, especially in the starting phase of a consulting activity, is characterised by a strong tacit content, requiring personal contacts in particular. Proximity (geographical, social, cultural, etc.) is hence helpful to manage these phases. Due to the importance of tacit knowledge, existing spatial patterns may even be reinforced by the development of ICT. Héraud (2000, p. 4) points explicitly to this phenomenon: "there is an apparent paradox in the new knowledge-based economy: to a certain extent, the trend of de-materialisation and the development of the techniques of communication should help the creative networks to get rid of distance; but at the same time it appears that complex cognitive processes need not

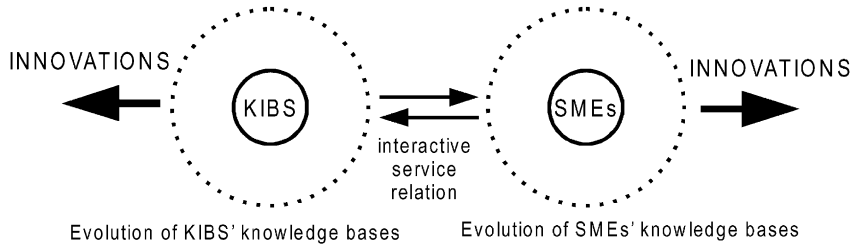

Fig. 2. The virtuous circle associating KIBS and SMEs (adapted from Muller, 2001, pp. 41–47).

only large flows of codified scientific and technical information, but also a lot of tacit knowledge for using and interfacing that information. Then proximity does matter, since building common tacit knowledge implies close contacts, at least at the beginning". Knowledge flows may favour regional differences and even generate a reinforcement of regional inequalities. According to Wood (1998), who analysed KIBS demand and supply response, the expansion of KIBS firms leads to a reinforcement of the core regions domination. His analysis features interactions involving KIBS and their clients on different spatial levels and pays particular attention to large enterprises both in consultancy and manufacturing sectors as well as to the role of international and national-scaled interactions. In this perspective, the growing role of KIBS appears to be an opportunity for core regions (in particular, large metropolitan areas) and a threat for peripheral regions.

Summarising, it can be assumed that KIBS play a crucial role in terms of activation of innovation potentials, notably due to the mutual impact of knowledge-based interactions on KIBS and SMEs. These interactions may affect significantly the production and diffusion of knowledge within national innovation systems as well as at regional level. The following section will attempt to provide some empirical evidence highlighting those assumptions.

3. Empirical investigations: exploring the influence of KIBS on innovation systems

3.1. The methodology and variables of the analysis

In order to get further insight into the role of interactions between KIBS and SMEs for the benefit of their respective knowledge bases and innovation activities, the following empirical analysis uses the results of a postal innovation survey in different French and German regions (Fig. 3).

