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Knowledge Commodification and new Patterns of Specialisation: Professionals and Experts in Knowledge-intensive Business Services (KIBS)

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Abstract:

The knowledge society is characterized by knowledge becoming a kind of commodity that can be traded and priced. Knowledge-intensive business services (KIBS) are representative for such a knowledge-based economy, since their main input and output factor is directly related to knowledge itself. While research on KIBS has been mainly conducted on the firm and sector level, focusing on their role in innovation processes, little attention has been paid to the knowledge workers within the firms, whose knowledge assets have to be acquired, configured and deployed. Yet these knowledge creation processes on the micro-level are central to understand how KIBS can drive innovation in regional and national economies by contributing to new patterns of knowledge specialisation and the diversification of knowledge markets. Hence this paper seeks to elaborate on the generic processes which underlay knowledge processing and production. It will introduce the influences of different types of knowledge and knowledge bases of KIBS sub-sectors on the processes and structures in which knowledge is produced. Thereby it will reveal that by gaining experience-based expertise in horizontal and vertical knowledge domains of both their knowledge workers and their clients KIBS foster the emergence of composite and combinatorial knowledge driving knowledge specialisation further.

Keywords: Knowledge development, Innovation, Professional and Business Services, Organization.

JEL Classifications: D23, L1, L84, O3

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1 Introduction

A qualitative shift towards the increasing value added directly related to knowledge itself and the more systematic generation and commodification of knowledge are the main underlying characteristics of what is named as a knowledge society. Dankbaar/Vissers (2008) underline that more than in the past, knowledge has become an object of commercial considerations and becomes a kind of commodity that can be traded and priced. By indicating change processes in the societal production and social distribution of knowledge, new modes of knowledge production are identified (cf. Gibbons et al 1994). The dynamic growth of knowledge-intensive business services (KIBS) in European countries is a structural feature of knowledge societies since the beginning of the 1990s. These service firms are particularly representative for a knowledge-based economy because their main input and output is directly related to knowledge itself. Professional service firms, including management consultancy, technical engineering services, research and development, software and information processing services, or advertising, marketing and media services, mainly provide non-material services. The primary value-added activities of KIBS consist of the creation, accumulation and dissemination of knowledge for the purpose of developing customised intangible service solutions (cf. Bettencourt et al. 2002).

Obviously, this has implications for the type of people employed: it is primarily knowledge workers, namely professionals and experts who represent the workforce of KIBS firms. A fundamental characteristic for KIBS is the customer participation in the delivery process of the knowledge-intensive service product which is very different from the production process in manufacturing industries. Clients are directly involved in the added value of the knowledge product. The provision of these knowledge-intensive services requires in-depth interaction between experts of KIBS firms and their clients and both are involved in cumulative learning processes. Paradoxically knowledge-intensive products are sold before they are finally produced. Knowledge workers in organisational settings of KIBS have therefore often direct contact to clients, using and creating knowledge to produce value added together with clients. In turn customer interactions are also a source of uncertainty for the experts in KIBS firms due to their direct participation in the added value of the knowledge product.

While manufacturing industries are characterised by a certain kind of division of labour and the use of industrial production methods, neither of them is very pronounced in the KIBS sector. Labour division in knowledge production apparently has distinct qualities compared to the one of tangible goods production or standardised services. Due to the process character of knowledge and its social construction, knowledge production and its validation is heavily context dependent. Complex and intensive communication processes between professionals of KIBS firms and their clients are necessary to overcome ambiguities abound. The social dimension of economic transactions is far more important in the production of knowledge-intensive services and a minor space-time stability of their commercialisation is a pronounced issue. Even though new information technology supports the transfer of rich information interaction and communication processes in face-to-face situations and proximity at least temporarily play an essential role in knowledge commodification and in conversion processes of knowledge for economic gain and value-added (cf. Teece 2008:11). Especially the uncodified, tacit and experienced based knowledge of the workforce which is gained in intense

interaction processes related to knowledge commodification is of great importance for KIBS firms and is slow and costly to transmit.

This chapter focuses on professionals and experts in organisational settings of KIBS which are to the largest part small size firms. Research on KIBS to date is mainly conducted using an innovation perspective and concentrating on the firm and industry level. This literature strand has especially outlined the more central role that KIBS firms are playing in innovation – as knowledge carriers, producers and mediators in national and regional economics (cf. Bessant/Rush 2000, Miles 2005, Wood 2002). Based on this research it becomes obvious that KIBS firms drive knowledge dynamics at multi-levels due to the particularity of their interconnectedness with other sectors and the way in which they are producing their knowledge intensive services (cf. Strambach 2008). But studies on KIBS have paid little attention to the knowledge workers within these firms. Problems of deployment and use of knowledge assets from professionals and experts as well as the configuration and acquisition of knowledge within the firm as a whole have been mainly neglected by the KIBS literature. Also there has been little detailed exploration of institutional effects on knowledge creation processes as identified and highlighted by research on professional service firms (PSFs). By bringing together these two mainly unrelated literature strands, the chapter tends to explore the ways in which KIBS and their knowledge workers contribute to new patterns of knowledge specialisation and the diversification of knowledge markets.[1]

Section 2 shortly describes structures and sector-specific institutions of KIBS. A short insight into the structure and growth of KIBS in European countries between 2000 and 2005 in quantitative terms is provided. Moreover, section 2 sheds light on the characteristics of those working in KIBS firms, i. e. professionals and experts. Section 3 takes the process view on knowledge commodification and knowledge processing and creation within and at the organisational edge of KIBS firms. The section aims to identify generic processes which underlay knowledge processing and production leading to knowledge commodification.

