Partnerships for better innovation support

EUROPE INNOVA Sectoral Innovation Watch

Sectoral Innovation Watch

Knowledge Intensive Services Sector

Final sector report

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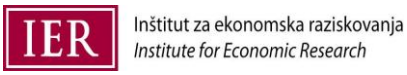

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Europe INNOVA Sectoral Innovation Watch

Detailed insights into sectoral innovation performance are essential for the development of effective innovation policy at regional, national and European levels. A fundamental question is to what extent and why innovation performance differs across sectors. The second SIW project phase (2008-2010) aims to provide policy-makers and innovation professionals with a better understanding of current sectoral innovation dynamics across Europe

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Central to the work of the Sectoral Innovation Watch is **analysing trends in, and reporting on, innovation performance in nine sectors** (Task 1). For each of the nine sectors, the focus will be on identifying the innovative agents, innovation performance, necessary skills for innovation, and the relationship between innovation, labour productivity and skills availability.

Sector Innovation Performance: Carlos Montalvo (TNO)	
Automotive: Michael Ploder (Joanneum Research)	Knowledge Intensive Business Services: Christiane Hipp (BTU-Cottbus)
Biotechnology: Christien Enzing (Technopolis)	Space and Aeronautics: Annelieke van der Giessen (TNO)
Construction: Hannes Toivanen (VTT)	Textiles: Bernhard Dachs (AIT)
Electrical and Optical Equipment: Tijs van den Broek (TNO)	Wholesale and Retail Trade: Luis Rubalcaba (Alcala) / Hans Schaffers (Dialogic)
Food and Drinks: Govert Gijsbers (TNO)	

The **foresight of sectoral innovation challenges and opportunities** (Task 2) aims at identifying markets and technologies that may have a disruptive effect in the nine sectors in the future, as well as extracting challenges and implications for European companies and public policy.

Sector Innovation Foresight: Matthias Weber (Austrian Institute of Technology)	
Automotive: Karl Heinz Leitner (AIT)	Knowledge Intensive Business Services: Bernhard Dachs (AIT)
Biotechnology: Govert Gijsbers (TNO)	Space and Aeronautics: Felix Brandes (TNO)
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Task 3 will **identify and analyse current and potential bottlenecks that influence sectoral innovation performance, paying special attention to the role of markets and regulations.** Specifically, the analysis will cover the importance of the different factors in the propensity of firms to innovate.

Role of markets and policy/regulation on sectoral patterns of innovation: Carlos Montalvo (TNO)	
Katrin Pihor (PRAXIS)	Klemen Koman (IER)

Task 4 concerns **five horizontal, cross-cutting, themes related to innovation**. The analyses of these horizontal themes will be fed by the insights from the sectoral innovation studies performed in the previous tasks. The **horizontal reports will also be used for organising five thematic panels** (Task 5). The purpose of these panels is to provide the Commission services with feedback on current and proposed policy initiatives.

Horizontal reports	
National specialisation and innovation performance	Fabio Montobbio (KITes) and Kay Mitusch (KIT-IWW)
Organisational innovation in services	Luis Rubalcaba (Alcala) and Christiane Hipp (BTU-Cottbus)
Emerging lead markets	Bernhard Dachs (AIT) and Hannes Toivanen (VTT)
Potential of eco-innovation	Carlos Montalvo and Fernando Diaz-Lopez (TNO)
High-growth companies	Kay Mitusch (KIT-IWW)

Contents

Acknowledgements

The final sector report for the knowledge intensive services sector builds on results from various tasks in the Europe INNOVA Sectoral Innovation Watch:

Gotsch, M., C. Hipp, J. Gallego and L. Rubalcaba (2010) *Sectoral Innovation Performance in the Knowledge Intensive Business Services*, Final Report Task 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, June 2010

Dachs, B. (2010 *Sectoral Innovation Foresight – Knowledge Intensive Business Services Sector*, Final Report Task 2, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2010

Montalvo, C., F. Diaz Lopez, M. Gotsch and C. Hipp (2011) Analysis of market and regulatory factors influencing sector innovation patterns – Knowledge Intensive Business Services Sector, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

H. Grupp†, D. Fornahl, C.A.Tran, J. Stohr, T. Schubert, F. Malerba, Montobbio F., L. Cusmano, E. Bacchiocchi, F. Puzone, (2010) *National Specialisation and Innovation Performance*, Final Report Task 4 Horizontal Report 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, March 2010

Rubalcaba, L, J. Gallego, C. Hipp, and M. Gotsch (2010) *Organisational innovation in Services*, Final Report Task 4, Horizontal Report 2, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, February 2010

Dachs, B., I. Wanzenböck, M. Weber, J. Hyvönen and H. Toivanen (2011) *Lead Markets*, Final Report Task 4, Horizontal Report 3, for DG Enterprise and Industry, European Commission, March 2011

Montalvo, C., Diaz Lopez F.J., and F. Brandes, (2011) *Potential for eco-innovation in nine sectors of the European economy*, Final Report Task 4, Horizontal Report 4, Europe INNOVA Sectoral Innovation Watch, DG Enterprise and Industry, European Commission, December 2011

Mitusch K. and A. Schimke (2011) *Gazelles – High-Growth Companies*, Final Report Task 4, Horizontal Report 5, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, January 2011

Executive summary

Eurostat statistics define the Knowledge Intensive Services (KIS) sector as a broad set of activities of a very different nature. KIS include many forms of professional services, including computer and management consulting, diverse types of specialist functions such as marketing and advertising, staff recruitment, and trade promotion or distribution logistics, as well as telecommunications, air transport, financial activities, and educational services, among others. However, innovation processes, structures, and performance differ notably among these sectors.

The growth of KIS has been supported by the increasing participation of knowledge in most economic production processes, the pace of technological change, a major inclusion of skilled workers, the introduction of new information and communication technologies (ICT), and the key role of intangible inputs in the generation of outputs. This growth has opened up new venues for the dissemination of knowledge and experience that has affected the way clients manage change and, therefore, their competitiveness and innovativeness. The phenomenon is particularly true for a smaller part of the KIS sector, the so-called Knowledge Intensive Business Services (KIBS) that in some cases are more manufacturing and service business related, having grown very fast over the past few years. According to the European Commission, KIBS are likely to be one of the main engines for future growth within the European Union.[1] Therefore, KIBS have been referred to as key sectors for analysis within this report.

KIBS has proved to create positive externalities in the economy throughout technological and non-technological innovation contributions in client industries. As intermediary input-organizations for the rest of economic agents, KIBS limited economic performance in terms of innovation and productivity may lead to a reduction of the competitiveness in other sectors. In this respect, policy intervention for supporting and promoting this type of activities is desirable in order to enhance the general economic performance of all productive agents.

Information from the CIS2004 database of Eurostat has mainly been collected to measure and compare innovation performance indicators concerning KIBS and the manufacturing industry. KIBS are less likely to engage in the acquisition of machinery and equipment in comparison to manufacturing and other more traditional service enterprises. However, they undertake training and other external knowledge activities to a larger extent. The same applies with respect to innovation outcomes, since innovation functions in KIBS result in a lower level of patent applications but a superior level of copyright claims. Furthermore, KIBS firms are more likely to introduce organisational innovations within their value chain and tend to cooperate with external agents for innovation to an

[1] European Commission (2007) Towards a European strategy in support of innovation in services: challenges and key issues for future actions. Commission staff working document SEC (2007) 1059, http://www.europe-innova.eu/c/document_library/get_file?folderId=26355&name=DLFE-3710.pdf

larger extent than most other sectors. This is particularly true when considering cooperation with clients and customers, competitors, or higher education centres.

In terms of innovation impacts, it appears that cost- and production-capability-related effects are more common within the industry sector. On the other hand, innovation activities in the KIBS sector generate superior impacts on a number of indicators such as improving the quality of products, entering new markets or increasing the range of products. Thus, the way in which the introduction of innovations affects enterprises is unequal depending on the sector regarded. The significant role of more intangible aspects within KIBS innovation leads to more quality related impacts, instead of those purely focused on costs and savings, which are more innovation in goods related. Cost factors are perceived by innovating firms as the most important factor hampering their innovation activities. Market factors are the second most important category of hampering factors, followed by knowledge factors. In general terms, KIBS enterprises report higher difficulties in developing their innovation activities than their counterparts in the manufacturing sector, although the empirical analysis also shows strong sectoral differences in the relative importance of the different types of hampering factors.

The share of innovative firms is larger in the KIBS sector than in the manufacturing industry. In this respect, KIBS companies undertake a greater volume of innovation expenditure as a percentage of total turnover and engage in intramural and extramural R&D to a higher extent than their counterparts in the manufacturing sector. Nevertheless, the outcomes resulting from their innovation activities are more difficult to appropriate, even if the percentage of sales of new or considerably improved products within total turnover is more significant in the KIBS sector than in its analysed counterparts. The intangible nature of many service innovations creates challenges for Intellectual Property Right (IPR) systems. Many service sector innovations do not meet the requirements for protection through patenting. This might be due to the fact that the type of knowledge they generate, such as business methods, can not be protected through patents.[2]

The requirements for employees and their skills in KIBS are higher than in other fields. They are even considered to be higher than in manufacturing sectors such as mechanical engineering or automotive industries. According to this, the share of staff with tertiary education among all employees is higher in KIBS than in most other sectors. The increase of highly qualified staff within the service sector, particularly within KIBS, is a clear indicator of the increasing interdependence of economic activities within different sectors. Companies concentrate on their core competencies, which leads to specialisation, new organisational structures and the increasing utilisation of information technologies. As a result, companies require more external knowledge, and are aware of the generation and implementation of knowledge, that mainly raises the demand for KIBS providers. These companies, in turn, play a central role in innovation processes and networks.

[2] European Commission (2007) Towards a European strategy in support of innovation in services: challenges and key issues for future actions. Commission staff working document SEC (2007) 1059, http://www.europe-innova.eu/c/document_library/get_file?folderId=26355&name=DLFE-3710.pdf

There is no typical KIBS firm with a typical output value and an average employment rate. The KIBS sector, by its definition, is very heterogeneous. Thus, it is difficult to analyse this sector and make generalised statements or conclusions on the optimal organizational form and integration of KIBS firms into the overall value chain. However, KIBS are mainly concerned with providing knowledge-intensive inputs to the business processes of other organisations, including private and public sector clients. As the public sector has recognised the important role of KIBS as a sector responsible for job creation and economic growth, policy measures and instruments have been introduced in order to increasingly address KIBS firms.

In contrast to the outputs of manufacturing firms, which contain a high degree of codified knowledge, KIBS outputs include a high degree of intangible or tacit knowledge. Consequently, KIBS companies are no longer seen as transferors of specific information, but play the role of an interface between the tacit knowledge base of their clients and the wider knowledge base of the economy in providing interactive, problem-solving processes. It is widely acknowledged that the interaction processes between KIBS and their customers is the central mechanism of knowledge creation and processing.

Companies belonging to KIBS operate in a specific network of actors. They have, on the one side, very tight links with the scientific base and, on the other side, close customer relationships. Traditional R&D oriented trajectories are not applicable within service industries. Instead of service-specific innovation, collaborative behaviour can be observed. Loosely-coupled collaboration and external knowledge sourcing strategies foster research collaborations with, for instance, universities. It can be assumed that KIBS innovators engaged in loosely-coupled innovation activities have a strong focus on knowledge building, and learning capabilities, which also require a strong internal knowledge generation process through research and development capabilities. This means that KIBS firms are both processors and producers of knowledge and innovation. Also, KIBS businesses play a particularly important role as knowledge brokers in collaborative or network activities. For example, they absorb knowledge from their environment and pass it on to their partners and customers for innovation activities. KIBS have a key role in the creation and commercialisation of new products, processes, and services. To summarise, one can state that the function of KIBS in the innovation system is as purchaser, provider, and carrier of knowledge.

New technology solutions have provided various new ways of introducing services over distances, which may help KIBS firms to enlarge their geographical range of delivery. However there are some factors which hamper this phenomenon. For instance, many KIBS are characterised by an intense interaction between the client and service provider. In this exchange process, trust and common understanding is essential. Naturally, both are easier to establish in geographical proximity and in face-to-face contact than over a long distance. Geographical proximity also helps service firms to understand the context in which their clients are working and to exchange more tacit pieces of knowledge, especially if their services consist not only of standardized components. All of these factors contribute to a strong local basis of KIBS firms.

The KIBS sector face several challenges and must deal with these issues accurately. The main drivers of service innovation lead to a number of so-called megatrends, which result from the interactions and combinations of the diverse challenges. The following areas must be analysed in this context: the relationship between industrialisation and customisation; service regression, which means that there is a trend of cost reduction in services; the rising significance of product-related services, the general population ageing; and the challenge of sustainable development.

Because of the heterogeneity, it is not feasible to identify a complete list of generic emerging innovation themes that are relevant in all KIBS. Nevertheless, some examples for emerging innovation themes in KIBS can be given. Increasing computing capabilities as well as advances in describing and analyzing natural and social systems will provide new technological opportunities for computer simulations in all types of KIBS. Services based on these simulations will, for example, provide new ways of virtual testing. The increasing tradability of services and innovations in the field of ICT promotes decentralisation, specialisation, and the division of labour in service and industrial activities. The prominent role of KIBS as an innovation broker leads to associated spillover effects on the whole productive system. In this sense, the introduction of ICT has unleashed important productivity enhancing effects in many service industries.

The future development of KIBS will be driven by various factors – developments in technology, changes in clients sectors, but also social factors and influences from the general economic and political level. Four scenarios of future development of KIBS based on technology (codification) and the environmental factors were sketched. These four scenarios describe possible future developments of various KIBS sectors – they are not exclusive, but allow different possible futures to exist side by side in various sectors. The present report discusses policy issues related to the four scenarios. Each of them includes different hampering factors for development and poses its own challenges and opportunities to policy.

Regulation and standards in the KIBS sector do not play an important role regarding innovation issues. The results of the analysis suggest a rather moderate association between regulation and the different types of innovations in KIBS industries. There are only very few regulations, which are strongly correlated to innovation in KIBS firms. The most important factors hampering innovation in KIBS industries are grouped under market and regulatory failures. The market factors having a negative effect on innovation in this sector includes globalisation and international competition. For the KIBS sector, increasing patterns of globalisation of production and technology have led to increased international competition. KIBS firms often have to struggle with competitors in a worldwide contest. In addition, labour costs and relocation of labour outside Europe, market protectionism, trade agreements, and insufficient government expenditure and procurement are also perceived as hampering factors for innovation in this sector. Furthermore, insufficient access to capital and information has always been considered a factor that may slow down innovation activities of firms.

In the present report, the main issues of the five horizontal reports relevant for the services sector are presented and discussed. In the analysis on national specialisation, KIBS were excluded from patent

based analysis. But the analysis of innovative performance covered services. Results show that some countries are specialised in certain types of innovation. The choice between different types of innovation is probably driven by the position on foreign and domestic markets. Inasmuch the positions differ, also the innovation paths differ. In general, cost reductions play a less decisive role in KIBS than in most other sectors of production. On the contrary, turnover with new products is quite high in services. This most likely reflects product intangibility of services, and low potentials for cost reduction. Considering the growth rates of firms, it appears that there are many KIBS companies which are considered to be high-growth. In the analysis on the impact of organisational innovation, results show how advances in innovation in the services industry are more intimately connected with the introduction of new organisational arrangements than their counterparts in the manufacturing sector, which are more technological product/process related. Additionally, organisational innovation increases progressively with the size of enterprises, thus turning large firms within the services sector into major originators and adopters of organisational improvements in the economy.

Little is said of the environmental impact of KIBS so identifying eco-innovation opportunities that may alleviate its carbon footprint is difficult. Eco-innovation opportunities which are related to the environmental impacts of KIBS organisations themselves may entail implementation of new communication technologies, improvements in logistics and technological improvements to decrease the environmental impact of tools. The lead market report suggests that the most promising industries for the evolvement of new lead markets in services are communication services, financial services and computer services. These industries combine a high degree of tradeability and innovativeness with opportunities for industrialisation.

Results of the study show that KIBS are more intensively engaged in innovation and training activities than their manufacturing counterparts, but at the same time are less likely to collaborate with international partners or perform internal R&D. In addition, KIBS innovativeness is strongly associated with highly qualified employees and intense collaboration with local customers and suppliers as compared to manufacturing firms. The most promising policy implications, which take into account the mentioned specifities are:

Firstly, to use an holistic approach for goods and services, which means that processes have to be considered across the whole supply and value chain. A clear separation between goods and services is no longer suitable.

Secondly, the education of qualified personnel. KIBS are playing a particularly important role and should be increasingly integrated into the teaching, transfer and knowledge generation process. The paramount importance of skilled individuals in KIBS points to the importance of policies towards increases in qualifications and skills that help firms to overcome problems from a lack of qualified personnel. By means of supporting the knowledge generation and qualification in service education, a new generation of workforce which is and more sensitized in service peculiarities, could enter the labour market. This next generation has to be trained according to new challenges. In contrast to many Asian countries, where mainly memorizing and factual knowledge is taughted, employees in

Europe must be able to deal with interfaces creatively and develop solutions situationally. Policy intervention in the supply of qualified personnel should target measures to increase the number of people who take up tertiary education, support training on the job, but also labour mobility which may help to overcome regional shortages in skilled personnel.

Thirdly, more public funding and financial incentives for service innovation. There is evidence from CIS data that a considerably lower share of service firms receive public funding for innovation compared to manufacturing firms. This may point to a bias in national as well as EU funding schemes which may lead to a situation where many potential innovations in services are not realized. Policy should be aware of the peculiarities of services and service innovation and how they may interfere with the design of policy measures. The introduction of innovation vouchers, which can be spend very flexible and only if necessary, would help to deal with KIBS´s heterogeneity and offer incentives to innovate.