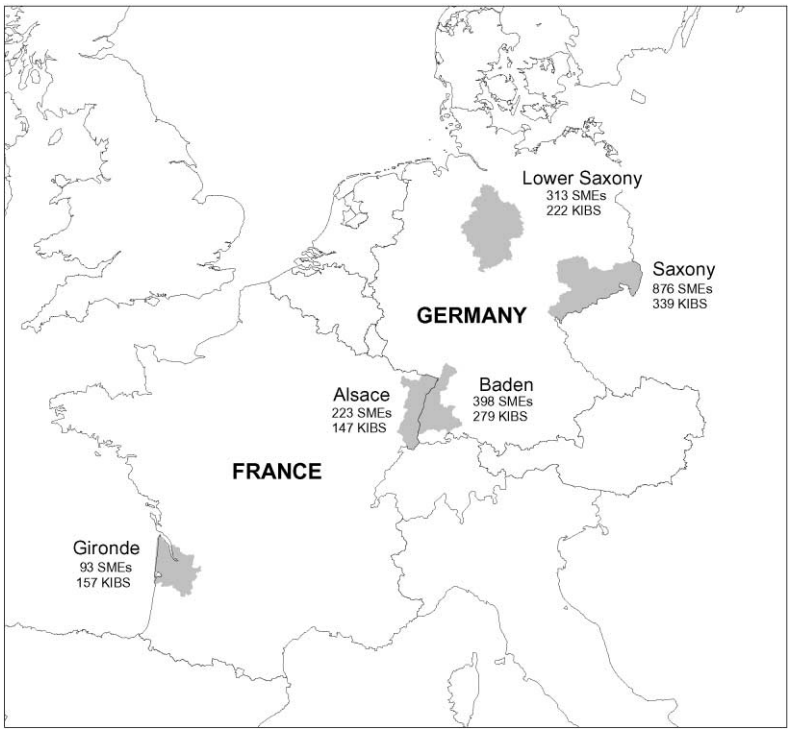

Fig. 3. The surveyed regions (data base: European Regional Innovation Survey (ERIS); software: MapInfo 4.1).

Table 2
The variables used for the analysis

Indicators	Target groups	
	Manufacturing SMEs	KIBS
Mutual interaction activities	Interactions with KIBS	Interactions with innovative SMEs
Internal and external knowledge determinants	Level of internal innovation expenses (RDINT) Interactions with ITI[a]	Level of internal innovation expenses (RDINT) Interactions with ITI
Indicator of firms' innovation performance and development	Introduction of innovations in previous 3 years (INNOV) Increase of number of employees in previous 3 years (GROWTH)	Introduction of internal innovations in previous 3 years (INNOV) Increase of number of employees in previous 3 years (GROWTH)

[a] For a presentation of the concept of ITI, see Koschatzky and Héraud (1996).

The survey was performed between 1995 and 1997, covering innovation and co-operation characteristics of manufacturing and service firms as well as research institutions. [5]

The French region of Alsace borders Germany at the Rhine river. The industrial fabric is mainly composed of small- and medium-sized firms, but Alsace simultaneously has a considerable amount of large firms, often branches of national companies or multinationals. The most important sectors are the metal, chemical and food industries. Baden is the western part of the Land Baden-Württemberg. Besides universities, numerous further research organisations and technical colleges are located here. The focus of industrial activities is electronics, data processing, vehicle construction and mechanical engineering. The economic structure of Gironde is dominated by SMEs and the region has a considerable share of foreign direct investments. Besides agriculture and viticulture, the oil, chemical and pharmaceutical industries, Gironde has high-tech industries such as aeronautics. The research triangle Lower Saxony (Hanover–Brunswick–Göttingen) is the economic core of the German Land Lower Saxony. Economic activities are concentrated on automotive industries; the headquarter of Volkswagen is located in this region. Various research organisations are located here and the size structure of regional firms is dominated by large businesses. Saxony is one of the "new German Länder" that underwent transformation and restructuring processes. The highest amount of firms are small ones, while large enterprises and industrial R&D are lacking to a larger extent.

Fig. 3 indicates the number of small- and medium-sized manufacturing enterprises and KIBS analysed in each region. [6] The variables used for the empirical analysis are displayed in Table 2. The choice of the variables refers to the issues addressed previously with respect to the innovation capacities of mutually interacting manufacturing SMEs and KIBS.

To give some general indications, the whole sample comprises 1903 manufacturing SMEs and 1144 KIBS. 1393 manufacturing SMEs reported product and/or process innovations during the preceding 3 years, whereas 736 firms increased their number of employees during the same period. Among KIBS, 819 firms innovated whereas 655 grew during the preceding 3 years. However, considering the two characteristics simultaneously, 543 SMEs (28.5%) and 493 (43.1%)

[5] The survey was conceived and performed by the University of Hanover (Lower Saxony), the Technical University Bergakademie Freiberg (Saxony) and the Fraunhofer Institute for Systems and Innovation Research, Karlsruhe (Baden) on behalf of the German Research Association. The data collection in France benefited from support of the department of economics (BETA) of the Louis Pasteur University of Strasbourg (Alsace) and from the department of regional economics (IERSO) of the Montesquieu University of Bordeaux (Gironde).