Section 4 deals with the institutional influences on knowledge creation and new patterns of knowledge specialisation. The social processes and structures through which knowledge is constructed are different with regard to types of knowledge and knowledge bases of KIBS sub-sectors. By gaining experience-based expertise in horizontal and vertical knowledge domains of their knowledge workers and their clients they foster the emergence of composite and combinatorial knowledge driving knowledge specialisation further.

Section 5 returns to the main argument of the paper and summarises how KIBS are driving knowledge specialisation in different contexts and contribute to knowledge commodification and diversification of knowledge markets.

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2 Knowledge Workers – Professionals and Experts in KIBS

2.1 Structures and organisational characteristics of KIBS industries

Compared to many mature industrial and manufacturing industries, the evolution of KIBS is only a recent development. In functional terms, KIBS are provided not only by service firms, they are also organised within industrial firms. Large firms have in-house service providers, organised as separate departments or firm units which provide services to the firm's different business units, their so-called internal clients. Other providers such as public and semi public research and technological organisations (RTO) also offer KIBS. This chapter is focused on firms and their knowledge workers which provide knowledge-intensive business services in the market place as their main product *(for statistical definition of KIBS in the narrow sense see annex)*.

KIBS firms are organisations which foster knowledge commodification and the diversification of knowledge markets due to both the way their knowledge workers are producing knowledge-intensive services and the properties of their service products. The knowledge markets in which KIBS act are highly fluid, rapidly changing, highly competitive and characterised by a high degree of uncertainty resulting from ambiguity with regard to performance, quality and appropriateness. The low formal constraints on market access in large parts of KIBS sub-sectors allow for fast market entries, which, however, are accompanied by a high ratio of market exits. Following the perspective of institutional approaches, sectors can be differentiated in relation to their specific economic and technological conditions, their knowledge base, and their types and structures of interactions among firms and non-firm organisations as well as with respect to sector-specific institutions (cf. Malerba 2005, Hall/Soskice 2001). Knowledge-intensive business services have common sector-specific institutional and organisational characteristics linking the heterogeneous KIBS sub-sectors:

- Knowledge is not only a key production factor of the firms, it is also the 'good' they sell. For the most part the firms provide non-material intangible services. The provision of these knowledge-intensive services requires in-depth interaction between the service provider, respectively, its experts and its clients, while both are involved in cumulative learning processes. The utilisation of knowledge-intensive services cannot simply be equated with the purchase of standardised external services. Therefore the intensive user–producer interaction and communication linked with the production of knowledge-intensive services is a characteristic feature.
- The activity of consulting, understood as a process of problem solving or problem framing in which knowledge workers of KIBS firms adapt their expertise and expert knowledge to the needs of the client, makes up, to different degrees, the content of the interaction process between KIBS and their customer.
- Project-based work is the dominant form of work organisation, due to the need for a high degree of flexibility and the provision of client specific and, at the same time, comprehensive solutions. Even though networking and project organisation are becoming more important in many industrial sectors, for KIBS firms they have always been the conventional forms.[2]

2 Meanwhile there is strong empirical evidence for the project-based work organisation of different KIBS sub-sectors, for example, in advertising (see Grabher 2004) or in engineering (see Gann/Salter 2000).

Innovation is inherently defined by novelty, but each project has a certain degree of uniqueness, thus is in a sense new. Due to the customer specific context where the knowledge is applied, the individual service delivery process show a high degree of variation and becomes different form the former ones.

Empirically well documented in international research are specific governance mechanisms which coordinate the transactions and interactions within and across the borders of the sector. Formal and informal network relationships mostly bound to the individual experts of the firms, references and reputation together make up a key function as coordination mechanisms in interaction processes between KIBS and their customers as well as among KIBS firms themselves (cf. Miles/Boden 2000, Glückler/Armbruster 2003, Wood 2002).

Besides the sector-specific institutional and organisational characteristics, KIBS in European countries share two common structural features which have not changed much in the last decades. One is its dynamic growth. Drawing upon employment data from EUROSTAT the share of total employment in services increased by 9.8 percent between 2000 and 2005. However, whereas the growth rate was only 6.9 percent in the less-knowledge-intensive services the growth of the share of total employment accounted for 12.9 percent in the knowledge-intensive services. With regard to the type of knowledge-intensive services market services grew more intensively (by 20.5 %) than the more technical oriented high-tech services (by 8.2 %) (EUROSTAT 2007, author's calculations). On the macro level international investigations into the spatial organisation of KIBS in different European countries also show country-specific specialisation patterns of KIBS sub-sectors. For instance, technical services are more important in Germany than in other European countries, while UK's KIBS specialisation is more pronounced towards accounting and management services. Especially institutional effects on KIBS client sector interactions seem to play an important role for the evolution of specialisation patterns in European countries over time.

The other common characteristic is the segmentation of the KIBS sector. National and regional based small and very small firms cover the largest part of the sector (see table 1). In the several KIBS sub-sectors mostly over 90 % of the firms have up to 9 employees. KIBS and other creative industries share a J-shaped industrial structure, they have few large often transnational producers, and a long tail of progressively smaller business and micro-business (cf. Miles/Green 2008: 13). These small size firms provide knowledge-intensive services mostly for national and regional markets while the few large, mainly multinational, KIBS firms which can be found in all KIBS-sub-sectors in management consulting as well as in engineering or advertising services operate at the global scale. Despite the rather small number of large firms their employees account for a considerable percentage of total employment in the sector.