Fourthly, cooperation programmes to further spur innovation with an increased exchange of information and knowledge between service firms and the science sector could be advantageous. Loosely-coupled collaboration and external knowledge sourcing strategies foster research collaborations with universities and other institutions. Policy could stimulate this exchange with programmes that target particular fields in the service sector.

Fifthly, the better access to international markets. Regulation can remove legislative barriers that hamper the mobility of KIBS and KIBS workers. This includes, for example, regulation concerning market access. Policy can facilitate internationalisation and trans-border operations of KIBS by new international regulatory frameworks.

Sixthly, an appropriate protection through IPR. Arrangements to ensure a high degree of IPR protection and encourage firms to make use of IPRs can create incentives to innovate, because it allows firms to reap a higher benefit from their innovations. IPRs are less frequently used in the service sector compared to manufacturing, which may justify policy intervention. Through integration of the ongoing open innovation discussion in the current IPR regime, an integrative approach could be found, which sets framework conditions for innovative service firms. These involves not necessarily IPR regulation, but furthermore consulting in strategic protection mechanisms or support in the exemplary design of cooperation with suppliers and customers.

Seventhly, another potential field for policy intervention is standardisation of services. More standards for services may allow a higher degree of transparency and comparability in services. Firms find it difficult to compare the quality of services ex-ante because there is an information asymmetry between the buyer and the seller. Moreover, many services are very much customer-specific and hardly a well-defined, distinguishable product. Transparency may be increased by more standardisation of services and a common terminology to describe the contents and functionalities of services. With the help of a European-wide service quality standard, service firms could try to achieve this award and use its reputation to send signals of quality to potential customers. Trust and assurance of consumers in new innovative service products would be increased.

1. Patterns and performance of sectoral innovation

1.1 Statistical definition of the sector and sector-specific indicators

Eurostat statistics define the Knowledge Intensive Services (KIS) sector as a broad set of activities of a very different nature. KIS include many forms of professional services, including computer and management consulting, diverse types of specialist functions such as marketing and advertising, staff recruitment, and trade promotion or distribution logistics, as well as telecommunications, air transport, financial activities, and educational services, among others. However, innovation processes, structures, and performance differ notably among these sectors.

This major aggregated sector as a whole currently accounts for more than 30 percent of total employment and added value generated in the European Union. The economic importance of these services means that improvements in European living standards are likely to depend more and more on productivity improvements in advanced services than in manufacturing (European Commission, 2007).3 The growth of KIS has been supported by the increasing participation of knowledge in most economic production processes, the pace of technological change, a major inclusion of skilled workers, the introduction of new information and communication technologies (ICT), and the key role of intangible inputs in the generation of outputs. This growth has opened up new venues for the dissemination of knowledge and experience that has affected the way clients manage change and, therefore, their competitiveness and innovativeness (Wood 2002).

This phenomenon is particularly true for a smaller part of the KIS sector, the so-called Knowledge Intensive Business Services (KIBS) that in some cases are more manufacturing and service business related, having grown very fast over the past few years. According to the European Commission, KIBS are likely to be one of the main engines for future growth within the European Union (European Commission, 2007).4 Therefore, KIBS have been referred to as key sectors for analysis within this report. KIBS firms are increasingly considered to be major users, originators, and transfer agents of technological and non-technological innovations, playing a major role in creating, gathering, and diffusing organisational, institutional, technical, and social knowledge. Advanced services are no longer thought of as laggards in adopting technological developments, working practices, or managerial innovations since they have developed extensive knowledge-based operating routines to support work such as knowledge management systems (Gann and Salter, 2000).

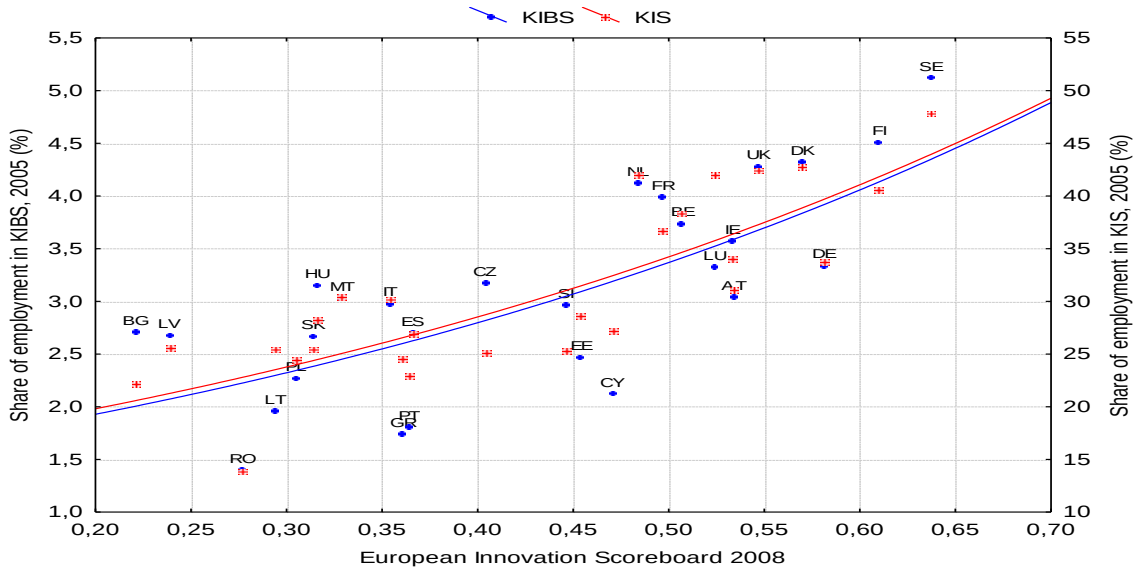
[3] European Commsion (2007) Towards a European strategy in support of innovation in services: challenges and key issues for future actions. Commission staff working document SEC (2007) 1059, http://www.europe-innova.eu/c/document_library/get_file?folderId=26355&name=DLFE-3710.pdf

[4] European Commission (2007) Towards a European strategy in support of innovation in services: challenges and key issues for future actions. Commission staff working document SEC (2007) 1059, http://www.europe-innova.eu/c/document_library/get_file?folderId=26355&name=DLFE-3710.pdf

According to den Hertog (2002), these advanced services lead to the generation of positive externalities by facilitating, adopting, transferring, and generating useful innovation for the other economic agents. Thus, advanced services are considered 'industry brains' that lead to the increased competitive advantage and economic development of organisations and regions with easy access to them. KIBS has proved to create positive externalities in the economy throughout technological and non-technological innovation contributions in client industries (van Cruysen and Hollanders, 2008). As intermediary input-organizations for the rest of economic agents, KIBS limited economic performance in terms of innovation and productivity may lead to a reduction of the competitiveness in other sectors. In this respect, policy intervention for supporting and promoting this type of activities is desirable in order to enhance the general economic performance of all productive agents.

In general, services innovation correlates quite well with overall innovation performance, as measured in the European Innovation Scoreborad (EIS) 2008.[5] Different levels of innovation performance in Europe can well be explained by different roles that knowledge intensive services are playing in the economies. The relationship between the share of employment in total KIS and in high-technological KIS is significantly and positively correlated with those innovation performance ratios attained by the various Member States (see figure 1.1).

Figure 1.1 Correlation between the 2008 European Innovation Scoreboard (EIS) rate and the employment in total KIS and high-technological KIS as share of total national employment



Note1: KIS refer to NACE Rev. 1.1 codes 61, 62, 64 to 67, 70 to 74, 80, 85 and 92; High-technological KIS refer to NACE Rev. 1.1 codes 64, 72, 73. Note2: Correlation factor EIS_KIBS: r = 0.7235; p < 0.001. Correlation factor EIS_KIS: r = 0.8271; p < 0.001.
Source: European Innovation Scoreboard 2008 (2006 data) and labour-market statistics (2005 data)

[5] European Commission (2008c) European Innovation Scoreboard 2008. Comparative analysis of Innovation performance, http://www.proinno-europe.eu/page/admin/uploaded_documents/EIS2008_Final_report-pv.pdf

Northern European countries such as Sweden, Finland and Denmark represent both important levels in terms of innovation attainment and high rates of knowledge-intensive activities in their respective economies. On the other hand, those countries performing more poorly in terms of innovation performance are mostly Member States that are also characterized by a weak position of KIS in their economies. The relatively weak role of KIS within the German and Austrian economies could be an indication that advanced services are still provided more "in-house" rather than through specialised service providers in these economies.

To this day, the main statistical techniques and empirical tradition have chosen R&D indicators and patents as measurement tools of innovative activities. Until recently, services as a whole have been considered to be productivity laggards and marginal activities with respect to innovation on the basis of limited R&D and patent generation (see for instance Pavitt et al. 1989). However, the frequently used R&D expenditures measure is too simplistic, since it under-reports the R&D activities of small firms and service providers since informal creative practices, software development, industrial design, and engineering activities account for a vast majority of innovative effort, which remain unmeasured (Salter and Tether, 2006). Different technologically advanced services over-perform the R&D activity levels achieved in the manufacturing industry. Some researchers have evaluated the ways in which total innovation activities undertaken by service firms are not well captured by official statistics (i.e. Rubalcaba, 2007). There is clearly a strong need for a revision of these statistics, although some minor improvements have been made in CIS2004 and in the new CIS2006 databases, mainly with regard to reporting organisational innovations occurring within the services sector. This will be analysed in chapter 2.

This part of the analysis mainly deals with methodological issues for further clarification of the indicator list, NACE sectors, and countries included in the analysis. Information from the CIS2004 database of Eurostat has mainly been collected to measure and compare innovation performance indicators concerning the manufacturing industry and total CORE-NACE[6] activities.[7] The new CIS2008 dataset, though already published, has not been used, since it is more incomplete than the CIS2004 information.

Table 1.1 lists those main KIBS analysed through the present work. CIS2004 organises productive activities based on the NACE Revision 1.1 codes.[8] Computer and related activities (NACE division 72) are placed at the forefront of the information society and comprise a broad range of activities, from hardware and software consulting to database activities and the repair of computing machinery.[9] In 2004, EU-27 NACE Division 72 generated 154.3 billion Euro of value added, employed 2.6 million

[6] The CORE-NACE section includes NACE Sectors C (mining and quarrying), D (manufacturing), E (electricity, gas, and water supply), I (transport, storage, and communications), and J (financial intermediation) and NACE Divisions 51 (wholesale trade and commission trade, with the exception of motors vehicles and motorcycles), 72, 74.2, and 74.3.
[7] Apart from the CIS2006 database, other statistical sources are helpful in investigating innovation developments in the services industry, with the most relevant summarised as follows: ANBERD database from OECD, New Cronos from Eurostat, and the Innobarometer Survey and Innovation Scoreboard, which consists of a collection of European innovation indicators on the basis of different databases, including the previous ones. These services reinforce the Community Innovation Survey database since they include information on industry activity, employment in high-technology sectors, human resources in science and technology, and the European and US patent systems, among other key indicators of science and technology services.
[8] Categorisation shifts occurring between NACE Revision 1.1 and Revision 2 are regarded in Annex 8.1.
[9] This sector does not cover computing equipment manufacturing nor their wholesaling, retailing, and renting.

persons, included more than half a million enterprises, and reported a level of labour productivity around 60,000 Euro per person employed (Eurostat, 2008). On the other hand, research and development activities (NACE 73), as observed in the table below (see table 1.1), are classified according to the field of investigation, namely 'natural sciences and engineering' and 'social sciences and humanities'. In 2004, the R&D sector in the EU-27 economy included around 37,000 firms, generated 18.4 billion of value added, and employed 390,000 jobholders (Eurostat, 2008). Finally, NACE Divisions 74.2[10] and 74.3 refer to a number of technical business services which are grouped into 'architectural and engineering activities and related technical consultancy' and 'technical testing and analyses'. In 2004, these NACE sectors employed 2.4 million people across 833,000 companies and generated 108 billion Euro of added value within the EU-27 economy (Eurostat, 2008), representing around 14.5 percent of the total value added for business services.

Table 1.1 Statistical classification of activities in the Knowledge Intensive Business Services as reported in the analysis

NACE 1.1
72 Computer and related activities
72.1 Hardware consultancy
72.2 Software consultancy and supply
72.3 Data processing
72.4 Database activities
72.5 Maintenance and repair of office, accounting and computing machinery
72.6 Other computer related activities
73 Research and development
73.1 Research and experimental development on natural sciences and engineering
73.2 Research and experimental development on social sciences and humanities
74 Other business activities
74.2 Architectural and engineering activities and related technical consultancy
74.3 Technical testing and analysis

For any of the selected innovation performance indicators, the figures will refer to average values for a set of European countries depending on the sector analysed. NACE 73 sector is not included within these average values, since reported information to CIS questionnaire is not compulsory for firms within this sector. The data for NACE 72, NACE 74.2, and NACE 74.3 include the following 18 countries: Belgium, Bulgaria, Czech Republic, Denmark, Germany, Estonia, Greece, Spain, France, Italy, Cyprus, Lithuania, Luxembourg, Hungary, Netherlands, Poland, Portugal, and Romania. CIS2004 database only provides information on NACE 74.2 and NACE 74.3 at an aggregated level. Data for NACE 73 were only available for 9 European countries: Belgium, Czech Republic, Spain, France, Italy, Lithuania, Hungary, Poland, and Romania.

Figures are given for innovative firms only. In order to complete the data analysis on KIBS, additional information was obtained from the Eurostat Safe Centre in Luxembourg. In this case, NACE at the 2-digit level is chosen as well as some other KIBS beyond NACE 72-74 in order to obtain additional comparisons. Moreover, depending on the data source, some figures will also refer to KIS as an aggregate sector (including NACE Rev. 1.1 codes 61, 62, 64 to 67, 70 to 74, 80, 85 and 92), high-technological KIS (referring to NACE Rev. 1.1 codes 64, 72, 73), market KIS (NACE Rev. 1.1 codes 61, 62, 70, 71, 74) and financial KIS (which comprise NACE Rev. 1.1 codes 65, 66, 67). For further

[10] This includes, for instance, building design and drafting, town and city planning, construction engineering, and weather forecasting activities.

clarification on KIS and KIBS definitions, see Table 1.2. These latter definitions will be mainly valuable to better approach the information coming form the REGIO database by Eurostat. Finally, the KIBS(2) definition comprises those selected industries to be analysed in the present work, since CIS2004 data for NACE Rev. 1.1 code 74 do not include information on disaggregated sectors NACE Rev. 1.1 codes 74.1, 74.4, 74.5, 74.8. Although KIBS(1) definition is a more generalized and concrete one, KIBS(2) classification will be the one in use when reporting in the study about knowledge intensive business services. In general, nearly all empirical studies use different definitions of KIBS. Therefore the comparability of study results is limited in most cases.

Table 1.2 Clarification on KIS (knowledge-intensive services) and KIBS (knowledge-intensive business services) definitions

NACE Rev. 1.1 codes:	**KIS**	**High-tech KIS**	**Market KIS**	**Financial KIS**	**KIBS(1)**	**KIBS(2)**
(72) Computer and related activities, (73) Research and development.	**X**	**X**			**X**	**X**
(61) Water transport, (62) Air transport, (70) Real estate activities, (71) Renting of machinery and equipment without operator and of personal and household goods.	**X**		**X**			
(65) Financial intermediation, except insurance and pension funding, (66) Insurance and pension funding, except compulsory social security, (67) Activities auxiliary to financial intermediation.	**X**			**X**		
(64) Post and telecommunications.	**X**	**X**				
(74.2) Architectural and engineering activities and related technical consultancy, (74.3) Technical testing and analysis.	**X**		**X**		**X**	**X**
(74.1) Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy; holdings, (74.4) Advertising, (74.5) Labour recruitment and provision of personnel, (74.8) Miscellaneous business activities.	**X**		**X**		**X**	
(74.6) Investigation and security activities, (74.7) Industrial cleaning.	**X**		**X**			

1.2 Characterisation of the sector

Additional to the common set of indicators which will be presented in section 1.3, other indicators from the CIS2004 database are particularly relevant for KIBS. As previously considered, KIBS are less likely to engage in the acquisition of machinery and equipment in comparison to manufacturing and other more traditional service enterprises. However, they undertake training and other external knowledge activities to a larger extent (table 1.3). The same applies with respect to innovation outcomes, since innovation functions in KIBS result in a lower level of patent applications but a superior level of copyright claims (more than doubling the levels attained in the manufacturing industry). Furthermore, KIBS firms are more likely to introduce organisational innovations within their production systems and tend to cooperate with external agents for innovation to an larger extent than most other sectors. This is particularly true when considering cooperation with clients and customers, competitors, or higher education centres.

Table 1.3 Sector specific indicators: KIBS industry innovation performance, innovative firms, in percentages

Innovation Indicator	NACE 72	NACE 73	NACE 74.2-74.3	SECTORS AVG	MANF GAP	TOTAL GAP
Firms engaged in training	68.47	62.52	68.51	68.49	31.37	24.88
Firms engaged in other external knowledge	35.24	27.44	27.80	31.52	55.62	39.36
Firms that claimed copyright	15.70	14.92	10.19	12.95	157.98	149.55
Firms that introduced organisational innovation	68.98	64.05	65.96	67.47	23.77	16.38
Cooperation with clients or customers	13.93	14.63	7.91	10.92	58.06	76.55
Cooperation with competitors or other enterprises of the same sector	4.57	2.56	4.31	4.44	101.92	87.90
Cooperation with universities or other higher education institutions	4.56	19.83	4.34	4.45	110.13	139.07

Note: KIBS AVG = Average value of NACE divisions 72-74.2-74.3; MANF GAP = Gap value between the corresponding KIBS average and manufacturing industry values; TOTAL GAP = Gap value between the corresponding KIBS average and total CORE-NACE values.
Source: Based on CIS2004 database, Eurostat.