[6] The samples were constituted in order to reflect the industrial structure of each region in terms of firms' size and activities. The sampling was realised with the help of data provided by the French statistical office (INSEE) for Alsace and Gironde on the one hand and by the different chambers of commerce (IHK) located in Baden, Lower Saxony and Saxony. The structural characteristics of the samples are presented in Tables 3–6.

Table 3
Characteristics of the SME sample: sector of activity (share of firms)

Region	Sector of activity (%)						
	Food products	Textiles	Wood and paper	Chemicals	Basic metals	Machinery and equipment	Electrical machinery and apparatus
Alsace	23.1	6.8	13.6	14.5	19.0	10.4	12.7
Baden	3.8	6.3	16.7	11.9	21.2	19.4	20.7
Gironde	16.1	6.5	22.6	15.1	20.4	9.7	9.7
Lower Saxony	5.8	3.2	18.1	24.8	12.9	21.6	13.5
Saxony	8.3	10.6	15.5	17.6	18.9	17.6	11.5
Total	9.1	7.8	16.3	17.1	18.5	17.4	13.8

Table 4
Characteristics of the KIBS sample: type of activity (share of firms)

Region	Type of activity (%)			
	Computer-related consultancy and activities	Legal, accounting and tax consultancy	Business, management and marketing consultancy activities	Architectural, engineering and technical activities
Alsace	16.3	16.3	25.2	42.2
Baden	27.2	16.1	24.7	31.9
Gironde	14.0	31.8	28.0	26.1
Lower Saxony	22.1	8.1	30.2	39.6
Saxony	13.3	15.3	26.0	45.4
Total	18.9	16.5	26.7	37.9

KIBS introduced innovations and grew at the same time during the observed period.

3.2. Some evidence of the mutual influence of KIBS and SMEs

This part of the analysis is devoted to the mutual impact of the relations between KIBS and SMEs on their respective innovation activities. To this aim, the following characteristics are compared for interacting and non-interacting SMEs and KIBS: (i) the introduction of innovation during the observed period; (ii) the level of innovation expenses; and (iii) the propensity to co-operate with universities and research organisations (designated as institutions of technological infrastructure or ITI).

Out of the 1903 sample firms, 1492 SMEs interacted with KIBS. As Fig. 4 shows, the share of

Table 5
Characteristics of the SME sample: size classes (share of firms)

Region	Size classes (%)				
	Less than 20 employees	20–49 employees	50–99 employees	100–199 employees	200–499 employees
Alsace	30.5	37.7	15.7	7.6	8.5
Baden	28.4	31.4	19.1	9.8	11.3
Gironde	46.2	30.1	11.8	7.5	4.3
Lower Saxony	16.3	28.8	21.1	18.8	15.0
Saxony	35.0	30.6	17.1	9.9	7.3
Total	30.6	31.3	17.8	11.0	9.4

Table 6
Characteristics of the KIBS sample: size classes (share of firms)

Region	Size classes (%)				
	Less than 3 employees	3–4 employees	5–9 employees	10–19 employees	Above 20 employees
Alsace	28.7	28.0	25.2	7.7	10.5
Baden	22.0	20.1	25.6	17.9	14.3
Gironde	35.9	24.1	22.8	8.3	9.0
Lower Saxony	13.4	20.4	19.9	19.4	26.9
Saxony	43.8	14.2	16.0	12.1	13.9
Total	29.6	19.9	21.2	13.9	15.4

SMEs having introduced innovation during the previous 3 years is higher in the case of firms maintaining co-operations with KIBS than in the case of non-interacting SMEs: 76.7% of SMEs that interacted with KIBS introduced innovations, whereas the group of non-interacting SMEs showed a share of 60.6% innovators. A 20.3% of interacting SMEs spent more than 8% of their turnover for innovations. These expenses include charges for research, development, construction, design including licenses and external services. Among non-interacting SMEs, the respective share of firms with high innovation-related expenditure is lower (13.9%). Turning to interactions with ITI, it appears that interacting firms display a higher share of co-operations than non-interacting ones. From the sample firms that interact with KIBS, about two-thirds also co-operate with ITI, whereas this share is 15.6% for non-interacting SMEs.