The structural features of KIBS indicate that knowledge commodification, i. e. to transform, reconfigure and combine knowledge into a kind of tradable good, has its limits. In view of the importance of sharing knowledge and personal experience larger firms might have no advantage over boutiques, they will rather suffer bureaucratic burdens which might sap productivity (cf. Teece 2008: 8). The fact that there are still so many small KIBS also shows that scale advantages are so far not very prominent in the sector. Additionally, the delay of internationalisation processes of KIBS compared to industrial manufacturing firms indicates difficulties to trade knowledge-intensive services across cultural and institutional borders. Several mutually related factors are responsible for that. Due to the

process character of knowledge and its social construction, knowledge production and its validation is heavily context dependent. National and regional markets are characterised by distinct cultural and institutional differences influencing customer behaviour, knowledge exchange and creation processes. Many knowledge intensive services still require face-to-face contacts between the provider and the customer, at least in some phases of the service production process, even though information technologies enhance possibilities for decoupling the synchronisation of time and location between service provider and customer. Particularly the transfer of tacit and experienced based knowledge needs and is facilitated by proximity. Spatial proximity is often combined with other types of proximity such as cultural, institutional social or cognitive proximity which make knowledge exchange easier. According to Teece (2008: 13), for example, replication – understood as transferring or redeploying competences from one concrete economic setting to another – in a different geographical context may be rather difficult as some routines and competences seem to be attributable to local or regional forces that shape a firm's capabilities. Moreover, the more tacit the firm's productive knowledge, the harder it is to replicate by the firm itself or by competitors.

The problem of deployment and the use of knowledge assets is closely linked with the knowledge workers of KIBS, through the way they are producing and using their experience based knowledge for problem solving and their motivation and engagement in client interactions. To understand processes and changes in knowledge commodification, the micro-level, namely the professionals and experts in organisational settings of KIBS companies, inevitably needs to be analysed deeper, which will be dealt with in the following section.

Table 1: Enterprises, employees and turnover in KIBS sub-sectors of selected European countries, 2004

Country	Size classes (in number of persons employed)	IT-Services			Economic Services			Technical Services			Marketing/Advertising		
		Share (in %) in …			Share (in %) in …			Share (in %) in …			Share (in %) in …		
		Enterprises	Employees	Turnover	Enterprises	Employees	Turnover	Enterprises	Employees	Turnover	Enterprises	Employees	Turnover
Denmark	1 to 9	93.2	18.3	23.7	95.7	29.9	40.9	93.1	16.6	22.5	91.5	24.5	31.9
	10 to 49	5.5	21.9	17.5	3.7	28.7	21.0	5.7	21.3	18.2	7.2	33.7	30.0
	50 to 249	1.0	22.6	21.1	0.4	19.2	16.3	0.9	17.2	15.6	1.2	28.5	32.3
	250 or more	0.3	37.2	37.6	0.1	22.2	21.8	0.4	44.9	43.7	0.1	13.3	5.8
Finland	1 to 9	84.5	13.6	13.9	95.8	46.3	49.7	90.2	26.4	31.7	91.8	43.6	30.3
	10 to 49	11.5	18.6	18.0	3.6	25.9	23.5	8.1	27.5	24.9	7.3	36.6	42.7
	50 to 249	3.4	31.5	32.3	0.5	N/A	N/A	1.4	N/A	N/A	1.0	N/A	N/A
	250 or more	0.5	36.3	35.7	0.1	N/A	N/A	0.2	N/A	N/A	0.0	N/A	N/A
Germany	1 to 9	88.7	16.1	12.8	87.1	35.9	35.5	91.8	32.0	36.9	90.3	16.4	34.3
	10 to 49	9.4	24.3	16.4	12.2	40.6	33.3	7.5	35.4	30.4	8.4	20.6	36.1
	50 to 249	1.6	21.3	17.3	0.5	10.2	11.9	0.6	15.3	15.8	1.0	13.9	20.9
	250 or more	0.3	38.3	53.5	0.1	13.3	19.3	0.1	17.3	16.9	0.3	49.1	8.6
Norway	1 to 9	94.6	21.3	22.7	96.4	49.9	50.1	94.4	32.0	34.6	94.4	43.6	31.4
	10 to 49	4.5	26.1	20.6	3.4	24.9	21.2	4.9	28.3	N/A	5.2	39.6	N/A
	50 to 249	0.7	21.1	20.2	0.2	10.1	N/A	0.5	15.1	17.9	0.4	12.1	17.0
	250 or more	0.2	31.6	36.5	0.1	15.1	N/A	0.1	24.6	N/A	0.0	4.7	N/A
Spain	1 to 9	91.6	14.0	13.8	96.9	51.5	55.2	97.4	33.1	47.0	93.3	25.1	24.7
	10 to 49	6.7	20.7	13.5	2.9	28.4	26.5	2.2	24.9	17.6	5.7	24.0	21.9
	50 to 249	1.3	21.3	15.5	0.2	10.1	10.1	0.3	19.3	16.5	0.9	23.0	45.3
	250 or more	0.3	44.0	57.3	0.0	10.0	8.2	0.1	22.8	18.8	0.1	27.9	8.0
Sweden	1 to 9	96.3	20.5	21.2	98.7	51.6	55.2	97.4	35.5	43.1	96.9	44.7	38.0
	10 to 49	2.9	21.0	19.8	1.1	N/A	N/A	2.2	21.3	20.9	2.8	33.8	34.1
	50 to 249	0.6	21.9	18.6	0.1	13.0	13.1	0.3	17.1	15.0	0.3	14.0	24.7
	250 or more	0.2	36.6	40.5	0.0	N/A	N/A	0.1	26.1	20.9	0.0	7.6	3.2
United Kingdom	1 to 9	94.4	28.4	0.3	91.8	28.3	1.2	90.8	28.8	0.3	88.8	22.8	1.2
	10 to 49	0.1	37.8	5.6	0.2	29.6	0.7	0.2	31.7	1.6	0.3	31.0	10.0
	50 to 249	4.6	17.6	8.0	7.1	24.0	1.5	8.0	23.7	4.3	9.3	24.6	12.8
	250 or more	0.8	16.2	86.0	1.0	18.1	96.6	1.0	15.8	93.9	1.6	21.7	76.1

Source: Eurostat (2008), author's calculations

Annotations: Sub-sectors correspond to NACE Rev. 1.1 72 (IT-Services), 74.1 (Economic Services), 74.2/74.3 (Technical Services) and 74.4 (Marketing/Advertising)

2.2 Professionals and Experts in organisational settings of KIBS

The specific features and the dynamic growth of KIBS firms obviously have implications for the situation of those employed in the KIBS sector; employees and firm characteristics are interrelated factors in the underlying processes regarding the creation and commercialisation of knowledge. While firms provide the physical, social, and resource allocation structure so that knowledge can be shaped into competences, knowledge assets are based on the experience and expertise of individuals (cf. Teece 2008: 10). Nevertheless, there has not been much debate about the features of the knowledge workers in the KIBS literature yet.