The analysis of table 1.4 indicates that firms in activities related to computers, telecommunications, and financial intermediation are at the top of innovation through training. The results in terms of copyrights present some differences, since firms in financial activities show lesser levels of copyright claims, while others such as advertising and R&D in social sciences and humanities present much higher percentages. Finally, concerning collaboration in innovative activities, nationality seems to be an important factor (the percentage of collaborations with domestic partners is clearly superior to that of foreigners, with the largest differences in activities that are affected by national legislations). However, it seems that firms involved in activities more linked to hard science or computer activities cooperate to a larger extent with foreign partners.

Table 1.4 Sector specific indicators: KIS industry innovation performance, innovative firms, in percentages by subsector

		Engagement in training	Claimed copyright	Cooperate with: domestic partners	Cooperate with: foreign partners
64	Post and telecommunications	83,6%	0,6%	90,3%	63,1%
64.1	Post and courier Act.	47,1%	2,5%	84,7%	32,3%
64.2	Telecommunications	67,9%	9,5%	87,9%	67,1%
65	Financial intermediation, except insurance and pension funding	75,4%	2,0%	75,5%	39,5%
65.1	Monetary intermediation	70,1%	8,0%	89,0%	29,8%
65.2	Other financial intermediation	69,5%	1,1%	86,7%	24,4%
66	Insurance and pension funding, except compulsory social security	68,7%	3,3%	88,7%	33,3%
67	Act. aux. to fin. intermediation	100,0%	0,0%	73,6%	11,2%
67.1	Act. aux. to fin. intermediation, except insurance and pension funding	66,8%	4,2%	91,9%	42,7%
67.2	Act. aux. to insurance and pension funding	71,9%	1,0%	94,8%	34,6%
72	Computer and related act.	79,9%	5,6%	94,6%	73,2%
72.1	Hardware consultancy	67,7%	15,1%	91,2%	58,6%
72.2	Software consultancy and supply	66,7%	21,0%	89,0%	48,9%
72.3	Data processing	73,0%	8,7%	92,5%	36,0%
72.4	Database activities	30,8%	20,7%	86,7%	58,2%
72.5	Maintenance and repair of office, accounting and computing machinery	57,1%	6,6%	86,7%	33,5%
72.6	Other computer related Act.	51,4%	5,5%	90,0%	38,6%
73	Res. and dev.	58,8%	9,1%	96,1%	54,2%
73.1	Res. and experimental dev. on natural sciences and engineering	68,0%	15,4%	93,9%	79,9%
73.2	Res. and experimental dev. on social sciences and humanities	48,7%	22,3%	100,0%	39,9%
74.1	Legal, accounting, book-keeping and auditing act.; tax cons.; market res. and public opinion polling; bus. & mgmt. cons.; holdings	65,8%	7,0%	89,0%	37,4%
74.2	Architectural and engineering Act. and related technical consultancy	70,4%	7,2%	90,8%	47,1%
74.3	Technical testing and analysis	72,8%	8,6%	86,0%	45,2%
74.4	Advertising	35,7%	12,9%	98,3%	62,5%
74.5	Labour recruitment and provision of personnel	56,3%	4,8%	87,7%	10,8%

Source: Based on CIS2004 database, Eurostat.

In terms of innovation impacts, it appears that cost- and production-capability-related effects are more common within the industry sector (table 1.5). On the other hand, innovation activities in the KIBS sector generate superior impacts on a number of indicators such as improving the quality of products, entering new markets or increasing the range of products. Thus, the way in which the introduction of innovations affects enterprises is unequal depending on the sector regarded. The significant role of more intangible aspects within KIBS innovation leads to more quality related impacts, instead of those purely focused on costs and savings, which are more innovation in goods related.

Table 1.5 KIBS industry innovation activity impacts: results for innovative firms, in percentages

Innovation Indicator	***NACE 72***	***NACE 73***	***NACE 74.2-74.3***	**SECTORS AVG**	**MANF GAP**	**TOTAL GAP**
Increased range of products	41.76	38.97	24.67	35.13	9.66	10.11
Entered new markets	37.85	30.31	23.61	30.59	12.16	12.59
Improved quality in products	48.58	38.94	37.08	41.53	15.06	14.55
Improved flexibility of production	28.68	19.12	22.51	23.44	-13.92	-9.15
Increased capacity of production	24.29	17.79	21.72	21.27	-27.95	-17.51
Reduced labour costs	11.59	11.60	13.47	12.22	-50.08	-32.32
Reduced materials and energy	6.63	8.01	11.30	8.65	-45.61	-20.86
Reduced environmental impacts	6.21	23.40	14.15	14.59	-18.19	1.76
Met regulations and standards	16.36	27.06	19.32	20.91	7.86	10.15

Note: KIBS AVG = Average value of NACE divisions 72-74.2-74.3; MANF GAP = Gap value between the corresponding KIBS average and manufacturing industry values; TOTAL GAP = Gap value between the corresponding KIBS average and total CORE-NACE values.
Source: Based on CIS2004 database, Eurostat.

Besides the traditional quantitative indicators, other more qualitative and dynamic indicators are needed within a context where services are key dimensions of an evolutionary innovation system. New indicators need to be created, taking into account the indirect impact and intangible gains of service innovativeness.

Moreover, an empirical analysis of Community Innovation Survey (CIS2004) data has shown that cost factors are perceived by innovating firms as the most important factor hampering their innovation activities (table 1.6). Market factors are the second most important category of hampering factors, followed by knowledge factors. In general terms, KIBS enterprises report higher difficulties in developing their innovation activities than their counterparts in the manufacturing sector, although the empirical analysis also shows strong sectoral differences in the relative importance of the different types of hampering factors. Firm-size disaggregation illustrates how large enterprises in KIBS sectors are more likely to be negatively affected by obstacles and barriers to innovation than manufacturing companies. Although the latter seem to face higher costs in developing their innovation activities, KIBS industry large firms report lack of funds, of finance, of qualified personnel, of information on technology and markets, of market transparency and of alternative for cooperation at a superior level. This trend evolves as the firm-size is declining. Thus, barriers to innovation mostly concern small-sized firms in the manufacturing sector. This might be reflecting a bias towards innovation support initiatives for large manufacturing corporations that are leading to innovation system malfunctions.

KIS are also characterised by a high proportion of professionally qualified staff. In 2007, the share of human resources in science and technology in KIS as a percentage of total employment reached 58.15 percent, more than doubling the total volume included in the manufacturing industry. Furthermore, a particular reason for the increasing interest in KIS is the distinctive localisation pattern of the sector, which is highly concentrated in large urban areas. In order to better approach this issue, we include a choropleth map (figure 1.2) where the shaded areas reflect the measurement of regional employment in high-technological KIS as a percentage of total employment. This shows that those areas largely specialised in high-technological knowledge intensive services mainly refer to European capital-regions, or regions comprising the principal urban centres within the respective countries. As suggested by Feldman (1994), the more knowledge intensive an economic activity is, the more this activity tends to be concentrated geographically. Thus, high-technological KIS, which are more related to information driving processes, show a superior trend towards geographical concentration than the services average, particularly within international-profile regions. Very high levels of concentration are observed in some national markets for some business services. Whether these may give rise to competition concerns has not been assessed and, moreover, to do so would necessitate more in-depth examination of the correspondence between market segmentation on the supply- and on the demand-side (European Commission, 2008a).[11]

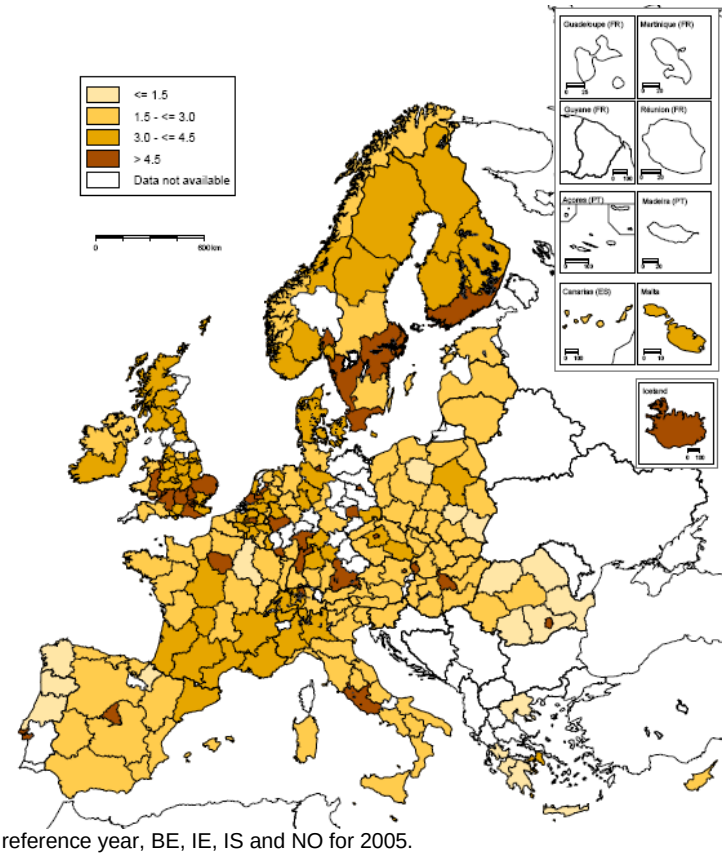
[11] European Commission (2008a) Study on Industrial Policy and Services, Directorate-General Enterprise & Industry, Contract of Sectoral Competitiveness Studies – ENTR/06/054:
http://ec.europa.eu/enterprise/enterprise_policy/industry/doc/industrial_policy_and_services_Part_1.pdf

Table 1.6 KIBS industry innovation activity barriers: results for innovative firms, in percentages

	COST FACTORS			***KNOWLEDGE FACTORS***				***MARKET FACTORS***	
	Lack of funds	*Lack of finance*	*Innovation costs*	*Lack of qualified personnel*	*Lack of information on technology*	*Lack of information on markets*	*Difficulty in finding cooperation partners for innovation*	*Markets dominated by established enterprises*	*Uncertain demand for innovative products*
Total size									
Total NACE	21.62	16.86	21.74	13.02	6.96	7.97	9.25	15.27	13.30
Manufacturing	24.49	18.49	**24.40**	14.07	7.53	8.27	10.26	16.26	14.36
Services	17.42	13.25	17.72	10.18	5.51	5.63	7.21	13.44	11.57
NACE 72	27.09	19.53	20.99	**14.97**	8.34	9.20	12.50	16.73	17.39
NACE 73	**34.24**	**27.09**	23.04	11.56	10.45	6.54	**12.84**	**17.10**	**22.61**
NACE 74.2-74.3	20.21	19.34	21.01	12.69	**11.45**	**12.81**	10.81	13.80	18.90
Large firms									
Total NACE	19.02	14.31	19.00	11.66	7.68	8.77	9.21	13.75	14.59
Manufacturing	18.71	14.55	**20.90**	12.01	8.94	10.27	10.28	14.37	15.87
Services	17.62	12.37	15.31	10.74	7.68	7.59	7.21	10.94	10.79
NACE 72-74.2-74.3	**25.91**	**19.69**	18.34	**18.81**	**18.31**	**12.32**	**20.13**	**20.63**	**22.07**
Medium firms									
Total NACE	19.78	15.38	20.79	12.28	7.77	8.20	9.41	14.37	12.94
Manufacturing	21.47	16.72	22.52	**12.84**	**8.63**	**9.37**	**10.08**	**15.22**	13.84
Services	15.36	12.19	17.30	11.06	6.79	7.64	7.13	12.14	10.38
NACE 72-74.2-74.3	**22.91**	**18.02**	**23.87**	11.63	5.91	6.06	8.84	12.09	**15.40**
Small firms									
Total NACE	23.05	18.20	22.41	13.64	7.18	7.91	9.75	16.01	13.38
Manufacturing	**26.08**	**20.75**	**25.55**	**15.31**	7.63	8.30	**10.91**	**17.57**	14.11
Services	18.09	14.01	17.77	10.48	6.42	5.76	8.27	13.90	12.03
NACE 72-74.2-74.3	24.02	19.48	20.48	14.15	**7.86**	**11.60**	10.00	15.56	**19.52**

Note: Data for NACE 73 only include the following 11 countries: Belgium, Czech Republic, Spain, France, Italy, Lithuania, Poland, Portugal, Romania, Slovakia and Sweden.
Source: Based on CIS2004 database, Eurostat.

Figure 1.2 Regional employment in high-tech KIS as a percentage of total employment, NUTS 2 regions, 2006



Note1: Exceptions to the reference year, BE, IE, IS and NO for 2005.
Note2: High-technological KIS refer to NACE Rev. 1.1 codes 64, 72, 73.
Source: Eurostat, 2008

As shown in table 1.7, the region of London presents the highest share of employment in total KIS in EU-15, followed by the regions of Berlin, Brussels, Stockholm and Paris, and present the highest levels of specialization in technological KIS within the total European economy. Business concentration is particularly relevant with regard to financial KIS. Here, Luxembourg and London present the largest specialization indexes (more than doubling the European employment average in this sector), followed by the regions of Hessen, Eastern and Île de France. Again, those regions located in southern European countries (Portugal, Greece and Spain) present a minor number of knowledge-intensive activities within the economy. Thus, differences observed in regions at NUTS1 level do not only exemplify the result of the fundamental role played by capital regions, but they also show the effect of a national component, as indicated above. In this respect, nine regions from the United Kingdom (London, the South East, Scotland, the East, the North West, the South West, the West Midlands, Wales, and Yorkshire and the Humber) are included among the twenty leading areas regarding the proportion of KIS comprised within their productive structures.

Table 1.7 Most specialized regions in KIS, 2006, NUTS0 and NUTS1, EU-15, (%)

Rank	*NUTS0*	*TOT*	*TEC*	*MKT*	*FIN*	*NUTS1*		*TOT*	*TEC*	*MKT*	*FIN*
1	Sweden	47.5	5.1	10.9	1.9	London	UK	53.63	5.27	15.18	6.62
2	Denmark	43.8	4.2	8.7	3.4	Berlin	DE	49.35	5.6	14.48	2.94
3	United Kingdom	43.0	4.2	9.6	4.3	Brussels	BE	48.22	4.01	16.01	4.8
4	Netherlands	42.3	4.1	10.4	3.4	Sweden	SE	47.67	5.06	10.91	1.9
5	Luxembourg	42.0	3.3	8.9	11.3	Île de France	FR	46.72	7.18	13.98	5.63
6	Finland	41.1	4.6	9.8	2.0	South East	UK	45.57	5.97	10.83	4.88
7	Belgium	38.6	4.0	7.9	3.5	West Nederland	NL	45.55	4.46	12.53	3.82
8	France	36.4	3.7	8.8	3.1	Denmark	DK	43.5	4.39	8.31	3.32
9	Ireland	34.9	3.9	7.6	4.3	Luxembourg	LU	43.49	3.28	9.46	11.32
10	Germany	34.3	3.5	8.5	3.5	Scotland	UK	43.47	3.56	8.09	5.12
11	Austria	30.4	2.9	7.8	3.3	Eastern	UK	42.77	5.26	9.43	5.27
12	Italy	30.1	3.0	9.2	2.9	Hamburg	DE	42.47	5.14	13.91	4.37
13	Spain	27.0	2.7	8.4	2.4	North West	UK	41.59	3.34	9.57	3.95
14	Greece	24.9	2.0	6.4	2.6	Noord-Nederland	NL	41.16	2.93	8.3	2.65
15	Portugal	22.7	1.9	5.5	1.8	Manner-Suomi	FI	41.05	4.58	9.77	2.01

Note: TOT=Total KIS refer to NACE Rev. 1.1 codes 61, 62, 64 to 67, 70 to 74, 80, 85 and 92; TEC= Technological KIS refer to NACE Rev. 1.1 codes 64, 72, 73; MKT=Market KIS refer to NACE Rev. 1.1 codes 61, 62, 70, 71, 74; and FIN=Financial KIS refer to NACE Rev. 1.1 codes 65, 66, 67.
Source: Based on the EUROSTAT, REGIO database

R&D expenditures and employment are highly concentrated in a few firms, most of which have formal and distinct R&D departments, an organisational arrangement that is uncommon in the services sector, although the share of R&D for services continues to grow (Salter and Tether, 2006). Furthermore, R&D investments by large individual firms represent only a part of the total innovation effort. This is particularly relevant for the services sector, which accounts for a greater number of small- and medium-sized enterprises than the manufacturing industry. However, during the last decade, R&D business expenditures grew faster in the service sector compared to the manufacturing sector. This trend is influenced by some business services, particularly computer services and related activities that experienced an outstanding growth during this period (Gallego and Rubalcaba, 2008).

Tables 1.8 and 1.9 shed some light on this phenomenon, presenting data for the top 15 European computer service and software companies in regard to their R&D investments. The figures have been extracted from the '2007 EU Industrial R&D Investment Scoreboard', which presents data on the top 1,000 R&D investing organisations with registered offices in the EU. The figures are derived from company accounts and represent the R&D invested by companies' own funds, independently of the location of the R&D activity. The computer services sector includes 32 enterprises among the top 1,000 R&D investors. Their R&D efforts are greater than 900 million Euro and employ more than 190,000 workers in Europe. The top five ranking European firms within this sector are among the 10 world leading enterprises by R&D investments. On the other hand, almost 10 percent of the major European R&D investors refer to the software services industry. Within this sector, there are 95 firms among the top 1,000 R&D investors, whose R&D efforts reach 3,500 million Euro. This particular service sector presents R&D investment levels above those achieved in more traditional manufacturing sectors such as food and beverage production or industrial machinery.