As a first result, the higher share of interacting SMEs reporting innovation activities suggests that such interactions play a stimulating role for SMEs innovation capacities.

However, this does not mean that interactions with KIBS constitute the only factor favouring innovations; as Fig. 4 shows, 60.6% of non-interacting firms also report innovative activities. Secondly, the propensity to interact with KIBS appears to be linked with the propensity to invest in internal R&D, which points to the combination of external knowledge sources (delivered by KIBS) and internal ones. When finally the second external knowledge source, namely ITI, is referred to, it becomes obvious that firms interacting with KIBS have a higher co-operation rate with ITI, i.e. the "barrier of co-operation" is lowered by already existing interactions. KIBS thus do not only have a direct impact on innovation activities of manufacturing SMEs, but also an indirect one, "paving the way" for co-operation with universities, research organisations and the like. To summarise, firms that use the external knowledge source delivered by KIBS are to a higher extent inclined to further external knowledge sources and devote in general higher efforts in terms of internal knowledge mobilisation.

These results are mirrored by the corresponding analysis performed for the KIBS sample. A sample of 985 out of 1144 KIBS interacted with manufacturing SMEs and supported innovation activities of the latter. Samples 720 of the interacting KIBS (73.1%) not only contributed to innovations of their clients, but equally introduced innovations in their own firms. Similarly to what has been done for SMEs, Fig. 5 shows a higher proportion of innovators among interacting KIBS.[7] When comparing interacting and non-interacting KIBS, the rate of innovators among the former group is 73.1%, whereas 62.3% of non-interacting KIBS introduced internal innovations. In this respect, it is astonishing to see that the share of KIBS with innovation expenses above 8% of their turnover is higher for non-interacting than for interacting firms. 27.0% of non-interacting KIBS devoted more than 8% of their turnover for the preparation of innovations, whereas 24.2% of interacting KIBS did so. This fact raises the question whether external knowledge acquisition via networking is substituted for internal knowledge

[7] In the following, "interacting KIBS" and "non-interacting KIBS" describes KIBS interactions with manufacturing SMEs. KIBS are interactive in nature, but not obligatory with SMEs which is the focus of this investigation.