KIBS are usually defined as companies where most work is of an intellectual nature and where well-educated, qualified employees form the major part of the workforce (cf. Robertson et al. 2003: 833) and a high level of professional work is a characteristic feature (cf. Miles/Green 2008:12). Thus, those working in KIBS firms are commonly referred to as professionals and experts. According to Stehr (2001:264 ff.) only occupational professionals have been analysed extensively although they are just a part of the occupational group of professionals and experts. In general professionals and experts in KIBS are particularly engaged in gaining knowledge about knowledge, in manipulating, organising and transferring knowledge; the typical end product is knowledge.

Traditionally a profession was defined as 'an occupation that controls its own work, organized by a special set of institutions sustained in part by a particular ideology of expertise and service' (Freidson 1994:10 in Robertson et al. 2003:834). According to Bryson et al. (2008:313) 'a profession establishes and regulates entry standards and ensures that only trained and accredited individuals are able to practice. Ideally, a profession is identified by the state and a monopoly is obtained for the regulation and control of qualifications that enable individuals to practice'. This definition also relates to the rather traditional perspective on professionalism.

Nowadays there is no distinct line between professions and occupations; they are rather seen as similar social forms with many common characteristics. Scarbrough (1996:3) states that expertise traditionally is the exclusive property of professional groups but is today more widely distributed and more contingently deployed than before. He defines expertise as 'encompassing a wide range of sociocognitive formations, including diffuse occupational networks, the expertise of specialist groups and even the established liberal professions'.

The terminology concerning knowledge workers in the KIBS sector has not been clarified yet, terms like 'professional' and 'expert' are commonly used. Professions are essentially the knowledge-based category of service occupations, and usually follow a tertiary education and vocational training and experience. With regard to the distinction made above, in KIBS firms both types of knowledge workers are found. On the one hand there are occupational professionals, or professionals in the traditional or narrow sense, as for instance in legal firms. On the other hand there is a growing proportion of professionals in the wider sense, also referred to as experts, as for example in advertising, marketing or in software firms.

Depending on the type of knowledge worker and thus also on the institutional context of KIBS firms knowledge creation processes seem to differ. Analysing institutional influences upon knowledge creation within professional service firms Robertson et al. (2003:833 ff.) suggest three features of the professional context as being critical to knowledge creation: the interplay between the jurisdictions, standards, and norms associated with particular professional contexts which highly influences the

degree of work autonomy available to professionals; the epistemological base of the profession (i.e. the means of knowledge legitimation) which has critical implications for knowledge-creating activities (Halliday 1983; MacDonald 1995; Knorr-Cetina 1999); the social identity, also described as the 'relatively stable and enduring constellation of attributes, beliefs, values, motives, and experiences in terms of which people define themselves in a professional role (Schein 1978 in Robertson et al. 2003:836).

According to Stehr (2001: 265 f.) two more features characterise the role of professionals in the wider sense: unusual relations to clients and certain structural relations in which experts operate. The outcome as well as the knowledge claim of experts have to be legitimised, and experts regard themselves as legitimised through the relationship to their client and, particularly, through the client's appreciation. In addition, the relation of knowledge-based professions and (socially created) knowledge forms and bases and the expert's location within a specific discourse community (i. e. membership and rank in the experts' community) are of importance. Sveiby (1997:54ff) points in the same direction and underlines three primary characteristics of professionals and experts: a focus on the job, the professional pride and a dislike of routines. Experts enjoy complex problems and freedom to seek solutions, they tend to organise themselves in professional associations and they have an aversion against rules limiting their individual freedom and against routine work. Based on these characteristic features, KIBS firms thus employ both types of knowledge workers: occupational professionals as well as, to a growing degree, professionals in a wider sense, also referred to as experts. Therefore the terms professional and expert are applied interchangeably in this article.

Using, producing and transferring knowledge by doing it within a organisational setting of KIBS firms involves a tension between professionals and managers due to distinct traditions, as discussed substantially in the professional service literature. It also involves the tension between organisational formalisation of knowledge sharing and the undermining of the creativity of professionals. Managers and professionals have different responsibilities in such organisations related to their distinct value systems. While managers have to take care of the organisation, carry out control functions on the way other people use their expertise and have therefore organisational competences, the professional values tend to compete with those of the managers (cf. Sveiby 1997, Scarbourgh 1996). The experts use their own skills and their ability to earn revenues for the companies. As described above they are linked to a professional value system that exists outside their organisation and they see themselves as legitimised through the relationship to their client. Professionals working within KIBS companies are mostly directly involved in complex problem solving or problem framing processes with clients in which they adapt their own expertise combined with firm specific competences to the needs of the customers. Clients appreciation is an important legitimisation for the value added of the knowledge product and the reputation of the experts. In turn, the reputation of the individual experts are inherent part of the reputation of KIBS firms.