Table 1.8 R&D investment, net sales and number of employees of Europe's largest computer service activities/groups in Europe in 2006, ranked by R&D investments

Rank	Company	Country	R&D Investment	Net Sales	Employees
			€m	€m	Numbers
1	Telent	UK	206.30	1,452	9,000
2	Fujitsu Siemens Computers	The Netherlands	145.10	6,952	10,757
3	Indra Sistemas	Spain	96.44	1,407	10,611
4	Wincor Nixdorf	Germany	87.44	1,948	7,444
5	TietoEnator	Finland	72.50	1,782	14,414
6	LogicaCMG	UK	59.66	3,956	32,425
7	Sopra	France	31.10	898	9,602
8	Northgate Information Solutions	UK	24.26	494	3,232
9	F-Secure	Finland	23.38	81	439
10	Anite	UK	21.48	248	1,387
11	Torex Retail	UK	18.74	248	2,285
12	IONA Technologies	Ireland	12.09	59	351
13	Teleca	Sweden	11.51	327	3,940
14	SciSys	UK	10.38	93	770
15	Cegedim	France	9.87	541	4,968

Source: R&D Investment Scoreboard 2007, http://iri.jrc.ec.europa.eu/research/scoreboard_2007.htm

Table 1.9 R&D investment, net sales and number of employees of Europe's largest software enterprises/groups in 2006, ranked by R&D investments

Rank	Company	Country	R&D Investment	Net Sales	Employees
			€m	€m	Numbers
1	SAP	Germany	1,298.12	9,402	38,053
2	Dassault Systemes	France	281.04	1,158	6,840
3	Business Objects	France	147.91	951	5,402
4	Amdocs	UK	141.63	1,881	16,234
5	Sage	UK	140.85	1,389	10,510
6	Misys	UK	131.50	1,343	6,081
7	UBIsoft Entertainment	France	130.66	547	3,240
8	SCI Entertainment	UK	85.19	266	900
9	Symbian	UK	80.86	170	1,047
10	Infogrames Entertainment	France	65.50	391	982
11	Software	Germany	44.86	483	2,621
12	Autonomy	UK	41.60	190	903
13	Gameloft	France	41.21	68	2,635
14	IBS	Sweden	35.16	252	1,873
15	ISOFT	UK	34.55	299	3,224

Source: R&D Investment Scoreboard 2007, http://iri.jrc.ec.europa.eu/research/scoreboard_2007.htm

1.3 Common set of indicators

Innovation performance analysis has been mostly focused on R&D expenditures and other forms of knowledge acquisition, public funding, cooperation liaisons, and innovation outcomes such as patent or copyright applications. Table 1.10 shows that the share of innovative firms is larger in the KIBS sector than in the manufacturing industry as well as in comparison to the total CORE-NACE averages. In this respect, KIBS companies undertake a greater volume of innovation expenditure as a percentage of total turnover and engage in intramural and extramural R&D to a higher extent than their counterparts in the manufacturing sector. Service companies, generally, do not innovate less than manufacturing companies but great differences exist between knowledge intensive and other services. Innovation in more traditional services tends to be a continuous process consisting of a

series of incremental changes, contrary to innovation in manufacturing which is often more radical. On the other hand, in certain cases KIBS firms show similar innovation patterns as in manufacturing firms. This is supported by the fact that the R&D intensity of this type of services is even above the average of manufacturing companies (European Commission, 2007).[12]

Nevertheless, the outcomes resulting from their innovation activities are more difficult to appropriate, even if the percentage of sales of new or considerably improved products within total turnover is more significant in the KIBS sector than in its analysed counterparts. The intangible nature of many service innovations creates challenges for Intellectual Property Right systems. Many service sector innovations do not meet the requirements for protection through patenting. This might be due to the fact that the type of knowledge they generate, such as business methods, can not be protected through patents (European Commission, 2007).[13] This is particularly relevant for software suppliers since they must provide solutions to manage digital rights for other content providers and also take into consideration their own protection rights (Eurostat, 2008).[14] This fact is reflected in figures regarding the share of firms in KIBS that apply for a patent, which is lower than in other economic sectors. In contrast, advanced services are expected to approach other types of property appropriation regimes, as in the case of copyrights.

Furthermore, data contained in table 1.10 also shows that the volume of firms engaging in any type of cooperative activity for innovation is particularly relevant for KIBS companies in comparison to the manufacturing industry and total CORE-NACE averages. As argued by previous researchers, services activities are characterised by a prominent cooperation with external agents in the development of innovation activities (European Commission, 2008a).[15]

[12] European Commission (2007) Towards a European strategy in support of innovation in services: challenges and key issues for future actions. Commission staff working document SEC (2007) 1059, http://www.europe-innova.eu/c/document_library/get_file?folderId=26355&name=DLFE-3710.pdf

[13] European Commission (2007) Towards a European strategy in support of innovation in services: challenges and key issues for future actions. Commission staff working document SEC (2007) 1059, http://www.europe-innova.eu/c/document_library/get_file?folderId=26355&name=DLFE-3710.pdf

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Table 1.10 KIBS industry innovation performance: results for innovative firms, in percentages

Innovation Indicator	NACE 72	NACE 73	NACE 74.2-74.3	SECTORS AVG *	MANF GAP	TOTAL GAP
Share of innovative firms	59.87	73.10	40.21	50.04	23.89	32.84
Firms innovation expenditure (% turnover)	7.39	51.74	5.34	6.36	60.10	119.01
Firms engaged in intramural R&D	64.79	91.24	51.96	58.38	19.38	36.67
Firms engaged in extramural R&D	24.42	53.05	25.62	25.02	13.79	17.19
Firms engaged in acquisition of machinery, equipment and software	73.85	73.37	75.18	74.52	-5.76	-3.98
Firms that received any public funding	21.73	70.60	26.73	24.23	-4.20	18.43
Sales of new or significantly improved products not new to the market (% turnover)	7.97	11.82	4.49	6.23	-28.68	-3.68
Sales of new or significantly improved products new to the market (% turnover)	13.78	21.94	5.58	9.68	42.85	74.70
Firms engaged in any type of cooperation	41.65	76.08	36.02	38.83	26.39	24.14
Firms that applied for a patent	8.94	43.87	9.99	9.46	-30.01	-4.06

Note: KIBS AVG = Average value of NACE divisions 72 and 74.2-74.3; MANF GAP = Gap value between the corresponding KIBS average and manufacturing industry values; TOTAL GAP = Gap value between the corresponding KIBS average and total CORE-NACE values.

Source: Based on CIS2004 database, Eurostat.

Table 1.11 contains a more detailed analysis of the innovation performance variables distinguishing subsectors on the basis of the 3-digit level of NACE Rev. 1.1. As can be seen, there are important differences across the subsectors. Apart from those activities within the Sector 73, that by nature present high expenditures on R&D, we find that activities related to computers software and databases present the highest ratios of R&D expenditures over turnover among KIS industries. Concerning the innovation results, we find that activities related to computers and financial intermediation are the subsectors with the largest share of sales from new to the market products, as well as the largest percentage of patent-appliers (again, within the subsector dedicated to R&D in natural sciences and engineering).

Table 1.11 KIS industry innovation performance: results for innovative firms, in percentage by subsector (extended list of KIS based on micro data from the Luxembourg safe centre)

			Engagement in			% of turnover during 2002-2004		
		Total expenditure on R%D over turnover	Intramural R&D	Acquisition of machinery	Public funding from any authority	New or improved products that were new to the market	Unchanged or marginally modified products that were new to the firm	Applied for a patent
64	Post and telecommunications	10,7%	59,7%	91,9%	9,6%	12,1%	12,1%	10,0%
64.1	Post and courier Act.	3,1%	31,2%	61,8%	5,3%	6,0%	18,3%	4,4%
64.2	Telecommunications	7,8%	58,6%	72,7%	19,4%	12,4%	14,1%	13,6%
65	Financial intermediation, except insurance and pension funding	4,4%	58,0%	83,0%	15,1%	3,3%	20,8%	0,0%
65.1	Monetary intermediation	3,2%	43,7%	74,4%	7,2%	4,7%	8,8%	1,7%
65.2	Other financial intermediation	10,4%	55,1%	78,3%	4,1%	3,8%	20,9%	3,1%
66	Insurance and pension funding, except compulsory social security	11,2%	54,3%	73,2%	4,8%	3,5%	10,2%	1,4%
67	Act. aux. to fin. intermediation	4,4%	40,3%	100,0%	15,2%	20,2%	11,8%	15,2%
67.1	Act. aux. to fin. intermediation, except insurance and pension funding	5,7%	54,2%	81,7%	8,2%	7,4%	6,8%	4,5%
67.2	Act. aux. to insurance and pension funding	8,4%	42,4%	66,7%	12,9%	4,9%	11,2%	4,2%
72	Computer and related act.	16,5%	80,5%	84,9%	45,1%	18,0%	17,7%	9,7%
72.1	Hardware consultancy	9,8%	82,4%	43,6%	16,6%	11,4%	11,7%	10,9%
72.2	Software consultancy and supply	15,4%	80,1%	68,1%	22,4%	19,5%	14,8%	16,3%
72.3	Data processing	11,4%	63,5%	80,4%	19,7%	11,1%	13,0%	4,4%
72.4	Database activities	15,8%	71,8%	50,2%	22,6%	20,3%	14,2%	5,1%
72.5	Maintenance and repair of office, accounting and computing machinery	9,5%	76,7%	51,9%	19,6%	13,6%	15,4%	3,0%
72.6	Other computer related Act.	15,4%	57,3%	77,5%	22,3%	22,2%	22,1%	13,3%
73	Res. and dev.	56,1%	93,9%	88,3%	69,1%	23,8%	13,9%	42,3%
73.1	Res. and experimental dev. on natural sciences and engineering	71,0%	95,8%	65,4%	64,4%	20,1%	13,5%	48,9%
73.2	Res. and experimental dev. on social sciences and humanities	34,8%	92,6%	47,1%	38,3%	18,2%	6,5%	4,9%
74.1	Legal, accounting, book-keeping and auditing act.; tax cons.; market res. and public opinion polling; bus. & mgmt. cons.; holdings	6,0%	48,0%	67,6%	11,7%	6,5%	9,6%	7,4%
74.2	Architectural and engineering Act. and related technical consultancy	10,1%	59,3%	68,5%	21,7%	8,5%	9,7%	12,0%
74.3	Technical testing and analysis	12,4%	69,8%	74,9%	30,8%	10,2%	9,2%	9,9%
74.4	Advertising	2,1%	38,4%	72,0%	9,2%	2,8%	12,7%	4,1%
74.5	Labour recruitment and provision of personnel	4,0%	36,7%	62,3%	10,2%	4,3%	18,1%	0,5%

Source: Based on CIS2004 database, Eurostat

2. Carriers of innovation

2.1 People

People have two different functions in a national economy. Firstly they serve as the workforce which creates the innovation. Therefore, they need the necessary knowledge and skills, both of which are gained through training and education. Depending on these individual factors, there is a certain level of mobility of employees between the firms and sectors and between countries as well. Secondly, people act as customers of service companies and as users and consumers of innovative products and services. The following chapter is arranged according to this distinction.

2.1.1 Knowledge, education, and skills

What skills do people working in KIS and KIBS need? This is the question the current section deals with. In 2006, approximately 70 million people within the EU27 were employed in the KIS sector, with 7 million in high-tech KIS, according to Eurostat (2008). Germany ranked first, with 12.7 million people employed in KIS, followed by the United Kingdom with 12.1 million. However, as mentioned previously, only one-tenth of the jobs in KIS were, in fact, in high-tech KIS. Germany and the United Kingdom were the only Member States where employment in high-tech KIS added up to more than one million people. As a percentage of total employment, Sweden had the greatest shares of employment in KIS and high-tech KIS, with 47.7% and 5.1%, respectively. In high-tech KIS, Sweden was followed by Iceland (5.0%), Finland (4.6%), and Denmark (4.4%). In general, employment in KIS has more than tripled in OECD countries over the last thirty years. The move towards a service-oriented society is accompanied by an considerable increase in jobs for skilled and highly qualified personnel (Hipp and Grupp, 2005).

The results of the annual German reports on technological competitiveness show that the percentage of professionals in the KIS industry grew from 1995 to 2000 by 5.4% annually, whilst the annual change in the total number of employees was only 1.3%. This indicates a trend of increasing employment among university graduates compared to those with lower levels of education, and constitutes a trend towards knowledge intensification in industries and services (Grupp et al., 2002).

As shown in chapter 1, the share of highly qualified employees within different industry sectors varies greatly. How can this fact be explained? On the one hand, the increasing complexity of organisational processes and stronger global competitiveness among enterprises have led to growing levels of KIBS requirements, for both manufacturing and other service activities. On the other hand, different knowledge intensive functions previously carried out in-house by manufacturing and service organisations are currently externalised and outsourced to KIBS companies (Rubalcaba et al., 2008).

The requirements for employees and their skills in KIBS are higher than in other fields. In a sector classification of educational intensity conducted by Peneder (2007), the requirements are classified as high or very high. They are even considered to be higher than in manufacturing sectors such as

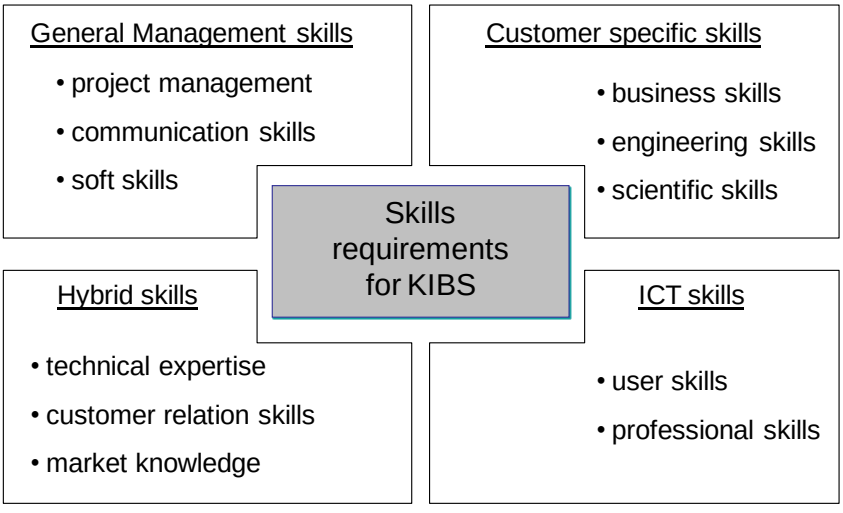
mechanical engineering or automotive industries. According to this, the share of staff with tertiary education among all employees is higher in KIBS than in most other sectors. The increase of highly qualified staff within the service sector, particularly within KIBS, is a clear indicator of the increasing interdependence of economic activities within different sectors (Miles et al., 1994). Companies concentrate on their core competencies, which leads to specialisation, new organisational structures and the increasing utilisation of information technologies. As a result, companies require more external knowledge, and are aware of the generation and implementation of knowledge, that mainly raises the demand for KIBS providers. These companies, in turn, play a central role in innovation processes and networks (Hipp and Grupp, 2005).

If taking into consideration the characteristics of highly qualified human resources, around 80% of science and technology jobs are in the services sector. In 2004, the services sector in the EU-25 employed most of the people working in science and technology, with about six times more than the manufacturing sector. Within the services sector, the KIBS sector employed the highest number of persons working in science and technology, an average of 73% for the EU-25. In addition, the KIBS sector employed the largest percentage of graduates from science and engineering degree programmes. Combining the KIBS sector with less knowledge intensive services sector can show that three out of four scientists and engineers were employed in services (Wilen, 2006).

Evangelista and Savona (2003) showed that high skilled and qualified jobs replace low skilled jobs in the long run. This effect is exceptionally strong in activities with a strong scientific and technological base, such as KIBS. In capital intensive industries and financial-related sectors, a negative impact on employment can be observed. This labour-saving effect of innovations is linked to the use of information and communication technologies, as will be shown later.

People employed in KIBS need appropriate skills related to general management issues such as project management needs. Other skills, especially so-called soft skills, are also crucial for business success. The most important skill requirements are presented in figure 2.1.

Figure 2.1 Skills requirements for KIBS



Source: own illustration

Customer-specific skills are more heterogeneous because they depend on a special type of service provided by KIBS companies. These customer-specific skills refer to business and engineering, and, in special cases, to scientific skills, which are all shown to be connected to the customer's needs. Skills in the handling of information and communication technologies are a main condition, and have to be assumed not only for hard- and software service firms, but for all KIBS. At any rate, the ability to use the provided ICT-tools is crucial. Last, but not least, hybrid skills refer to the optimal combination of technical know-how and knowledge about current customer demands.

Are some skills missing in the labour market, which may hamper the innovativeness of KIBS firms? Mahroum (2007) showed that a number of studies have come to the conclusion that the lack of ICT skills is a main hampering factor for the emergence of an information society in Europe and as a consequence, for the low European productivity compared to the USA. Preissl (2000) argued that qualification is not a sufficient condition, but that experience on the job is equally, if not more, important for the success of the job. Another point seems to be some employees' lack of management thinking, which could be solved by providing training on management skills. Due to the partial sizable cuts in public investments in education, the qualification levels are expected to become a larger problem in the future, that should urgently be addressed from political side.

To our knowledge, statistical information and survey results about KIS and international job mobility between different European countries do not exist, perhaps due to the relative recent implementation in all EU Member States of the EU rules of freedom of movement of people. This lack of information should be addressed by Eurostat. Concerning intra-national job mobility and company rotations within KIBS, there are also no statistical data available.

2.1.2 Customers, users and consumers

The customers, users, consumers, and clients of KIBS are as heterogeneous as the KIBS firms themselves. As a result, an attempt to make generalisations is not trivial. Little is known about the factors that explain why some firms use KIBS such as strategic consultancy, engineering services, or technological advices more frequently than others. Garcia-Quevedo and Mas-Verdu (2008) analysed the factors related to the use of KIBS by small and medium-sized firms. Their survey results, similar to most other available studies, show that the demand for KIBS increases with the size of the user firms. Another result of their study is that the spatial proximity between the KIBS user and supplier seems to be a relevant factor. However, there is relatively little knowledge available on the profiles of firms using KIBS. This could be linked to the complexity of the relations between the characteristics of firms and their use of external services like KIBS. Garcia-Quevedo and Mas-Verdu (2008) concluded that there is, on the one hand, the existence of a certain threshold value in terms of firm size in order for the firm to be able to make efficient use of KIBS, and on the other hand, the importance of proximity in geographical and sectoral aspects between the supplier and user of KIBS.