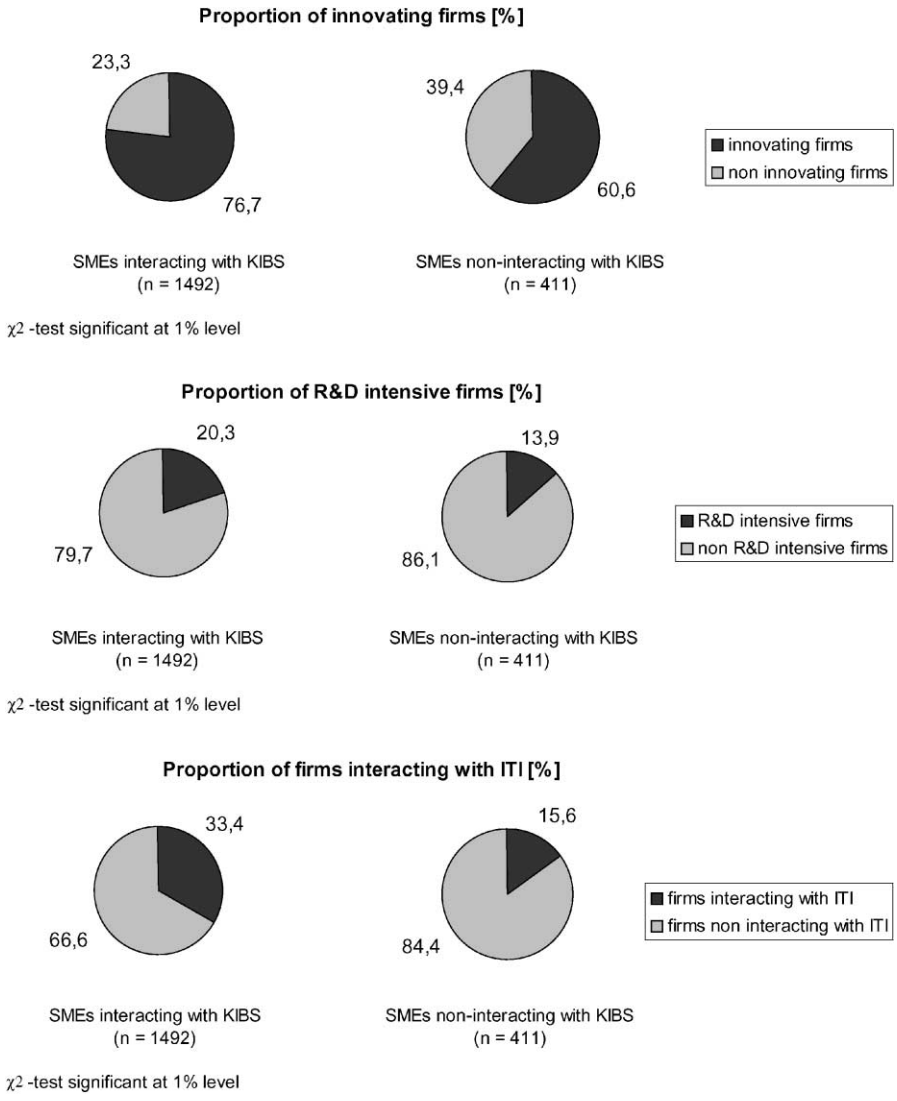

Fig. 4. Elements of comparison between interacting and non-interacting SMEs.

generation. Turning finally to co-operations with ITI, Fig. 5 shows that the difference between interacting and non-interacting KIBS is less sharp than in the case of manufacturing firms. This result might indicate that access to knowledge delivered by universities and research organisations does not constitute a distinctive factor for KIBS interacting with SMEs as it seems to be the case for SMEs interacting with KIBS.

3.3. Interregional and international comparisons: key findings

Reviewing firms' interactions, their growth, their innovation activities as well as their innovation expenses, Figs. 6 and 7 aim at comparing the different sample groups within their regional environments. Figs. 6 and 7 show simultaneously interregional similarities within the two differ-