But when the gained knowledge from knowledge interactions with clients remain personally bound and experienced bases and are not somehow shared than the firm can best expect to achieve constant return to scale (cf. Teece 2008). As Sveiby (1997) emphasises regarding professionals and managers in knowledge organisations: the tension between professionals and their customers and between professionals and managers is a critical internal structure that must be managed. The formalisation of personal knowledge sharing and the development of organisational routines as mechanisms to transfer and circulate cumulative experience-based knowledge throughout the firm is a challenging task for managers. Due to the dislike of administrative routines of professionals and experts, their focus on

complex problems and the autonomy to seek solutions, the organisational formalisation of knowledge circulation may undermine creativity and impede learning. Scarbrough (1996) highlights that the competitiveness and innovation of KIBS firms not only come from the individual experts but from the configuration, acquisition and distribution of knowledge within the firm as a whole.

3 Knowledge commodification: knowledge contextualisation, de-contextualisation and re-contextualisation

The following section focuses on the way KIBS and their knowledge workers produce their knowledge-intensive services, foster knowledge commodification and knowledge specialisation. Three processes – the contextualisation, de- and re-contextualisation of knowledge – play an important role in exploring general linkages between knowledge processes and knowledge commodification in organisational settings of KIBS and the client interactions. These processes are especially shaping the contribution to multi-level knowledge dynamics.

Client participation in the delivery process of the knowledge-intensive service product is a fundamental characteristic of KIBS and is very different from the production process in other industries. It is different insofar as clients are directly involved in the added value activities.

KIBS are specialists in the **contextualisation** of knowledge, this is evident from substantial empirical and theoretical research in the field. Contributions from innovation in services and systems of innovation research are emphasizing KIBS firms as 'innovation or knowledge agents' (e.g. Bessant/Rush 2000, den Hertog 2000, Miles et al. 1996, Muller/Doloreux 2007, Strambach 2001, Wood 2002). Important functions are described, such as transferring technological knowledge and management know-how, exchanging experience-based knowledge and best practice from different branch contexts, integrating different stocks of knowledge and competencies and adapting existing knowledge to the specific needs of the clients. These functions refer to the knowledge contextualisation as an essential process that fosters knowledge dynamics by being conducive to the change of knowledge bases of client firms. As mentioned above, knowledge assets are based on the experience and expertise of the professionals and experts of the respective KIBS firm, thus – in other words – KIBS organisations offer their customers the expertise of their employees which is then applied to the client's situation, hence contextualised.

Whilst the contextualisation process itself has been widely described, research is lacking with regard to the determinants fostering or hindering successful knowledge contextualisation. Within the contextualisation process client capabilities are a key factor in achieving performance gains. As indicated by Bettencourt et al. (2002: 101), clients have different roles to play and different responsibilities to meet in these intensive interaction processes. They argue that clients must effectively perform a variety of roles as they serve as co-creators, co-producers of the knowledge-based solutions. Clients themselves have knowledge and competencies which they must be willing to bring into shared problem solving during the delivery process of the knowledge-based service. The transaction situation has to be actively developed and interpreted by the actors during the process of providing the service. Knowledge products have a dynamic character, they develop and change during the interaction process while being influenced by the actors' interpretation models and expectations. Paradoxically knowledge-intensive products are sold before they are finally produced. Clients are directly involved in the added value of the knowledge product, which in turn is a source of uncertainty and unpredictability for KIBS providers. Therefore the quality of knowledge production is the result of cumulative learning processes determined by the competence and experience of the knowledge worker as well as by the clients'

capability to use external knowledge and to integrate it into their own knowledge base and, not least, the capability of both agents to design the interaction process.

In complex application context the need of client participation and the high degree of necessary interactions to combine and configure a myriad of different types of knowledge bits to achieve comprehensive and at the same time customised solutions are a major limitation for the tradability of knowledge-intensive services. They also hinder the realisation of economies of scale. In recent years new institutional arrangements such as procedural contracts can be observed in several sub-sectors of KIBS. These institutions are a response to the uncertainty in specifying the content of the final knowledge product. Therefore they focus on the agreement on behavioural obligations and their timing instead of the specific product content. Examples are quality-level-agreements with clients which try to complement trust-based and subjective validation of the KIBS-client interaction by market-based transactions.

In KIBS research there has been little detailed examination of different kinds of interaction processes and their impacts on knowledge processes like knowledge contextualisation. Not all KIBS transactions constitute the exploration of new knowledge for their respective clients, but may as well be of exploitative nature, as Gallouj (2002:281) underlines. Different kinds of interaction processes may be influential to knowledge dynamics in varying degrees. Additionally Grimshaw/Miozzo (2006) emphasise that research on KIBS has to date tended to rely on the use of broad taxonomies with regard to interaction relations, and the influences of institutional and organisational characteristics of different sectors are underexplored.

Turning from the processing of knowledge within a given service relationship to the knowledge circulation and production within KIBS firms, the process of **de-contextualisation** is a main mechanism. KIBS have the capability of producing new knowledge from this accumulated and experience based knowledge through de-contextualisation. We define de-contextualisation as the deliberate process of extracting experience based and procedural based knowledge from client and project specific contexts, to combine and reconfigure it with the pre-existing knowledge base in order to develop new knowledge products. KIBS firms, or, respectively, the professionals and experts employed by KIBS firms acquire explicit and tacit knowledge from a variety of client contexts in the course of the provision of the service. They learn the main characteristics of their customers over time and develop competencies that are related to the specific contexts of clients' vertical as well as horizontal knowledge domains.