Den Hertog (2000) provided some insight on the interactions that take place between KIBS and their clients. His analysis emphasised the importance of tacit forms of knowledge flows that are at least as

important as the codified forms of exchanges taking place during KIBS-consumer interactions. The process is described as an enrichment of the client's knowledge base through confrontation with the knowledge base of the KIBS firm. This means much more than just a transfer of information, or the provision of expertise. In contrast, KIBS can trigger and strengthen processes of knowledge conversion in their client companies. They can provide new knowledge, but also act as catalysts, which can improve internal communication and knowledge conversion.

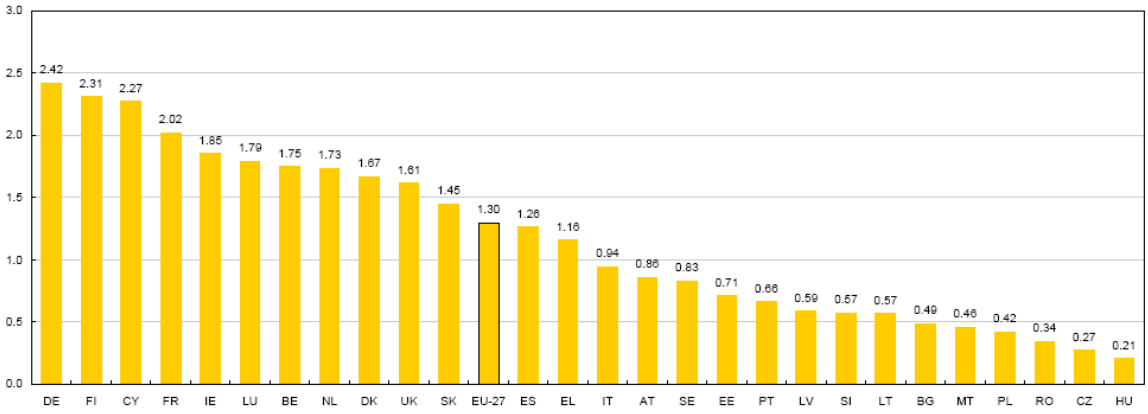
Analysing the role of knowledge cycles in the interactions between KIBS and their clients, Muller and Zenker (2001) put forward the hypothesis that these interactions stimulate the generation and diffusion of knowledge within innovation systems. They believe that the appropriation of knowledge by customers is not the result of a transmission from the KIBS firm to the client, but rather the result of a re-engineering process performed by a KIBS firm in cooperation with the client. It is the recombination of knowledge previously acquired by KIBS that enables them to create their own market. This takes the form of an appropriation of this knowledge through integration into the client's own cognitive context.

Bettencourt et al. (2002) concluded that users play a critical role in helping KIBS firms co-create or co-produce a knowledge-based service solution. The contribution of their clients to the service delivery process is integral to service success, affecting both the quality of the service output and client satisfaction with the service solution. Wood (2002) agreed with this argumentation, adding that KIBS firms offer strategically significant technical or organisational knowledge that the client's staff do not possess or could not exploit without the consultancy support provided by KIBS. KIBS firms are knowledge suppliers, with the knowledge in question resulting from a co-production process intimately involving the clients of KIBS (Muller and Doloreux, 2009). Almega (2008), for instance, showed that the user-driven development of new services is often the result of client-supplier interfaces. The conclusion is that user-driven demand leads to user-driven innovations, which are more driven by consumers and tacit knowledge than by the research of several KIBS firms.

2.2 Organisations

There is no typical KIBS firm with a typical output value and an average employment rate. The KIBS sector, by its definition, is very heterogeneous. Thus, it is difficult to analyse this sector and make generalised statements or conclusions on the "optimal" organizational form and integration of KIBS firms into the overall value chain. However, an average EU enterprise in the high-tech KIS sector generated a production value of 1.3 million euro in 2005. The amount varies considerably between different countries, as seen in figure 2.2, where Germany is ranked first with an average production value per enterprise of 2.42 million euro, followed by Finland with 2.31 million euro. At the lower end are the Czech Republic (0.27 million euro) and Hungary (0.21 million euro).

Figure 2.2 Production value in EUR million per enterprise, high-tech KIS sector, EU-27, year 2005

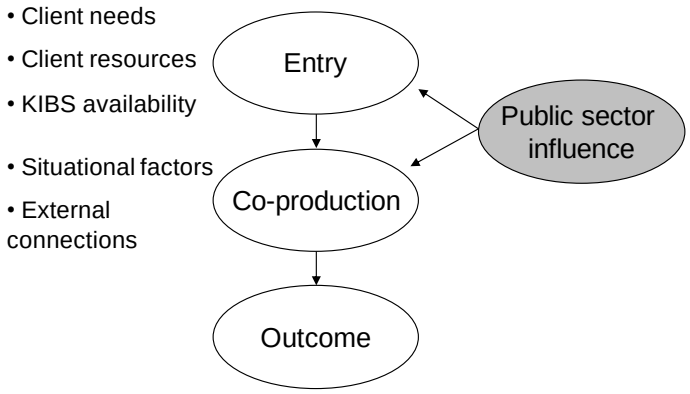


Note: Exceptions to the reference year: 2004: CZ, IE, EL and SE; 2002: CY, LU and MT.
Source: Eurostat's high-tech statistics

In combination with the production value, it is interesting to observe the quantity of employees in KIBS firms. Unfortunately, there is no average size of a KIBS company. Miles (2005) stated that KIBS feature a higher share of small firms than the economy as a whole. As illustrated in the economic literature, in an above-average way, the KIBS companies are concentrated on smaller companies (Hipp, 2000). However, there are exceptions to this assumption, for instance IBM, which is a very large company that has redefined itself from manufacturing of hardware to a KIBS company.

Muller and Doloreux (2009) concluded that a typical KIBS firm is mainly concerned with providing knowledge-intensive inputs to the business processes of other organisations, including private and public sector clients. As the public sector has recognised the important role of KIBS as a sector responsible for job creation and economic growth, policy measures and instruments have been introduced in order to increasingly address KIBS firms. According to Kuusisto and Viljamaa (2004), various policy measures may influence the use of KIBS. This includes, for instance, public funding, subsidies, and support for the use of various types of R&D-related services. Nevertheless, there is limited research on how policies facilitate the utilisation of KIBS or as facilitators of business growth by providing small enterprises the needed complementary resources. Figure 2.3 shows how the public sector could influence the use of KIBS.

Figure 2.3 Public sector influence on the use of KIBS



Source: Kuusisto and Viljamaa (2004)

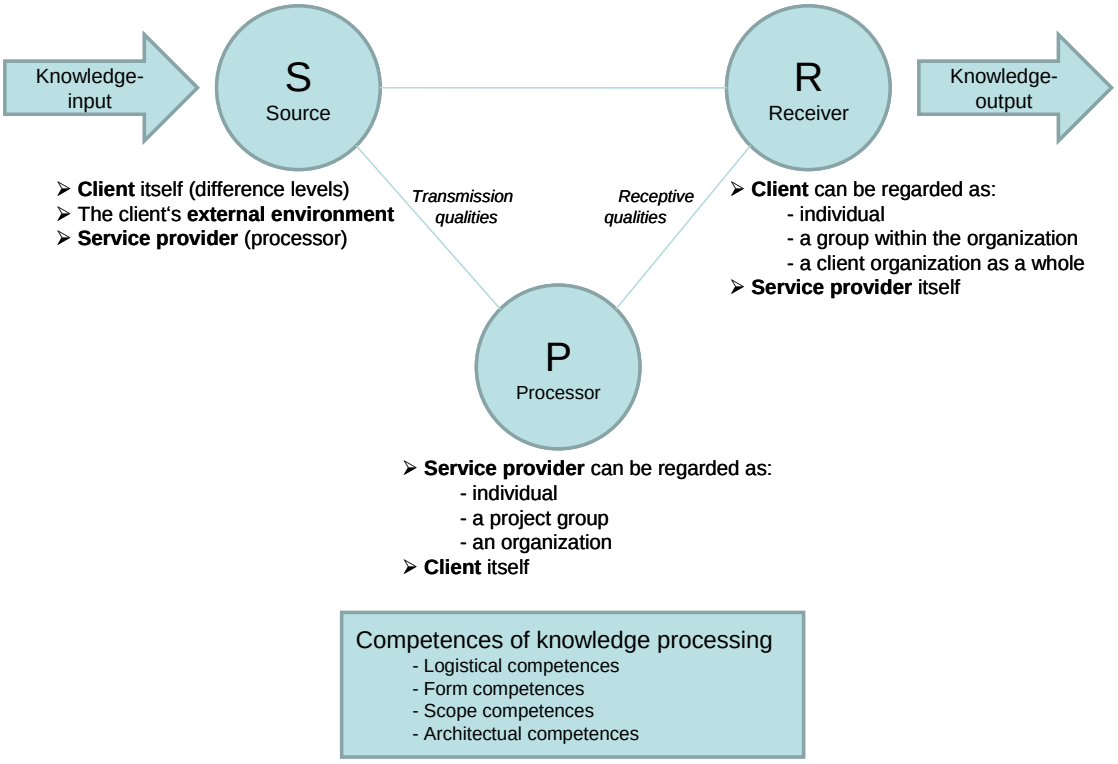
If limited resources prevent potential consumers from using available KIBS, then public sector intervention could play a role as an initiator of a positive cycle of innovation and growth. This could occur through supporting the finding- and selection-processes of co-production partners and influencing the formation of co-production relationships.

A considerable amount of studies (Sundbo and Gallouj (2000); Tether (2005); Camacho and Rodriguez (2005); Freel (2006)) show that KIBS are more intensively engaged in innovation and training activities than their manufacturing counterparts, but are less likely to collaborate with international partners or perform internal R&D. In addition, KIBS innovativeness is strongly associated with highly qualified employees and intense collaboration with local customers and suppliers as compared to manufacturing firms.

Figure 2.4 presents a model to clarify the relation between the actors based on the use of knowledge flows. The KIBS transaction involves three elements. First is the source (S) of the input knowledge, which can be the client himself, but also the client's environment. Even the processor can be seen as a source. Due to the previous KIBS transactions, the processor can accumulate knowledge, save it in a database, and therefore operate like a source. Second is the receiver (R) of the output knowledge, which can be an individual client, but also a small group inside the organisation. Even the organisation as a whole can receive the output knowledge. As explained earlier, the processor is also a receiver, because it stores the knowledge emerging from each transaction, and can use this later as input knowledge. The processor (P) is a connector between the source and the receiver, and is also a converter of input and output knowledge. The main activity is transferring, as effectively and efficiently as possible, the knowledge from a source to a receiver. Thus, the provider can also be called a "service provider". An individual, group, or organisation as a whole can function as a service provider. The client itself is also a processor if the service is co-produced (the client helped to create knowledge). Some of the components of a KIBS transaction may merge with one other. It is comprehensible that, in small-sized companies, the processor and receiver of knowledge are the same. For example, a group receiving input knowledge from a client can act like a processor while forming output knowledge in a group discussion and, at the same time, can be a receiver of the

created knowledge in order to fulfil the client's desires. However, in large firms, it is commonly the case that the source is different from the receiver.

Figure 2.4 KIBS transaction as a form of knowledge processing



Source: Gallouj (2002)

In contrast to the outputs of manufacturing firms, which contain a high degree of codified knowledge, KIBS outputs include a high degree of intangible or tacit knowledge. Consequently, KIBS companies are no longer seen as transferors of specific information, but play the role of an interface between the tacit knowledge base of their clients and the wider knowledge base of the economy in providing interactive, problem-solving processes (Muller and Doloreux, 2009). It is widely acknowledged that the interaction processes between KIBS and their customers is the central mechanism of knowledge creation and processing (Bettencourt et al (2002); Den Hertog (2000); Miles (2005); Wood (2002)). Considering the structure of the relationship between business service firms and their clients, the allocation of control rights to the intellectual assets is what is created in joint projects, which is not a trivial task, as Leiponen (2006) showed in her survey.

2.3 Clusters and networks

Cooperation forms the basis of clusters and networks, and can always be perceived as a form of organisation between the two extreme cases of hierarchy and market. On the one hand, cooperation has the typical characteristics of market coordination based on voluntary collaboration between interacting companies. On the other hand, cooperation can be interpreted as coordination, which is formed by hierarchy and the involved fixedly defined competences and functions (Jansen, 2001).

As shown in table 1.10, the volume of firms engaging in any type of cooperation activity for innovation is particularly relevant for KIBS companies in comparison to the manufacturing industry and total CORE-NACE averages. As a consequence, Miles (2000) and Rubalcaba (2007) concluded that service activities are characterised by a prominent cooperative nature with respect to external agents in the development of their innovation activities. Furthermore, the question has to be raised whether cooperation is a preliminary stage of networking.

Sydow (2006) showed that, in most cases, innovation results from the collaboration of different companies while concentrating their competences in order to manage the technological challenges of complex modernisation efforts. This collaboration is often based on a type of network presenting itself as an organisational form of economical activities realised by gaining competitive advantages and utilising common interests. In general, networks are characterised more by cooperative than by competitive and relatively stable relationships between legally autonomous, but often economically dependent, companies.

The advantages arising from networking activities are an improvement of the economic situation of all members, an increase in economic competitiveness, better achievement of aims compared to individual actions, and advantages of rationalisation by concentrating on the particular core competences. Another aspect is the common responsibility for and share of costs, which minimises risk for every participant (Schmidthals, 2007).

As shown in table 1.3, KIBS firms cooperate with clients or customers, competitors or other enterprises of the same sector, and with universities or other higher education institutions that will be elaborated upon in depth in the following section. To reach the intended goals of the cooperation, there must be internal coordination processes and an intensive exchange of information before the production of services takes place. Small and medium-sized businesses are particularly suited for cooperation or fusion in order to integrate networks in this way (Sydow, 2006).

2.3.1 The role of KIBS in innovation networks

Companies belonging to KIBS operate in a specific network of actors. They have, on the one side, very tight links with the scientific base and, on the other side, close customer relationships. This signifies the relevance of KIBS firms as intermediaries between knowledge producers and users (Hipp and Grupp, 2005). Traditional R&D oriented trajectories are not applicable within service industries. Instead of service-specific innovation, collaborative behaviour can be observed. In this context, Sundbo and Gallouj (2000) differentiate between two innovation subsystems, the “institutional” and the “loosely-coupled” system. In a normal case, KIBS providers belong to the latter, because of the lack of coherence in terms of technological and professional trajectories as well as the weak science base. This means that there is no fixed or contract-based constellation between the actors. As a result, the integration of external knowledge is less formalised and institutionalised. Similarly, the knowledge diffusion process does not follow a straight line.

KIBS firms not only interact with similar firms but also with companies from other sectors such as manufacturing. Therefore, one has to keep in mind that innovation and market trends in one sector deal with innovation and market trends in other sectors. The survey from Drejer and Vinding (2005) shows that the collaboration of KIBS and manufacturing firms has a positive effect on employment development at least for firms located in the periphery areas. Another finding to be taken into account is that the existence of local innovation networks is more important for KIBS firms than for manufacturing firms (Koschatzky, 1999).

In this context, we have to distinguish between horizontal and vertical cooperation. Vertical cooperation exists if the participating companies originate from downstream and upstream production stages and their value chain activities are jointly interlinked. The relationship between the supplier and consumer is an example. Horizontal cooperation is an incorporation of businesses, where firms are producing the same products. This is what indicates that their commodities compete.

In general, this network-based structure of cooperating companies is not commonly advantageous in regards to the provision of innovative services (Brockhoff, 1999). In fact, these structures are only a possible reaction of the product complexness and the way knowledge is spread. Concerning the work-sharing services, the organisational units are often too small to economically guarantee the coordination of the many activities and the utilisation of resources in the market. Thus, alternatives to the absolute market solution are required. Cooperation could be a practical possibility to solve this set of problems. Considering the fact that companies want to draw a profit, flexibility, which is typical within cooperative environments, can also lead to an optimal arrangement of jobs between the interacting companies, because all concentrate on the branches and functions where they have an advantage. Cooperation between different companies ought to be a promising way, particularly among medium-sized businesses.

Loosely-coupled collaboration and external knowledge sourcing strategies foster research collaborations with, for instance, universities. It can be assumed that KIBS innovators engaged in loosely-coupled innovation activities have a strong focus on knowledge building, and learning capabilities, which also require a strong internal knowledge generation process through research and development capabilities. This means that KIBS firms are both processors and producers of knowledge and innovation (Gallouj, 2002).

KIBS businesses play a particularly important role as knowledge brokers in collaborative or network activities (Hipp, 1999). For example, they absorb knowledge from their environment and pass it on to their partners and customers for innovation activities. One can say that looking at KIBS firms as interaction agents or brokers leads to an acceleration of the diffusion of the respective innovation and, in this context, the KIBS firms can be described as drivers of the entire innovation process. Garcia-Quevedo and Mas-Verdu (2008) observed that KIBS have a key role in the creation and commercialisation of new products, processes, and services. To summarise, one can state that the function of KIBS in the innovation system is as purchaser, provider, and carrier of knowledge.