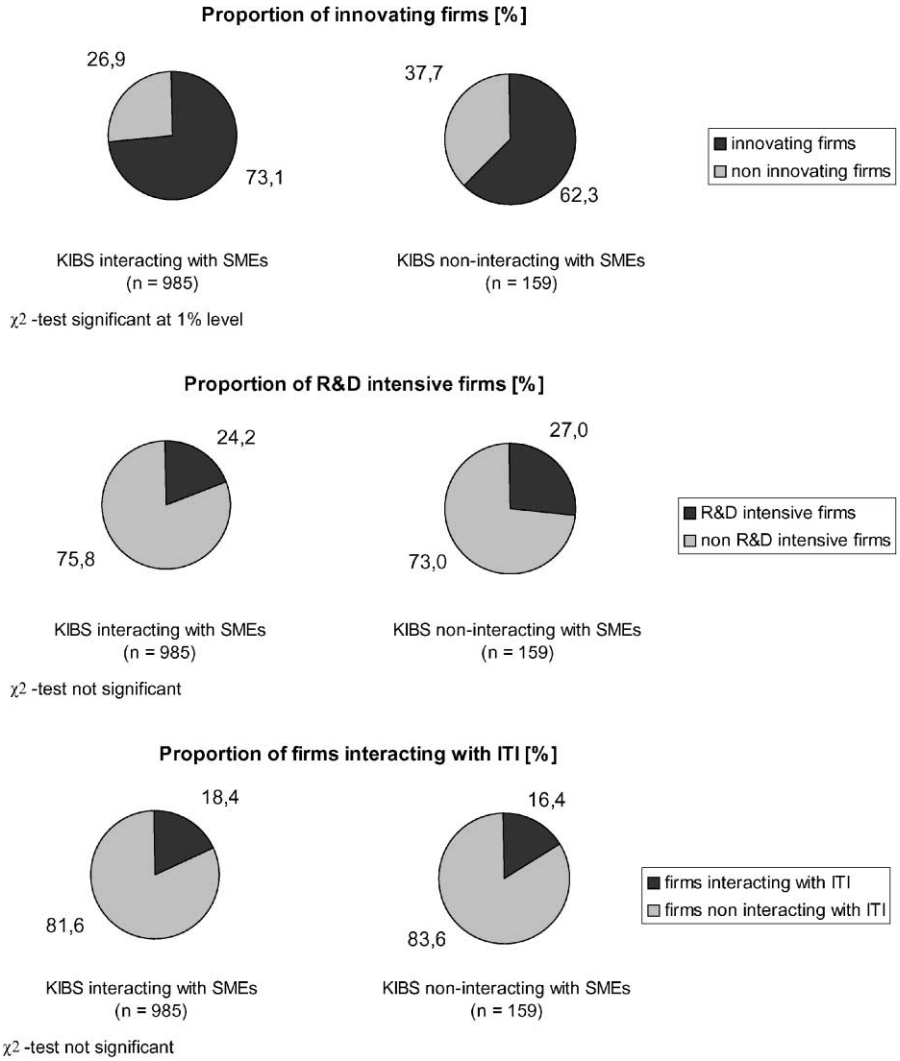

Fig. 5. Elements of comparison between interacting and non-interacting KIBS.

ent countries and divergences between France and Germany.

In both French regions, the share of growing firms is higher among KIBS than among SMEs. The same can be concluded for interactions with the other firm group: 74.1% of Alsatian and 84.7% of Girondian KIBS interact with manufacturing SMEs, whereas 55.6% of Alsatian SMEs and 48.4% of Girondian SMEs maintained relationships with KIBS. But the share of firms that reported interactions with ITI is higher in the manufacturing than in the service firm group. In both French regions, a high share of KIBS can be considered as "R&D intensive firms": 19.0% of Alsatian KIBS and 26.1% of KIBS in Gironde spent 8% or more of their turnover for innovation activities, whereas 4.5% of Alsatian and 7.5% of Girondian SMEs reported such a share of expenses devoted to research and development.

Similarly to the French samples, the share of growing firms is higher among German KIBS than among SMEs. For both types of firms and in all three regions, the share of interacting sample firms is above

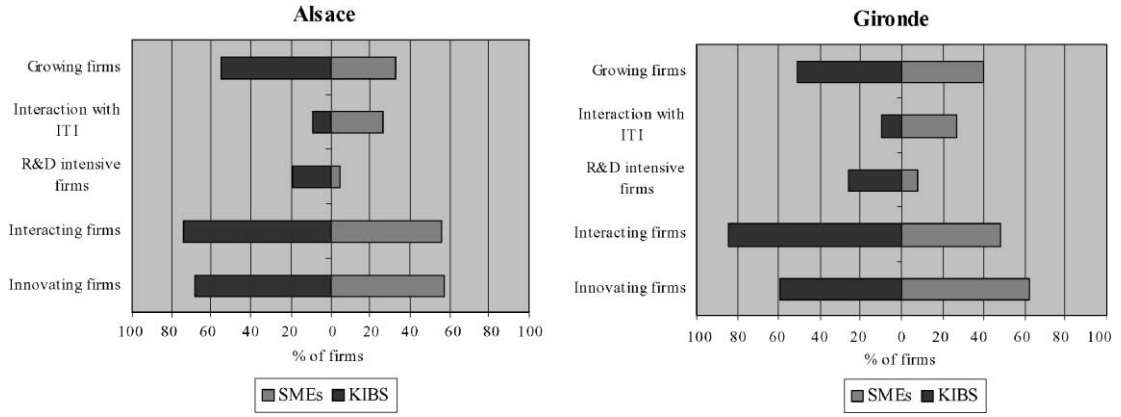

Fig. 6. Interregional comparison: the two French regions.