De-contextualisation is a process characterised by multiplicity and a strong collective dimension whose aim is to unleash accumulated procedural and experimental knowledge units from their context-dependence. There has been little exploration of the de-contextualisation process in KIBS research itself, which is mostly concentrated on the firm level. KIBS are companies that work mainly on a project base (section 3) – repeated tasks are not the norm. Therefore these organisations' learning and capability development usually takes place during projects. The recently developing literature strand on innovation in project based environments throws some light on the de-contextualisation process even if not explicitly named as such. As Acha et al. (2005) show for project based firms, capabilities are often located at the organisational edges of the firms. Djellal et al. (2003) refer to the interface as the locus where the interactivity occurs that constitutes one of the fundamental driving forces for, one of the targets of, and one of the laboratories for research in service activities. A common practice for KIBS firms is to carry out knowledge processing in cross-functional and interdisciplinary project teams and communities of practice composed of both client and KIBS staff. Project learning, or episodic learning

(cf. Gann/Salter 2000, Acha et al. 2005), involves relationships between learning by individuals, project teams and across project-based firms and includes cross-sectoral learning. These firms operate in a multi-actor environment and thus the de-contextualisation process entails the unleashing of dispersed experience-based knowledge components bound to practice contexts of individual experts and collective knowledge agents in complex project configurations or what Grabher (2004) called 'project ecologies'. The de-contextualisation implies knowledge codification of accumulated experience based knowledge and procedural based knowledge mainly attained by group level learning in projects. The formation of new knowledge products through de-contextualisation in turn opens up new opportunities for KIBS to interact with their customers. In a certain sense, KIBS create their own markets. As such, the competitive advantage of (KIBS) firms in today's economy does not stem from market position but from the firms' and the knowledge workers' difficulties to replicate knowledge assets and the manner in which they are deployed (cf. Teece 2008: 10).

A third process, which we call re-contextualisation, plays an important role for the contribution of the KIBS sector to knowledge dynamics and knowledge specialisation. **Re-contextualisation** can be understood as the process of direct contextualisation of individual or collective tacit knowledge without transforming that knowledge through codification. From the perspective of the knowledge worker this implies that the tacit knowledge gained working with one customer is not disclosed until it is applied again when cooperating with another client. Knowledge codification aims at reducing and converting knowledge into explicit knowledge and facilitates its exchange and valorisation. It is, however, widely acknowledged that knowledge can be transferred without codification. As Cohendet/Meyer-Krahmer (2001:1565) point out, codification processes themselves are context dependent. There are contexts where agents are willing to invest more into codifying knowledge and others in which they use and reinforce their tacit knowledge. The discontinuous and temporary nature of project-based service production by KIBS firms in combination with the often highly context-specific knowledge gained in service delivery processes act as a significant brake on knowledge codification and, in turn, fosters re-contextualisation processes. For project-based firms, the costs for codification are high and hinder the exploitation of systematic knowledge. The highly customised service solutions and the multiplicity and collective dimension of de-contextualisation processes increase the use of tacit knowledge and its exploitation in the application. Knowledge creation in the mode of the interactive (social) construction of a solution to a particular client problem in a complex application context is typical for KIBS. The term 'ad hoc innovation' is used in service innovation research to describe this result (Gallouj 2002). Furthermore, new complex projects provide the opportunity to build up new capabilities in fast changing knowledge markets. Thus it is more attractive for KIBS firms to engage in new projects than to invest in knowledge codification of organisational dispersed implicit knowledge for capturing and storing it. Also professionals in KIBS indirectly function as drivers of knowledge re-contextualisation due to their dislike of routines, their preference of new creative interaction with challenging customers which are a trigger for knowledge creation. Hence, under these conditions, the direct contextualisation of experience-based tacit knowledge is supported through its adaptation in project contexts and project learning.

Summarising, the organisation of knowledge is a key issue for KIBS and, as argued, knowledge products are closely interwoven with knowledge actions in this sector. Three processes – the contextualisation, de- and re-contextualisation of knowledge – can be seen as main mechanisms through which KIBS firms shape knowledge dynamics beyond their own sector boundaries and foster knowledge commo-dification. Through these processes they seem to support tendencies both towards specialisation and

towards diversification of knowledge and thus contribute markedly to the diversification of knowledge markets. The following section turns to the new specialisation patterns in horizontal and vertical knowledge domains fostered by these processes of knowledge commodification.

4 New patterns of specialisation in horizontal and vertical knowledge domains

In innovation research the KIBS sector is mostly considered as a unit due to its relatively recent dynamic evolution. Particularly in comparison to manufacturing firms, the marked features of innovation are highlighted. Dankbaar (2003: 344) points out that, while in manufacturing industries a relatively clear distinction between the primary process of transformation and the process of innovation can be made, both transformation and innovation are more closely intertwined in KIBS. The internal processes of knowledge creation are only weakly formalised, as has been shown by empirical research (cf. Hauknes 2000, Sundbo 2000, Marklund 2000). In contrast to manufacturing firms, most KIBS firms do not distinguish R&D activities systematically in organisational terms as R&D departments or R&D management structures (cf. Hipp/Grupp 2005[3], Miozzo/Miles 2002). As outlined, a project-based, ad hoc development of new knowledge in customer relations and at the interface with customers is characteristic for knowledge-intensive service firms. Knowledge exploration and exploitation often overlap and take place simultaneously.

In order to identify at a more general level ways how knowledge workers in organisational settings of KIBS are involved in knowledge commodification processes leading to knowledge dynamics and new patterns of specialisation, we take a closer look on changes in vertical and horizontal knowledge domains. The latter are related to business functions and vertical knowledge domains comprise sector specific knowledge (cf. figure 2). Professionals and experts of KIBS firms operate in complex horizontal and vertical knowledge domains and the cumulative knowledge bases of KIBS firms are located in these domains. A firm's domain refers to 'what' is delivered to 'whom', 'where' and 'how.' The choice of domain is valid at different levels; firms might target a certain industry, a certain sub-sector of an industry or a certain client type within a particular segment, for instance rather large business clients than small client firms (Løwendahl et. al. 2001:914). Consequently, knowledge domains are an important dimension of firms' and industrial evolution, because they affect the type of competencies and the competition in an industry (Malerba/Orsenigo 2000). Over time, firms develop highly sector- and technology-specific competencies which are also related to the specific features of their clients and certain demand characteristics.