2.3.2 Clusters

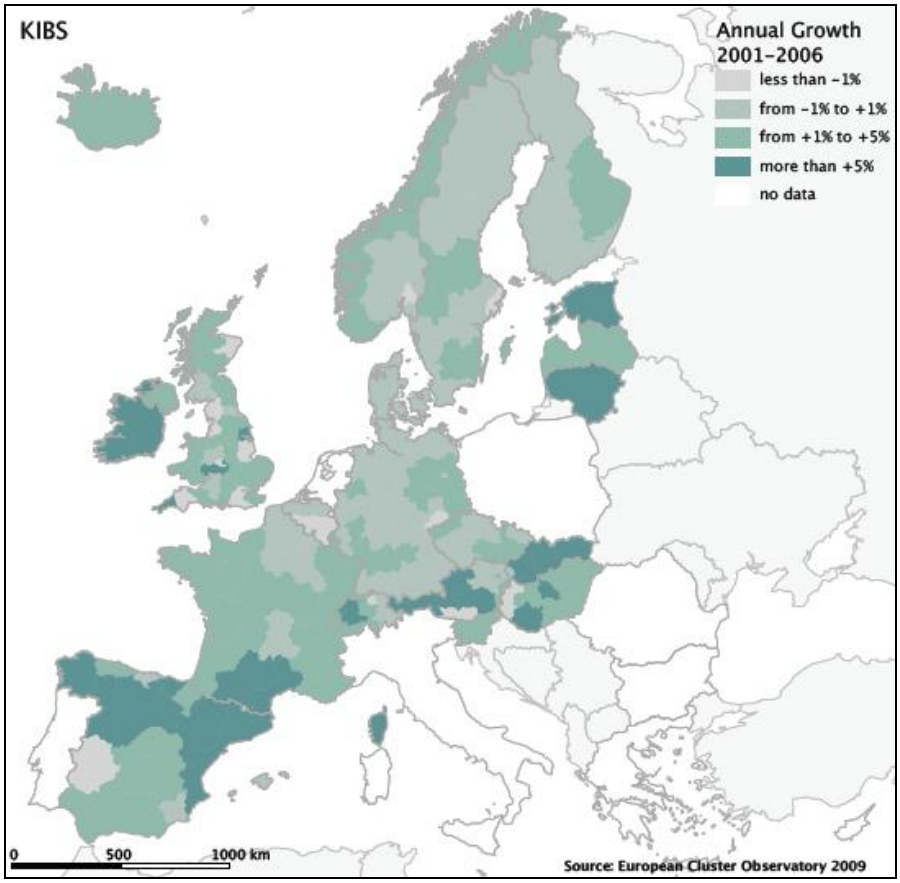
Better understanding the relationship between knowledge, innovation, and spatial proximity requires systematically sorting out the connections between the three dimensions, as they are interrelated and constitute a basis for innovation in KIBS. In spite of the fact that the economy is global, innovation is, in many aspects, a regional phenomenon in which services, and in particular KIBS, have acquired a central role. Some past studies assume that innovation rates are greater in regions where a high concentration of KIBS exists. It is argued that, despite technological changes such as the rise of ICT, inter-regional trade in KIBS is not possible in the majority of cases because of the need to establish "face to face" contacts in order to transmit tacit knowledge (Meri, 2008). In the same way, there is a local character of supplier/provider relationships in services (Wood, 2002). As a result, it can be concluded that the regional level becomes the most adequate scope in which to study the role of KIBS in innovation.

One approach to examine more closely existing clusters in Europe is the European Cluster Observatory, which has the mission to provide neutral and comparable data on the strength of clusters and their regional distribution throughout Europe. In order to achieve this target, an common approach with quantitative statistical data is used (European Commission, 2008).

In order to better visualise the issue of cluster building, figure 1.2 was introduced. The areas on the NUTS 2 level are shaded in proportion to the measurement of regional employment in high-tech KIS as a percentage of total employment. To analyse the relationship between the activities of KIBS and their spatial distribution, it can be assumed that KIBS firms concentrate in metropolitan areas. A few studies document this fact, such as the study by Aslesen and Isaksen (2004), indicating that KIBS firms are usually highly concentrated in large urban areas.

After dealing with the static picture of figure 1.2, a more dynamic view is presented in Figure 2.5, prepared by the European Cluster Observatory (2009). The annual growth rate of employment in KIBS between 2001 and 2006 is presented in this map. The average annual growth rate of KIBS employment was 1.7% compared to an 1.2% increase in total employment in Europe. KIBS are, in general, a predominantly urban activity. However, the fastest growing regions are mostly small ones with little KIBS employment.

Figure 2.5 Average annual growth rate of employment in KIBS between 2001 and 2006



Source: European Cluster Observatory (2009)

Overall, the cluster concept offers a better understanding of the eco-system in which innovative services may flourish best. For example, correlation analyses by the European Cluster Observatory show that the existence of cluster strengths in services is highly correlated with GDP per capita, which is most evident for clusters in business and financial services. Overall, strong service clusters are not strongly related to patent applications to the European Patent Office (EPO), with the exception of IT and financial services. Most of the services industries also show a high but weaker correlation to education levels in terms of the share of population with tertiary education (among people older than 15 years). In particular business services have a very strong correlation.

These first results from the European Cluster Observatory provide an indication of which framework conditions for services clusters are most important. Simultaneously, it cannot be assumed that services clusters are driven by the same institutional links as research or manufacturing-led clusters. The quantitative analysis carried out by the European Cluster Observatory needs, therefore, to be further developed and complemented by a more qualitative analysis of the drivers of services clusters, in particular those relevant for innovation.

A survey conducted by Koschatzky (1999) showed that the innovation activities of KIBS reflect their ability to interact with their partners and that this ability is not spatially neutral. The existence of a

relationship between KIBS firms' innovation intensity, its integration in networks, and the spatial range of its interactions are crucial. The influence of geographical area on KIBS firms' activities is shown by the fact that firms in central regions show a higher probability of interregional interactions, while rural areas are dominated by intraregional contacts. One can recognise interregional differences in KIBS networking behaviour. Heraud (2000) also advanced this view because complex cognitive processes need not only large flows of codified scientific and technical information, but also a lot of tacit knowledge for using and interfacing that information. As a result, proximity does matter since building common tacit knowledge implies close contacts, at least in the beginning of cooperation processes.

Koch and Stahlecker (2006) observed the interrelationship between establishments of KIBS and their innovation and production systems in some German metropolitan regions. They concluded that, especially in the early stages of developing a new service, geographical proximity to suppliers, cooperation partners, and clients seems to play a crucial role. In addition, the structure and configuration of the regional knowledge base could play an important role in the growth of these new firms. Depending on the specific techno-economic and institutional structure, regions can be incubators for the foundation of KIBS. Key factors of the foundation activities in this particular sector relate to the quality of regionally bound entrepreneurial social networks and the structure and configuration of the regional knowledge potential. Keeble and Nachum (2002) commented that KIBS clusters are a consequence of the need for, and benefits of, proximity and accessibility to clients. Simultaneously, their survey results provide strong evidence for the existence and importance of localised processes of collective learning and networking involving KIBS.

It has been argued that there is no need for such spatial proximity. Some researchers, based on surveys, conclude that the exact location of the firm does not matter because of the current rise in information and communication technologies. For instance, Antonelli (1999) summarised that the remote access of potential customers to KIBS made possible by new information and communication technologies provides these firms with a global scope of action. In this way, multinational KIBS firms can gradually emerge, combining the advantages of proximity and variety. This is particularly true for standardized services that can be delivered over long distances without problems.

It cannot be denied that new technology solutions have provided various new ways of introducing services over distances, which may help KIBS firms to enlarge their geographical range of delivery. However there are some factors which hamper this phenomenon. For instance, many KIBS are characterised by an intense interaction between the client and service provider. In this exchange process, trust and common understanding is essential. Naturally, both are easier to establish in geographical proximity and in face-to-face contact than over a long distance. Geographical proximity also helps service firms to understand the context in which their clients are working and to exchange more tacit pieces of knowledge, especially if their services consist not only of standardized components. All of these factors contribute to a strong local basis of KIBS firms, which is elaborated upon in depth with prospective developments in the Foresight Report of Task 2 of SIW (Dachs, 2010).

3. Sectoral innovation futures

3.1 Emerging and future drivers of innovation between S&T and (market) demand

As analysed before, service providers innovate in a customised way. They are simultaneously supported by high skilled, knowledge intensive employees. In the KIBS sector, increasing patterns of globalisation of production and technology have led to increased international competition, which makes it necessary to discuss current trends in services. The KIBS sector face several challenges and must deal with these challenges accurately. The main drivers of service innovation, as discussed by Rubalcaba et al. (2008) and Dachs (2010), include the following:

- **Industrialisation of services**: The standardisation of work procedures and the production of standardised services on a large scale (mass production) reflect a certain form of industrialisation which leads to standardisation of the service itself.
- **ICT, technology, and R&D**: The relationship between technology and service innovation is not trivial, but complex and multifaceted. There is no doubt that technology is a driver of innovation, but other types of relationships are also involved. Technological change provides new opportunities for product and process innovation to KIBS firms in a very general sense because it stimulates demand for new types of knowledge. Moreover, growing technological complexity also creates growing demand for technical advice, and a number of KIBS have emerged to help clients deal with technologies. ICT are certainly the most important class of technologies for innovation in KIBS and in services in general. ICT allows KIBS firms to develop new services and producing existing services more efficiently. The codification of previously tacit knowledge, in combination with ICT, is a major driver of new services. Modern ICT considerably lowers the price of codification of knowledge and give way to a codification of various parts of knowledge. Also, ICT can alter the way existing knowledge-intensive services are provided. ICT provides new ways of service provision over distance and can relax the requirement that service producer and the client have to be in the same place. As a consequence, the use of ICT increases the tradability of services, in particular of services dealing with the exchange, storage, processing and retrieval of standardized, digitized and codified information. This opens new ways for service providers to meet the growing demand for services due to offshoring and to serve clients outside their town or region.
- **Globalisation**: The service sector can no longer rely on a public monopoly, which was originally used to protect against international competition. Through liberalisation and deregulation, this approach has resulted in new opportunities for innovative services. Despite the local character of many KIBS, some authors argue that international outsourcing in KIBS will become considerably more prominent in the future. Their main argument is that ICT have created new ways for communication between service firms and clients and service provision over distance. As a consequence, ICT changed the local character and the tradability of many services. These types of services, as Blinder (2005) puts it, " have more in common

with manufactured goods that can be put in boxes than they do with personal services". Outsourcing, as a consequence, increasingly gets an international dimension with a growing share of outsourcing taking place between partners in different countries. International outsourcing, like domestic outsourcing, has a strong cost component, but is also fuelled by the effects from serving a larger range of clients such as economies of scale and increasing specialisation at the KIBS provider's side.

- **Demography and increasing knowledge-intensity in the economy**: In sophisticated European countries, the most important demographic variable affecting innovation is ageing, which leads to new niches for the development of specific services. Another major demand-side driver of KIBS growth is the increasing knowledge intensity of a number of economic activities and, as a consequence, a higher need for special expertise. Society is becoming increasingly differentiated, knowledge-intense and complicated which raises the need for advice and consultancy.
- **Outsourcing**: Outsourcing means that manufacturing and service firms buy services which were previously provided in-house from external service providers. KIBS predominantly are consumed by other businesses and outsourcing has been a major driver of KIBS growth in the past. Outsourcing is cost-driven to a certain degree, but also has to be seen in a larger context of corporate restructuring where firms increasingly focus on their core competencies and handle other activities to external suppliers. Outsourcing enables KIBS to gain dynamic learning effects, increasing returns from scale and specialisation, and benefit from experiences with different clients.
- **Customisation and Open Innovation**: Adaptation to clients needs is more important for the success of the service sector than for the manufacturing sector. Enterprises increasingly make use of external scientific and technological knowledge in their innovation process. Many innovative enterprises have shifted to an 'open innovation' model where they exploit ideas and knowledge not only provided by internal R&D, but also from a broad range of external sources and actors. In the context of KIBS, this could further boost demand for R&D services and other KIBS providing scientific and technological expertise. Hence, from the KIBS point of view, Open Innovation could be seen as an extension of the general trend towards outsourcing for R&D.
- **Deregulation**: Through several waves of liberalisation transposed in the past years, new chances and opportunities were created for service innovations.
- **Local character of KIBS**: Technology has provided various new ways of delivering services over distance. These tools may help KIBS firms to enlarge their geographical reach. There are, however, considerable hampering factors to such an expansion which are a result of the very nature of the process of service production in KIBS. As a result, these factors are negative drivers to outsourcing and the internationalisation of services. Differences in culture and language between countries can hamper internationalisation, since a number of KIBS industries are characterised by an intense interaction between the client and the service provider. Geographical proximity also helps service firms to understand the context of the

client and to exchange more tacit pieces of knowledge with the client. All these factors contribute to a strong local character of KIBS and many KIBS remain local even if technological change provides ways to deliver these services over distance.

Of course, there are other drivers and challenges that KIBS deal with in addition to those mentioned above. In general, it can be stated that the innovation processes and structures of the KIBS Sector are changing, so it is essential to examine future prospects. The different drivers and challenges lead to a number of so-called megatrends, which result from the interactions and combinations of the diverse issues mentioned before (Rubalcaba et al., 2008). The following areas must be analysed in this context: the relationship between industrialisation and customisation; service regression, which means that there is a trend of cost reduction in services; the rising significance of product-related services, the general population ageing; and the challenge of sustainable development.

In general, these findings support the observation that the KIBS sector as a whole should be politically supported by the implementation of an appropriate innovation policy. Creating framework conditions for the emergence and growth of KIBS will generate employment growth and more flexibility in the labour market (Evangelista and Savona, 2003).

3.2 Sector scenarios

The following scenarios build on some general trends which constitute the background for the scenarios proposed below. These general trends are:

- Economic growth is expected to continue at a rate similar to the past.
- Technological change in information and communication technologies is expected to proceed at considerable speed which means that new technological opportunities will open up.
- Policy measures such as regulation and restrictions to market access will not hamper service growth, outsourcing and international trade in services.
- Possible scenarios are considerably shaped by the heterogeneity of KIBS. It is extremely different to find a common trajectory for all KIBS sectors.

The approach is to develop scenarios of possible states of KIBS along two drivers. The future state of these drivers remains uncertain, but each driver nevertheless should be regarded as highly relevant for the future development of the sector. Each driver has two states; the combination of these two states results in four scenarios of possible future KIBS development. KIBS firms co-operate with their clients in service production, so the mode of co-operation with the client and the business environments of KIBS is used as the first driver. This first driver is called the state of the business environment. The driver has two possible states; it can be a stable, traditional environment, or a dynamic, flexible, virtual environment. To expand the scenario space, a second dimension is introduced which describes the degree of codification of the knowledge base of the individual/project/firm/sector. The codification dimension ranges from pure tacit knowledge, that can reproduced and transferred only at very high cost, to highly codifyable knowledge which can easily stored, reproduced and transferred, often via ICT.

Scenario "Customized delivery": The first scenario, which is characterized by a combination of a high degree of tacitness and a stable environment, is closest to established picture of consultants: internal experts who contribute to innovation and the provision of services at their clients. A characteristic of this scenario are stable supplier-client relationships which may be a good environment to codify knowledge. In the scenario, innovation is very much ad-hoc, involving co-production and creativity-based activities, so the opportunities for codification remain low despite the favourable environment. Growth of KIBS in this scenario will be a prolongation of the trend we have observed over the last 30 years; KIBS will play an increasing role in the innovation processes of their clients, fuelled by specialisation and cost advantages, and by the trend towards outsourcing. KIBS are provided by firms, rather than individual experts, who have a along-term relationship with their clients.

Scenario "Creativity & innovation": The combination of a high degree of tacitness and a dynamic environment results in a scenario where innovation activity is very much interactive and an industry structure that is fluid. Co-operation is often not very deep – information rather flows through 'weak ties' rather than year-long co-operation. Activity is mostly project-based and rests on individual people and their expertise rather than on the institutionalized firms. This scenario may be close to what is currently discussed as "open innovation". KIBS are often facilitators, by providing platforms to support exchange. This scenario implies a high degree of openness and a vivid exchange of ideas, which may bring forward new solutions to problems and a higher innovativeness in general. One can assume that this scenario will bring considerable growth potentials for KIBS because their integration into the innovation processes of client industries is easy in this scenario.

Scenario "R&D": This scenario is characterized by the combination of a low degree of tacitness and a dynamic environment. As a result, we see more opportunities for codification and a more decisive role of ICT for service provision. This will lead to a considerably higher degree of automatisation in this scenario. Growth prospects for KIBS are again favourable in this scenario, because it assumes a high degree of openness, user involvement and a more user-driven mode of innovation. Moreover, there may also be considerable growth prospects from the technology side, because the scenario assumes rapid progress in the codification of services which may lead to increasing returns to scale and decreasing unit costs of service provision.

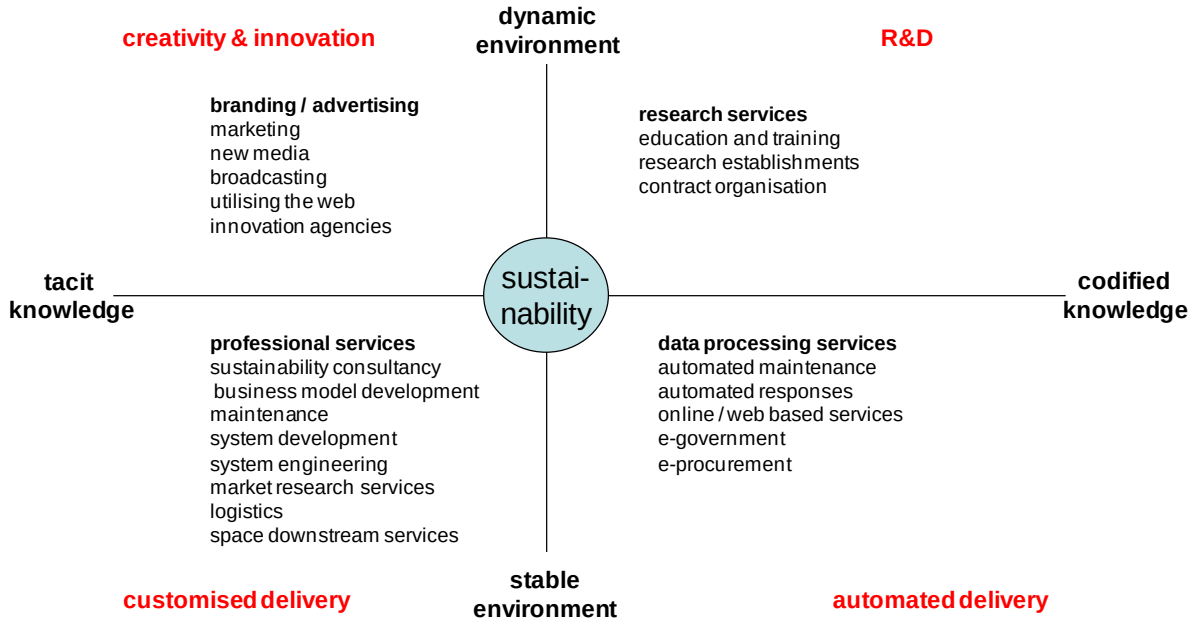
Scenario "Automated delivery": This scenario results from a combination of a low degree of tacitness and a stable environment. It shares the importance of ICT for service provision with the previous scenario. Co-operation in this scenario, however, is much more closed, the number of partners is smaller, and R&D and creativity proceeds in more stable, routinized way. This scenario is very similar to the "R&D" scenario with respect to growth prospects of KIBS. In contrast to "R&D", growth will mainly arise from codification, facilitated by the use of ICT. It will benefit considerably from cost degression, and only to a lesser extend from an expansion of KIBS involvement in the innovation processes of client industries.