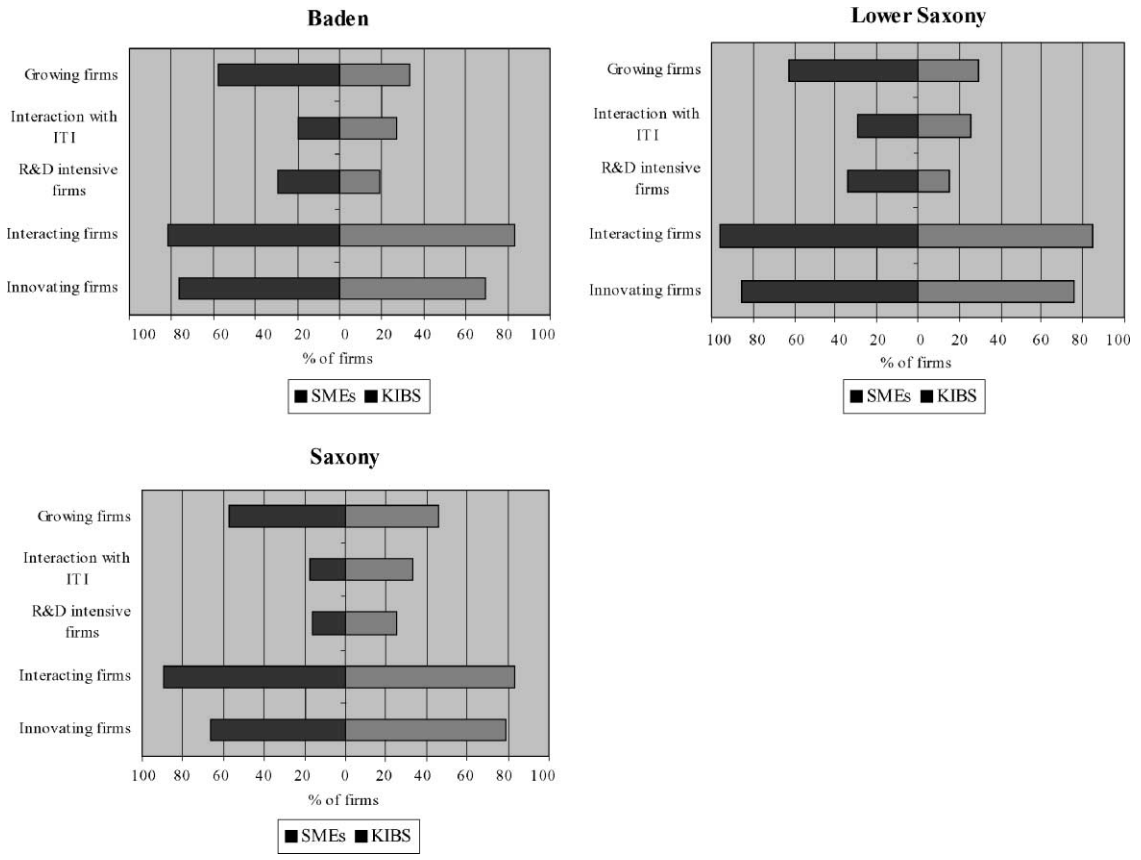

Fig. 7. Interregional comparison: the three German regions.