Particularly in the KIBS sector the domains where the firms operate in are shaping both the development of the specific knowledge base of the KIBS firms itself and the expertise of their professionals in a co-evolutionary way. As outlined, due to the characteristic of the project-based service production and the necessary intensive interaction and communication with clients in the service delivery processes, professionals learn from the clients and projects they engage in. Hence the projects determine both what they learn and how much (cf. Løwendahl et. al 2001:914). In turn, the experience-based knowledge of the individual experts gained in customer relations and previous projects may enhance the knowledge base of the firm and contribute to its reputation. Gallouj (2002: 274) stresses the fact that the knowledge stocks drawn on by KIBS firms as the main input for their services are essentially the product of knowledge based on past experience that has been memorised. Previous project experiences, customer references and reputation are on the other hand the 'signal' for

[3] For the detailed discussion of service specificities in innovation and innovation processes see Hipp/Grupp 2005.

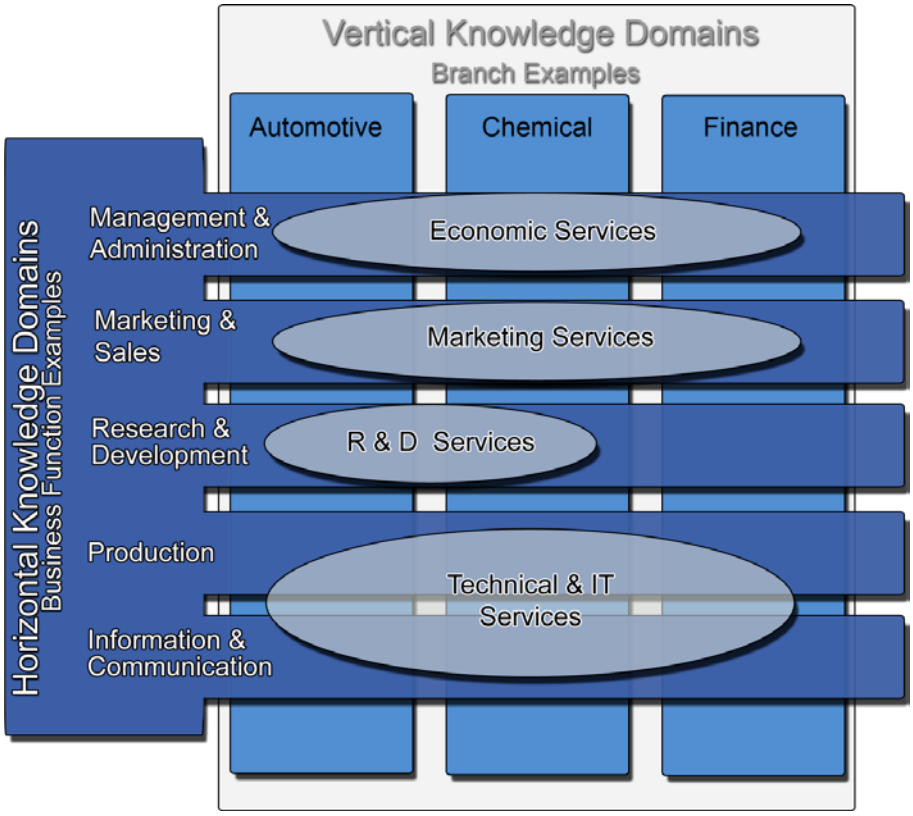
new clients that the firm has the adequate competences in the knowledge domain. The type of professionals and experts KIBS firms employ are highly interconnected with its domain, or, vice versa, the domain choice of the firm influences the type of professionals hired by the firm, and shape their further learning and competence development. In the following we discuss some profound changes in vertical and horizontal knowledge domains and their impacts on knowledge creation and commercialisation processes in the KIBS sector at both the individual and the firm level.

Professionals and experts in KIBS firms gain and cumulate highly specialised knowledge in vertical knowledge domains covering sector specific knowledge as well as in horizontal knowledge domains which are related to business functions during complex problem solving processes for clients. The ongoing restructuring of the value chain, combined with the increasing interdependence of technological and organisational change at the corporate level (Tidd et al. 2005), is leading to the increasing complexity of horizontal and vertical knowledge domains. KIBS firms and their knowledge workers appear to be responding to the increasing need of clients for coordination, communication and organisation caused by these developments by using both their composite and combinatorial knowledge 'assets' and the specific mode they apply their expertise in producing the knowledge intensive services.

The ongoing vertical specialisation of industries is driven by the dynamic reconfiguration of value chains (cf. Humphrey/Schmitz 2004). Vertical specialisation is displaying industry-specific characteristics that seem to be rooted in related different technological and market characteristics (Macher/Mowery 2004). Hence, vertical domain knowledge becomes more complex as sector specialisation continues to advance. Vertical disintegration and specialisation processes in industries, as well as modularity and standardisation at the corporate level, are generating more interfaces between diverse knowledge using and producing units, thus creating the need for communication and coordination of knowledge exchange and implicit and explicit knowledge sharing. KIBS firms are responding to this development with their knowledge product specialisation, or even emerge, typically along sector oriented knowledge domains. Examples are specialised software firms which develop software solutions exclusively for the financial services or the automotive industry or KIBS firms offering R&D services particularly for the biotechnology industry.