KIBS are a heterogeneous group of service industries. Therefore, the four scenarios are not mutually excluding variants of possible futures, but as existing side by side. Firms that are characterized by

different scenarios may even be found in one sector. Hence, one scenario may be a plausible future for service industry A, but quite impossible for service industry B. To take this heterogeneity into account and further illustrate the quadrants, KIBS industries that represent the 'spirit' or dominant mode of innovation of each scenario have been identified. The "Creativity & innovation" scenario, for example, is best represented by the branding/advertising sector, while the current mode of service provision in professional and consultancy services fits best with the "customized delivery" scenario.

There may be also combinations of the scenarios, for example in the form of services based on a range of highly automatized standard products which can be customized to a certain extent. Banking is a good example for such a co-existence. There are internet-based standard accounts with a high degree of automatisation and almost no labour input, but also asset management with almost no industrialisation and a lot of personal contact between the service provider and the client. Gallouj (2002) has called this the 'dialectic between industrialisation and customisation': firms, on the one hand, provide highly standardized automated services in some areas, and labour-intensive, tailor-made services in the other areas.

Figure 3.1 The sectoral dimension of the KIBS scenarios



Source: Europe INNOVA Foresight workshops, June and December 2009

3.3 Future innovation themes and corresponding linkages with other sectors

Identifying innovation themes and new products and processes in KIBS is considerably more difficult in services than in manufacturing for various reasons; first, services are often not well-defined, indistinguishable products; KIBS in contrast, are often tailor-made, created as a response to the specific problems of the client and in interaction between client and service provider (Miles 2005). Second, the service is essentially co-produced with the client and very much content-specific. As a

result, differences between singular service cases can be huge and it cannot be said if a particular product variation is an innovation or not. Because of this heterogeneity, it is not feasible to identify a complete list of generic emerging innovation themes that are relevant in all KIBS.

Nevertheless, some examples for emerging innovation themes in KIBS can be given. Increasing computing capabilities as well as advances in describing and analyzing natural and social systems will provide new technological opportunities for computer simulations in all types of KIBS. Services based on these simulations will, for example, provide new ways of virtual testing.

In order to develop new service innovations, KIBS serve as key users and often as a lead user of new information and communication technologies (ICT), initially working as absorbers and adopters of innovations of the ICT sector. The influence of technological development on service products and processes and the specific use of ICT was first analysed by Quinn (1987). Ebling et al. (1998) demonstrated the empirical relevance of certain technologies for German service companies, showing, for example, that 87% of all innovative service companies regarded computer, electronic data processing, and other hardware as important for their innovation activities, closely followed by software application. In addition, 45% of the innovative service providers used high performance communication networks for the same reason (Hipp, 2008).

Recruiting the highly qualified staff that KIBS need is not easy and involves heavy search costs. In order to reduce the costs, electronic databases can be used. In general, it can be observed that the use of the Internet offers a growing range of new possibilities for services with high information input. KIBS and technology intensive services have higher expenses on electronic transactions than, for instance, retail trade or real estate services (Preissl, 2003). Also, Tether and Hipp (2002) showed that KIBS firms invest more heavily in ICT compared to other service firms.

By using new information, communication, and related technologies, KIBS enhance productivity in the whole economy by improving their own productivity figures. In particular, KIBS taking advantage of ICT plays an important role as a converter or broker of technological information. These KIBS act as providers, purchasers, and partners in the context of innovation. Windrum (2002) concluded that there is a positive association between KIBS and new, innovative technologies. For that reason, Czarnitzki and Spielkamp (2003) characterised KIBS as bridges for innovation because of their knowledge, creativity, and management skills. The increasing tradability of services and innovations in the field of communications and information technology promotes decentralisation, specialisation, and the division of labour in service and industrial activities. The prominent role of KIBS as an innovation broker leads to associated spillover effects on the whole productive system. In this sense, the introduction of ICT has unleashed important productivity enhancing effects in many service industries, for instance in service industries using ICT (van Ark et al., 2003).

Another generic emerging innovation theme in KIBS is convergence. Convergence implies that service activities and service products which have their origins in two or more different KIBS industries are becoming increasingly entangled (Toivonen 2004). Convergence can promote service innovation

because it offers new markets for service firms, but may also intensify competition. It leads to new, hybrid service offers that incorporate characteristics of various services. Another consequence is that sectoral boundaries inside the KIBS sector, but also between KIBS and some other service industries, are increasingly blurred. Future opportunities for KIBS will emerge to a considerable degree where boundaries between different sectors blur. Convergence can also be observed at a higher level. Some observers see blurring boundaries also between manufacturing and services (Pilat et al. 2006). Manufacturing firms are increasingly offering supplementary services to their products and raise the share of services on their turnover. Some firms even redefine themselves as KIBS – IBM being the most prominent example.

3.4 New requirements for sectoral innovation: new forms of knowledge, organisational and institutional change, regulatory frameworks

Due to the rising complexity of organisational processes, KIBS have to change and adapt along with other enterprises. KIBS provide services based on a level of professional knowledge with transactions made up of knowledge and often intangible output. In this context, innovations do not always have to have a technological background. Also, non-technological innovations play an important role. Examples of non-technological innovations are new marketing concepts, new client interfaces, new types of delivery organisations, and new smart combinations of service and product elements or new organisational concepts (Rubalcaba et al., 2008).

It can be concluded that there are, next to product and service innovations, other types of innovations of high importance for KIBS, namely marketing and organisational innovations. The changes in marketing and organisational re-structuring are often continuous processes and essential activities to maintain the firm's competitiveness (Schubert, 2009). In the Community Innovation Survey (CIS2004), marketing innovations were split into changes to design and packaging, product promotion, product placement, and pricing, whereas in the area of organisational innovation, distinctions were made between changes to business practices, knowledge management, the organisation of work responsibility and decision-making, and the organisation of external relations. Over two-thirds of KIBS Firms introduced organisational innovations during the survey period.

Innovations usually result from a new combination of knowledge and not from a new combination of physical products (Amara et al., 2008). According to the survey of Czarnitzki and Spielkamp (2003), KIBS are more likely to co-operate in innovation projects than other companies in the service sector, as mentioned previously. KIBS not only use external information sources, but are also active contributors to the innovation process itself. In this context, KIBS are able and willing to co-operate with other firms.

A number of studies that compare skills intensity across the economy have pointed out that skills requirements in KIBS are considerably higher than in many other sectors. Business services are classified as "high" or "very high" in a sectoral classification of educational intensity brought forward by

Peneder (2007). According to Peneder, skills requirements in KIBS are also higher than in most manufacturing sectors including automotive, chemicals or mechanical engineering. Additional figures are presented by Miles (2005) who shows that a total of 40 per cent of business services personnel in the EU15 and 36 per cent in the EU10 were classified under high skills. Moreover, compared to the business sector, personnel cost account for twice the share on total cost in KIBS (EUROSTAT 2008). The high importance of skills for KIBS in combination with the heterogeneity of the sector, however, makes it also difficult to say exactly what skills are important for future development.

3.5 Sectoral innovation policy in a scenario framework

The future development of KIBS will be driven by various factors – developments in technology, changes in clients sectors, but also social factors and influences from the general economic and political level. Four scenarios of future development of KIBS based on technology (codification) and the environmental factors were sketched. The four scenarios describe possible future developments of various KIBS sectors – they are not exclusive, but allow different possible futures to exist side by side in various sectors. This section will discuss policy issues related to the four scenarios. Each of them includes different hampering factors for development and poses its own challenges and opportunities to policy.

Policies to support the "Automated delivery" scenario: Growth in the "Automated delivery" scenario is mainly driven by codification of knowledge, the use of ICT, and the automated provision of services which allows considerable economies of scale and scope. The prominence of codification in this scenario points to the importance of measures to protect intellectual property rights (IPRs) in this scenario. Measures to ensure a high degree of IPR protection and encourage firms to make use of IPRs can create incentives to innovate, because it allows firms to reap a higher benefit from their innovations. Differences between the private and the social returns to innovation are an important type of market failure. IPRs are less frequently used in the service sector compared to manufacturing (van Cruysen and Hollanders 2008), which may justify policy intervention. However, critics also argue that a too strict protection of IPRs may also have the opposite effect, by hampering knowledge diffusion and circumventing innovation that build on prior discoveries.

Scientific knowledge, in particular information technologies and computer sciences, is an important source of innovation in the "Automated delivery" scenario. A considerable number of market entries are supposed to be technology-based start-ups with a university background. To further spur innovation, an increased exchange of information and knowledge between service firms and the science sector could be advantageous. Empirical evidence suggests that service firms co-operate less frequently with science than manufacturing firms. This can be partly explained by a lack of resources in small firms necessary to co-operate and asymmetric information. Policy could stimulate this exchange with programmes that target particular fields in the service sector.

Another potential field for policy intervention is standardisation of services. More standards for services may allow a higher degree of transparency and comparability in services. Companies and

governments in Europe spend a huge amount of money on KIBS each year. In many cases, however, it is difficult to tell what you get for the money and if services offered by one company are better than a service offered by another company. Firms find it difficult to compare the quality of services ex-ante because there is information asymmetry between the buyer and the seller. Moreover, many services are very much customer-specific and hardly a well-defined, distinguishable product. A lack of transparency even becomes more pressing for service clients with the liberalisation of many service industries, which leads to a rise in the number of service providers and in variety of services offered. Transparency may be increased by more standardisation of services and a common terminology to describe the contents and functionalities of services.

Policies to support the "R&D" scenario: In contrast to "Automated delivery" scenario, the "R&D" scenario is characterised by a stable environment with a mature market where big companies dominate. Service challenges include internationalisation and international outsourcing. As a consequence, issues related to the International regulatory frameworks for KIBS come into focus for policy in this scenario. Regulation can remove legislative barriers that hamper the mobility of KIBS and KIBS workers. This includes, for example, regulation concerning market access. Policy can facilitate internationalisation and trans-border operations of KIBS by new international regulatory frameworks. A new protectionism, which may arise as a consequence of the current economic crisis, may have the adverse effect on internationalisation and growth prospects of KIBS. If countries start to increasingly protect domestic markets from foreign competition, the internationalisation trend and associated welfare gains from increased specialisation and increasing returns to scale may come to an abrupt stop. KIBS service providers may instead focus on their domestic markets.

Another challenge related to asymmetric information is privacy and data security. In the outsourcing process, clients have to reveal key sensible information to external service providers. An increased public awareness of security issues may lead to more opposition against outsourcing. Firms may become more sceptical to hand over central business processes to third parties, even at the consequence that costs for in-house provision become higher. As a result, firms may see limits to outsourcing, which pose, at an economy-wide stage, barriers to the process and may even reverse the level of outsourcing in the economy. Policy initiatives that help increasing trust may overcome this hampering factor.

Policies to support the "Creativity and innovation" scenario: The "Creativity and innovation" scenario is characterised by a high degree of openness, a fluid, dynamic environment with considerable opportunities for market entrants and a high number of small companies. Services are based on highly experienced individuals rather than on ICT and automatisation, which sets limits to automatisation and economies of scale. The paramount importance of skilled individuals in this scenario points to the importance of policies towards increases in qualifications and skills that help firms to overcome problems from a lack of qualified personnel. According to CIS results, al lack of qualified personnel is one of the most severe hampering factors for innovation in KIBS (van Cruysen and Hollanders, 2008). This includes, on the one hand, individuals with tertiary education. However,

as van Cruysen and Hollanders point out, there is also demand for other, non-tertiary jobs due to the considerable heterogeneity of the service industries. A wide range of skills can be acquired through vocational training and training on the job. Policy intervention in the supply of qualified personnel should target measures to increase the number of people who take up tertiary education, support training on the job, but also labour mobility which may help to overcome regional shortages in skilled personnel. In the “Creativity and innovation”-scenario, a public policy may therefore have a strong focus on overcoming the market failures related to start-up financing. There is massive asymmetric information between entrepreneurs and financiers of new ventures, which may call for public intervention. In addition, small businesses are mostly bound to operate in domestic markets and in certain sub sectors after the start-up phase because they lack the capital and resources for expansion.

Policies to support the “Customized delivery” scenario: This scenario is closest to established picture of consultants; a high degree of tacitness and a stable environment creates conditions where the favourite organisational form are firms with highly knowledgeable internal experts who contribute to innovation and the provision of services at their clients. Innovation in firms in this scenario may suffer from a number of hampering factors already discussed for other scenarios. In addition, firms may also suffer from a lack of support from innovation programs in general. There is evidence from the CIS reported by van Cruysen and Hollanders (2008) that a considerably lower share of service firms receive public funding for innovation compared to manufacturing firms. This may point to a bias in national as well as EU funding schemes which may lead to a situation where many potential innovations in services are not realized. Policy should be aware of the peculiarities of services and service innovation and how they may interfere with the design of policy measures.

Another field for policy intervention in the “Customized delivery” is the access to external funding. It has already been discussed that support for start-ups in KIBS may be even more important than in manufacturing because of the higher share of start-ups and a potential lack of funding. The same is true for access to external funding for later stages in firm growth. Problems of finance may arise due to underdeveloped venture capital markets within Europe. It may be even worsened by the fact that the production factors of most KIBS are intangible in nature and difficult to offer as a deposit to a bank. Again, the problem of external funding is related to market failures from information asymmetries.

4. Barriers to innovation

4.1 Market factors affecting innovation

As analyses of CIS4 data has shown, the most important drivers for KIBS to innovate are benefits for the reduction of cost labour, ability to respond fast to clients, improved product flexibility, likely increases in market share and collaboration with external partners. Also ranking within the top ten drivers are the need for increased range of products and their quality, employee satisfaction and access to European funds for research. The need to reduce materials and energy usage might be hindering innovation in the KIBS sector.

In the KIBS sector, the survey results suggest that firms clearly engage more in innovation related to services and products. Remarkable, KIBS firm rank top of the list in service innovation. In opposition, innovation in manufacturing methods, design and logistics are lower in KIBS compared to the average value in all other sectors. Survey respondents perceive innovations as having an overall positive effect on their company's competitiveness, brand image and technical risk, so it has to be investigated which market factors affect service innovation primarily.

Summarizing, the survey results confirmed the factors stressed by literature as positive drivers for innovation, and in addition, found a number of variables that are also contributing to innovation in KIBS firms. These additional factors include: increased demand for products and inputs in Asia and Eastern Europe, market expansion in new emerging and transition economies, life cycle of goods, products, machinery and equipment, and heterogeneity of customer base. In contrast to the literature, the results found that competition originated inside Europe is also a positive factor to innovation. In general, literature on the effects of specific factors of the business environment affecting KIBS firm's innovation responses is difficult to be found. Survey results show, that in-house know-how and access to information are factors driving innovation efforts, being the former variable the most important factor fostering innovation in KIBS firms. The survey results also suggest that collaboration and open innovation of KIBS firms with customers and suppliers is seen as a positive driver for innovation.

4.2 Regulation and innovation

Regulation and standards in the KIBS sector do not play an important role regarding innovation issues. Literature on innovation in services suggests that firms face an increasingly dense regulatory framework. The field of environmental, hazardous materials, health and safety regulation, taxation or other fields where KIBS firms provide advice are examples of this. Regulations are in turn regarded as positive drivers for innovation (Dachs 2010). However, the literature also reports that excessive regulations may hinder innovation in the service sector as a whole (Rubalcaba 2007). It is also suggested that differences in rules and regulations in different countries may hinder innovation in KIBS across national boundaries (Dachs 2010). Interoperability between old and new standards and setting up industrial standards are additional factors fostering innovation. Protection through IPR can

constitute an additional incentive to innovate, but monopoly protection hinders the diffusion of new technologies and services (Amara et al. 2008). Finally, differences in judicial and regulatory systems, communications regulations, price regulations and fiscal and taxation regimes across Europe also constitute important innovation barriers in the KIBS sector (Dachs 2010). The survey results only find 'setting up new industrial standards' as a clear driver to innovation in KIBS firms, but this variable is not associated with any of the innovation types. Overall, the results of the correlation analysis suggested a rather moderate association between regulation and the different types of innovations in KIBS industries. There are only very few regulations, which are strongly correlated to innovation in KIBS firms.

4.3 Systemic failures

The most important factors hampering innovation in KIBS industries are grouped under market and regulatory failures. The market factors having a negative effect on innovation in this sector includes globalisation and international competition. For the KIBS sector, increasing patterns of globalisation of production and technology have led to increased international competition. KIBS firms often have to struggle with competitors in a worldwide contest.

In addition, labour costs and relocation of labour outside Europe, market protectionism, trade agreements, and insufficient government expenditure and procurement are also perceived as hampering factors for innovation in this sector. Furthermore, insufficient access to capital and information has always been considered a factor that may slow down innovation activities of firms.