80%; in Lower Saxony, even 95.5% of sample KIBS interact with manufacturing SMEs. In Baden and Lower Saxony, 29.4 and 33.8% of KIBS spend more than 8% of their turnover for innovation issues which is a higher share than R&D intensive SMEs. Among Saxonian KIBS, the share of firms with more than 8% innovation expenses is lower (16.2%); in this region, the share of R&D intensive firms is higher in the manufacturing sector. In Lower Saxony, the share of firms that interact with ITI is nearly similar for both sub-samples (25.9% of SMEs and 29.3% of KIBS interact with universities and research institutions). Baden and especially Saxony present a different result, having higher shares of ITI interactions among manufacturing SMEs than among KIBS. In Lower Saxony and in Baden, the share of innovating KIBS is higher than the respective share of SMEs. In Baden, 76.0% of sample KIBS and 69.6% of SMEs reported innovations, whereas 85.6% of Lower Saxonian KIBS and 76.0% of SMEs did so. In Saxony on the contrary, the share of innovators is higher in the SMEs sample: 79.0% SMEs innovated, but 66.1% of KIBS sample firms. These findings indicate that there are regional specificities in the considered cases. Baden and Lower Saxony show quite similar results, especially for manufacturing SMEs. Considering the KIBS in these two regions, Lower Saxony shows higher growth shares, higher shares of interactions with SMEs and with ITI and higher innovation rates. Nevertheless, differences are rather low between Baden and Lower Saxony. On the contrary, in Saxony, innovations, innovation expenses and interactions with ITI are rather to be found in manufacturing SMEs than in the KIBS sample.

Some similarities can be observed among regions of the same country. For example, German regions show higher shares of interacting and innovating SMEs than French ones. The share of innovating KIBS is slightly higher in Baden and Lower Saxony than in both French regions. Compared with Gironde and Alsace, the share of SMEs spending more than 8% of their turnover for innovations is higher in the German regions. Additionally, the differences between manufacturing and service firms seem to be lower in the German cases. Generally, a higher share of German KIBS seem to interact with ITI than French firms and with regards to interaction activities between manufacturing SMEs and KIBS, the share of co-operations is higher in Germany than in France. This leads to the conclusion that KIBS seem to play a more important role in Germany (especially in Baden and Lower Saxony) than in the French regions.

4. Conclusion

Considering the main results of the investigation, it is possible to stress the following conclusions. Firstly, the analysis showed clearly that interacting SMEs and KIBS are more oriented towards innovation than non-interacting firms. This supports the hypothesis of a virtuous innovation circle linking SMEs and KIBS, a circle made virtuous through the knowledge generating, processing and diffusing function KIBS fulfil within innovation systems. As a consequence, it can be assumed that interactions between KIBS and SMEs have an impact on their respective innovation features. Secondly, the interregional comparison have shown that there are indeed regional differences concerning SMEs and KIBS innovation and interaction behaviour. Those differences reflect disparities in the generation and diffusion of knowledge by firms. These in turn induce inequalities in terms of innovation capacities and performance. Besides interregional differences, discrepancies could be detected between French and German firms. Thus, it appears that the respective national innovation systems have a perceptible influence on SMEs and KIBS propensity to interact, on their knowledge-related activities and more generally on their innovation capacities.

It can be assumed that KIBS play an important role in innovation systems. They show a considerable innovation and growth potential and support economic development at regional and national levels. KIBS do not only “transmit” knowledge, in fact they play a crucial role in terms of “knowledge re-engineering”. As such, KIBS constitute a “relevant object” for both innovation and regional policies. First of all, through their activities, KIBS enhance innovation capacities of client firms and get stimuli for own innovations. Consequently, it may be worthwhile from a policy perspective to reinforce (internal) innovation activities of KIBS. At the same time, it seems indicated to favour a broad access to KIBS services, for instance, in supporting potential client firms with limited resources or with no previous experience in terms of interactions with KIBS. Secondly, KIBS contribute to the devel-

opment of innovation potentials at regional level. In this respect, one suggestion for regional policy would simply be to focus less on the development and support of manufacturing firms and more of service firms, especially on knowledge-intensive ones. In fact, since numerous services are linked (both as suppliers and as users) with manufacturing activities, a leverage effect can be expected, in terms of investment and in terms of knowledge-creation and diffusion.

Considering the crucial contribution of KIBS to knowledge generation and diffusion within the economy, it is nevertheless important to stress the systemic dimension of those knowledge-related processes. KIBS are not interacting with their clients in a "knowledge vacuum": de facto other influences are necessary in order to foster innovation in KIBS as well as innovation accompanied by KIBS. In terms of knowledge-creation and diffusion, to consider KIBS potentially as receptors, interfaces and catalysators show the way for further research.

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