Not only vertical but also horizontal knowledge domains (or functional knowledge domains) connected to business functions have been undergoing an increase in technological and organisational complexity. Business functions like production, R&D, marketing, financial and data processing or human resource management are generic in the sense that they apply across many different sectors/industries. The focal point of the professional expertise of KIBS sub-sectors and the nature of their respective service products is often located in the fields of business functions, as for instance advertising, accounting or software and management consulting. The vertical disintegration in production has been going on for a long time (cf. Dicken 2003), whereas the increasing organisational decomposition of more intangible business service processes, enabled through ICT, is a recent development that is leading to further fragmentation of value chains.

Figure 2: KIBS linkages to vertical and horizontal knowledge domains



Source: Strambach, 2008: 162

Modularisation and externalisation processes in intangible business services and recently in R&D, and thus in knowledge creation processes itself, have led to the further break-up of company structures and to new hybrid organisational forms. These processes are reinforcing the complexity of knowledge domains around business functions and are creating new space for customers to reconsider the balancing between outsourcing and insourcing of knowledge intensive services.

To contribute to the client's value or, as Dankbaar (2003: 360) put it, 'to stay ahead or outperform the most demanding customers', client-specific business know-how and the mastering of client processes have been gaining importance. Toivonen et al. (2008: 177) identify the increasing client orientation and the increasing multidisciplinarity of KIBS firms as two major development trends. The boarding of expertise in these two directions and the changes in vertical and horizontal knowledge domains are mutually related due to the emergence of a strong tension providing highly-specialised, knowledge-intensive expertise and comprehensive problem solving simultaneously. The understanding of the specific context of clients in particular their overall value-creation process becomes a fundamental aspect of professional work. Specialisation in accordance with the clients' industries and individual clients facilitates the recognition of new opportunities and the localisation of innovative services to create value for clients. As a result some external experts of KIBS firms are now more knowledgeable about a sector than most people working for companies in those sectors. Furthermore, having specialised knowledge bases in functional knowledge domains professionals of KIBS firms often apply

their expertise in companies located in completely different sectors, due to the growing fragmentation processes of intangible business services. At the firm level the increasing complexity of vertical and horizontal knowledge domains challenges KIBS firms to direct their expertise towards specialisation and diversification at the same time.

Being highly specialised and keeping up-to-date in the own professional knowledge field is needed as clients become more demanding. While on the other hand providing comprehensive problem solutions for clients which are requiring the combination of different knowledge bases often spread over organisational borders, KIBS firms have to master tasks from several expert areas. Diversification of established services into other service branches and the convergence in the knowledge domains among KIBS firms are recognised by empirical research. Examples are IT-services offering organisational and management consulting, accountancy services expand into legal services or media services providing software services. Such convergence is a trend across many KIBS sectors, as traditionally distinct KIBS sub-sectors increasingly offer services that were previously only provided by each of them individually (cf. Toivonen 2004). As response KIBS firms are changing their business models the way they serve their clients employing multidisciplinary teams for knowledge-creation tasks, building and improving networks, adjusting the way projects are staffed and altering compensation systems.

This has noticeable implications for professionals and experts employed in KIBS companies who are confronted by the need to develop new competences and to broaden their expertise in areas besides their own professions. Particularly the need for process-related skills to master complex co-production and collaborating processes in cross-functional and interdisciplinary project teams are identified. Processes of knowledge interaction in multidisciplinary teams span professional domains that have fundamentally different epistemological bases, and thus different epistemic cultures for legitimating knowledge, which hampers the development of a common understanding in processes of using and creating knowledge (Robertson et al. 2003, Newell/Swan 2001, Toivonen et al. 2008).

Given the further fragmentation of the value chain and the distributed knowledge generation accordingly, new demand for integrative and coordinative knowledge-intensive services is created, which is the counterpart to other disintegrating tendencies. The development of KIBS as the context in which knowledge workers are employed points to new patterns of specialisation. However, KIBS firms themselves enable the breaking up of the value chain through the contribution of their experts to knowledge commodification and new specialised knowledge creation, and consequently both can be seen as an outcome and a prerequisite of the further fragmentation of value chains.

5 Conclusion

The dynamic growth of KIBS in European countries is a structural feature of knowledge societies. These service firms are particularly representative for a knowledge-based economy because their main input and output is directly related to knowledge itself. KIBS are acting in complex horizontal and vertical knowledge domains which force their experts to combine and reconfigure knowledge units of various kinds very flexibly by producing customised ‘knowledge products’. In these industries firm capabilities and individual skills of experts and professionals are tightly interrelated.

This working paper argues that KIBS firms and their experts directly and indirectly contribute to the knowledge dynamics at both the level of client firms and industries. The dominant feature of the KIBS firms is their dynamic interconnections with other sectoral contexts. By extracting knowledge from

different vertical and horizontal knowledge domains and recombining it in different sectoral contexts they contribute at the same time to knowledge specialisation and diversification. Besides professionals in KIBS being specialists in the contextualisation and reconfiguring of existing knowledge bases, the firms are characterised by their dynamic capability to de-contextualise knowledge and to transfer it to new contexts using mixed types of horizontal and vertical knowledge domains. Additionally the re-contextualisation of implicit knowledge founded in the experiences and expertise of their knowledge workers is a special competence of KIBS firms which accelerates the diffusion of implicit knowledge within client and industry contexts.

The ongoing change processes do not proceed uniformly in KIBS industries. The understanding of certain sub-sector differences with regard to the exploration of knowledge and processes for transforming technological, science based or symbolic knowledge based on aesthetic creativity into economically valuable client 'products' is still only at the beginning. The development of organisational models and routines for managing different kinds of knowledge processes and mechanisms for integrating knowledge beyond intra- and inter-firm boundaries are not well understood. Enhancing the individual, group, and firm aggregation levels and taking the inter-organisational dimension into account are particularly important to explore the knowledge production of KIBS firms and the labour division and work practices of professionals and experts in such organisational settings.

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