The regulation factors having a negative effect on innovation in this sector comprises particularly IPR. For example, patent protection often is denied to service innovations. Also, protection through IPR can constitute an additional incentive to innovate, but monopoly protection hinders the diffusion of new technologies and services. Other hampering factors of regulation effects on KIBS innovation are stated to be the predominant fiscal & taxation regime and market regulations.

5. Horizontal issues relevant to the sector

In the present chapter, the main issues of five horizontal reports relevant for the services sector are presented and discussed.

Impact of technological specialisation on economic performance: In the Task 4 analysis on national specialisation, KIBS were excluded from patent based analysis. But the analysis of innovative performance covered services. In order to measure innovative performance at the country level, the following indicators have been used:

- Share of product innovators
- Share of process innovators
- Share of turnover due to new products in 2004
- Cost reductions due to process innovations relative to turnover in 2004

Results show that some countries are specialised in certain types of innovation. For example Portugal primarily reduced costs, while its product palette is (relatively) dominated by products older than 3 years. The same holds true for Latvia. On the contrary, Bulgaria has the highest share of turnover with new products (16%), while it is only slightly above average with respect to cost reduction. The choice between different types of innovation is probably driven by the position on foreign and domestic markets. Inasmuch the positions differ, also the innovation paths differ. In general, cost reductions play a less decisive role in KIBS than in most other sectors of production. On the contrary, turnover with new products is quite high in services. This most likely reflects product intangibility of services, and low potentials for cost reduction.

Impact of innovation on high-growth companies: Considering the growth rates of firms, it appears that there are many KIBS companies which are considered to be high-growth. Within the Task 4 Horizontal Report 5 on gazelles, the investigation focused on whether high-growth companies are more likely to be found in growing industries such as knowledge intensive business services, than in stagnating industries. The results of the report tend to support this thesis. From a practical point of view, the authors conclude that high firm growth is most likely affected by industry.

Impact of organisational innovation: Results show how advances in innovation in the services industry are more intimately connected with the introduction of new organisational arrangements than their counterparts in the manufacturing sector, which are more technological product/process related. Additionally, organisational innovation increases progressively with the size of enterprises, thus turning large firms within the services sector into major originators and adopters of organisational improvements in the economy.

The more intangible nature of non-technological-based organisational innovations encourages significant impacts related to quality and client/provider/employee satisfaction, rather than those purely focused on costs and savings, which are more important in goods-related innovation. However, a

variety of organisational innovations also impel increasing business productivity gains in terms of costs and savings, the effects of which may be underestimated. Thus, to better approach and assess those potential benefits coming from the introduction of organisational innovations, it is essential to not only enquire as to whether companies implemented organisational innovations at all, but also to discover which particular kind of organisational innovation was implemented.

Technological and non-technological innovations should not be considered in isolation, but as complementary forces that, in combination, may lead to firms' improved productivity, flexibility and quality gains. Analysis has proved relevant correspondences between the introduction and use of ICT business tools and organisational innovation developments. In this respect, an effective exploitation of new technologies often involves complementary changes in administration and organisational structures within companies; whereas investment in ICT turns out to be more productive when organisational changes have been implemented in the firm. Moreover, the personnel training input factor has revealed a positive and significant relationship with respect to the introduction of new organisational progresses by service firms, which may also be highlighting a relevant policy action in searching for increasing innovation developments and performance in service-related activities.

Impact of Eco-innovation opportunities: The environmental impact from traditional services is mainly attributed to travelling, buildings and tools. Although Knowledge Intensive Business Services have limited CO2 emissions as compared to other industries, countries with a strong orientation towards services are considered in the top global polluters. It has been argued that the dematerialisation of the economy does not necessarily leads to a reduction of the environmental impact of a country. Yet, this environmental pressure is only indirectly related to the service industry. Therefore, opportunities for the reduction of environmental impact partially lies within the scope of the way services are offered (Gadrey 2009).

KIBS services are perceived as a solution to the environmental problems in other sectors. Consulting services can implement ICT applications which reduce energy consumption in other industries and products through energy saving applications such as smart homes, smart buildings, or smart transportation systems (OECD 2009). Little is said of the environmental impact of KIBS so identifying eco-innovation opportunities that may alleviate its carbon footprint is difficult. Eco-innovation opportunities which are related to the environmental impacts of KIBS organisations themselves may entail implementation of new communication technologies, improvements in logistics and technological improvements to decrease the environmental impact of tools. In the case of organisational and process innovation, eco-innovation opportunities which are directly related to the environmental and energy efficiency impacts of KIBS entail the implementation of new communication technologies or improvements in logistics and technological improvements to decrease the environmental impact of tools. For the case of service innovation, opportunities for eco-innovation for KIBS organisations mainly lie in the development of environmental services which help other companies to reduce their environmental impact.

In the KIBS sector, relationship of environmental regulation with different types of innovation activities was found weak. Product innovation is associated with environmental and energy regulations, innovation in designs is associated with hazardous and alternative materials regulations as well as with waste regulations. Weak associations were found also between waste regulations and REACH and innovation in services and sales and distribution methods respectively.

Impact of innovation on new lead markets: Only one out of six sectors identified as lead markets by the lead market initiative (LMI) includes activities which are usually regarded as services (e-health). But it is argued that this fact is due to some propensities of service goods that make them difficult to address with the instruments of the LMI. Services differ from material products, therefore the concept of lead markets have to be extended to services. Four service characteristics (industrialisation, tradeability, service specitity and standardization, innovativeness) are used as a set of criteria to judge if a certain service meets the basic requirements for lead market development. In order to evolve into a lead market, it should be possible to codify automatize and/or modularize the service in order to reap cost advantages with increasing production size; the service should be tradeable, tangible and storable to a certain degree; if should have a certain level of specifity and allow to compare it before consumption; a certain level of innovativeness should be inherent to the sector which offers this service.

The lead market report suggests that the most promising industries for the evolvement of new lead markets in services are communication services, financial services and computer services, which are all part of the knowledge intensive services sector. These industries combine a high degree of tradeability and innovativeness with opportunities for industrialisation. Moreover, the degree of specifity is high, at least in some types of these services. Other industries like business services, R&D services, insurance, renting and real estate share with the former group a high degree of tradeability and opportunities for industrialisation. The degree of customized or bespoke services, however, is higher in these sectors.

6. Policy analysis and conclusions

Deregulation as a process by which governments remove, reduce or simplify restrictions on business activities with the intent of encouraging the efficient operation of private markets, can offer opportunities for business services. In this context, government is seen as a key actor which must provide a policy and regulatory framework to encourage innovation and the competitive edge of economies. Policies to set better framework conditions for innovation are even more relevant. It is clear that the design of policies that facilitate the creation of new markets must be underpinned by smart regulation which promotes innovation and foster competitiveness.

Results of the study show that KIBS are more intensively engaged in innovation and training activities than their manufacturing counterparts, but at the same time are less likely to collaborate with international partners or perform internal R&D. In addition, KIBS innovativeness is strongly associated with highly qualified employees and intense collaboration with local customers and suppliers as compared to manufacturing firms. In the following, the most promising policy implications, which take into account the mentioned specifities, are presented:

Holistic approach for goods and services: Processes have to be considered across the whole supply and value chain. A clear separation between goods and services is no longer suitable. Also, in policy analysis and consulting, a holistic approach has to be preferred. Thereby, a service culture in companies and a service paradigm in society could be established.

Education of qualified personnel: Knowledge, innovation and willingness to learn, will be crucial to differentiate european firms from asian competitors in the long term. In this context, KIBS are playing a particularly important role and should be increasingly integrated into the teaching, transfer and knowledge generation process. The paramount importance of skilled individuals in KIBS points to the importance of policies towards increases in qualifications and skills that help firms to overcome problems from a lack of qualified personnel. According to CIS results, a lack of qualified personnel is one of the most severe hampering factors for innovation in KIBS. This includes, on the one hand, individuals with tertiary education. However, there is also demand for other, non-tertiary jobs due to the considerable heterogeneity of the service industries. By means of supporting the knowledge generation and qualification in service education, a new generation of workforce which is and more sensitized in service peculiarities, could enter the labour market. This next generation has to be trained according to new challenges. They have to learn how to aquire knowledge, to process a better understanding, to actively and creatively apply their knowledge in order to develop new service applications and technologies. In contrast to many Asian countries, where mainly memorizing and factual knowledge is taughted, employees in Europe must be able to deal with interfaces creatively and develop solutions situationally. A wide range of skills can be acquired through vocational training and training on the job. Policy intervention in the supply of qualified personnel should target measures to increase the number of people who take up tertiary education, support training on the job, but also labour mobility which may help to overcome regional shortages in skilled personnel.

Public funding and financial incentives for service innovation: Various policy measures may influence the use of KIBS. This includes, for instance, public funding and subsidies, as well as support for the use of various types of R&D-related services. Service firms may suffer from a lack of support from innovation programs in general. There is evidence from CIS that a considerably lower share of service firms receive public funding for innovation compared to manufacturing firms. This may point to a bias in national as well as EU funding schemes which may lead to a situation where many potential innovations in services are not realized. Policy should be aware of the peculiarities of services and service innovation and how they may interfere with the design of policy measures. Most of KIBS firms are relatively small, and therefore they have to deal with typical problems of SME´s like complicated access to capital and financial funding. The introduction of innovation vouchers, which can be spend very flexible and only if necessary, would help to deal with KIBS´s heterogeneity and offer incentives to innovate. A similar approach would be, to give taxation reductions to certain innovation activities of small firms.

Cooperation programmes: To further spur innovation, an increased exchange of information and knowledge between service firms and the science sector could be advantageous. Empirical evidence suggests that service firms co-operate less frequently with science than manufacturing firms. This can be partly explained by a lack of resources in small firms necessary to co-operate and asymmetric information. On the other hand, loosely-coupled collaboration and external knowledge sourcing strategies foster research collaborations with universities and other institutions. Policy could stimulate this exchange with programmes that target particular fields in the service sector.

Access to international markets: Service challenges include internationalisation and international outsourcing. As a consequence, issues related to the international regulatory frameworks for KIBS come into focus for policy. Regulation can remove legislative barriers that hamper the mobility of KIBS and KIBS workers. This includes, for example, regulation concerning market access. Policy can facilitate internationalisation and trans-border operations of KIBS by new international regulatory frameworks.

Appropriate protection through IPR: The prominence of codification in several scenarios points to the importance of measures to protect IPRs. Arrangements to ensure a high degree of IPR protection and encourage firms to make use of IPRs can create incentives to innovate, because it allows firms to reap a higher benefit from their innovations. IPRs are less frequently used in the service sector compared to manufacturing, which may justify policy intervention. However, critics also argue that a too strict protection of IPRs may also have the opposite effect, by hampering knowledge diffusion and circumventing innovation that build on prior discoveries. Through integration of the ongoing open innovation discussion in the current IPR regime, an integrative approach could be found, which sets framework conditions for innovative service firms. Each firm would have coverage for its own flexible composition of individual innovation activities. These involves not necessarily IPR regulation, but furthermore consulting in strategic protection mechanisms or support in the exemplary design of cooperation with suppliers and customers.

Standardisation of services: Another potential field for policy intervention is standardisation of services. More standards for services may allow a higher degree of transparency and comparability in services. Firms find it difficult to compare the quality of services ex-ante because there is an information asymmetry between the buyer and the seller. Moreover, many services are very much customer-specific and hardly a well-defined, distinguishable product. A lack of transparency even becomes more pressing for service clients with the liberalisation of many service industries, which leads to a rise in the number of service providers and in variety of services offered. Transparency may be increased by more standardisation of services and a common terminology to describe the contents and functionalities of services. With the help of a European-wide service quality standard, service firms could try to achieve this award and use its reputation to send signals of quality to potential customers. Trust and assurance of consumers in new innovative service products would be increased.

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Annex Statistical classification of activities and the knowledge intensive services sector

Categorisation shifts occurring between NACE Revision 1.1 and Revision 2 are briefly regarded as a way to see the similarities and differences in the two forms of classification. Apart from changes in the categorisation numbers, some differences may be observed between the classification forms. In this respect, the NACE 72 sector (in NACE Rev. 1.1) has been mainly differentiated into 'computer programming, consultancy and related activities' and 'information service activities', although other minor activities included in the previously aggregated NACE sector have been transferred to more specific NACE groups, such as the case of 'publishing activities' and 'repair of computers' as observed in Table 1.11. On the other hand, the 'other business activities' sector (in NACE Rev. 1.1) has been disaggregated into various activity levels in NACE Rev. 2. This is particularly true for professional services such as legal, accounting, auditing activities, tax and management consulting, and market research, among others, which form a NACE group of their own. This may reflect the increasing importance, in terms of employment and added value, of such services in modern economies.

NACE 1.1	NACE 2
61 Water transport 61.1 Sea and coastal water transport 61.2 Inland water transport	**50 Water transport** 50.1 Sea and coastal passenger water transport 50.2 Sea and coastal freight water transport 50.3 Inland passenger water transport 50.4 Inland freight water transport
62 Air transport 62.1 Scheduled air transport 62.2 Non-scheduled air transport 62.3 Space transport	**51 Air transport** 51.1 Passenger air transport 51.2 Freight air transport and space transport
64 Post and telecommunications 64.1 Post and courier activities 64.2 Telecommunications	**53 Postal and courier activities** 53.1 Postal activities under universal service obligation 53.2 Other postal and courier activities **61 Telecommunications** 61.1 Wired telecommunications activities 61.2 Wireless telecommunications activities 61.3 Satellite telecommunications activities 61.9 Other telecommunications activities
65 Financial intermediation, except insurance and pension funding 65.1 Monetary intermediation 65.2 Other financial intermediation	**64 Financial service activities, except insurance and pension funding** 64.1 Monetary intermediation 64.2 Activities of holding companies 64.3 Trusts, funds and similar financial entities 64.9 Other financial service activities, except insurance and pension funding
66 Insurance and pension funding, except compulsory social security	**65 Insurance, reinsurance and pension funding, except compulsory social security** 65.1 Insurance 65.2 Reinsurance 65.3 Pension funding
67 Activities auxiliary to financial intermediation 67.1 Activities auxiliary to financial intermediation, except insurance and pension funding 67.2 Activities auxiliary to insurance and pension funding	**66 Activities auxiliary to financial services and insurance activities** 66.1 Activities auxiliary to financial services, except insurance and pension funding 66.2 Activities auxiliary to insurance and pension funding 66.3 Fund management activities
70 Real estate activities 70.1 Real estate activities with own property 70.2 Letting of own property	**68 Real estate activities** 68.1 Buying and selling of own real estate 68.2 Renting and operating of own or leased real estate

70.3 Real estate activities on a fee or contract basis	68.3 Real estate activities on a fee or contract basis
71 Renting of machinery and equipment without operator and of personal and household goods 71.1 Renting of automobiles 71.2 Renting of other transport equipment 71.3 Renting of other machinery and equipment 71.4 Renting of personal and household goods	**77 Rental and leasing activities** 77.1 Renting and leasing of motor vehicles 77.2 Renting and leasing of personal and household goods 77.3 Renting and leasing of other machinery, equipment and tangible goods
72 Computer and related activities 72.1 Hardware consultancy 72.2 Software consultancy and supply 72.3 Data processing 72.4 Database activities 72.5 Maintenance and repair of office, accounting and computing machinery 72.6 Other computer related activities	**62 Computer programming, consultancy and related activities** 62.0 Computer programming, consultancy and related activities **63 Information service activities** 63.1 Data processing, hosting and related activities; web portals **95 Repair of computers and personal and household goods** 95.1 Repair of computers and communication equipment **58 Publishing activities** 58.1 Publishing of books, periodicals and other publishing activities 58.2 Software publishing
73 Research and development 73.1 Research and experimental development on natural sciences and engineering 73.2 Research and experimental development on social sciences and humanities	**72 Scientific research and development** 72.1 Research and experimental development on natural sciences and engineering 72.2 Research and experimental development on social sciences and humanities
74 Other business activities 74.1 Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling; business and management consultancy; holdings 74.2 Architectural and engineering activities and related technical consultancy 74.3 Technical testing and analysis 74.4 Advertising 74.5 Labour recruitment and provision of personnel 74.6 Investigation and security activities 74.7 Industrial cleaning 74.8 Miscellaneous business activities	**69 Legal and accounting activities** 69.1 Legal activities 69.2 Accounting, bookkeeping and auditing activities; tax consultancy **70 Activities of head offices; management consultancy activities** 70.1 Activities of head offices 70.2 Management consultancy activities **71 Architectural and engineering activities; technical testing and analysis** 71.1 Architectural and engineering activities and related technical consultancy 71.2 Technical testing and analysis **73 Advertising and market research** 73.1 Advertising 73.2 Market research and public opinion polling **74 Other professional, scientific and technical activities** 74.1 Specialised design activities 74.2 Photographic activities 74.3 Translation and interpretation activities 74.9 Other professional, scientific and technical activities **77 Rental and leasing activities** 77.4 Leasing of intellectual property and similar products, except copyrighted works **78 Employment activities** 78.1 Activities of employment placement agencies 78.2 Temporary employment agency activities 78.3 Other human resources provision **80 Security and investigation activities** 80.1 Private security activities 80.2 Security systems service activities 80.3 Investigation activities **81 Services to buildings and landscape activities** 81.2 Cleaning activities **82 Office administrative, office support and other business support activities** 82.1 Office administrative and support activities 82.2 Activities of call centres

	82.3 Organisation of conventions and trade shows 82.9 Business support service activities **85 Education** 85.6 Educational support activities
80 Education 80.1 Primary education 80.2 Secondary education 80.3 Higher education 80.4 Adult and other education	**85 Education** 85.1 Pre-primary education 85.2 Primary education 85.3 Secondary education 85.4 Higher education 85.5 Other education
85 Health and social work 85.1 Human health activities 85.2 Veterinary activities 85.3 Social work activities	**86 Human health activities** 86.1 Hospital activities 86.2 Medical and dental practice activities 86.9 Other human health activities **87 Residential care activities** 87.1 Residential nursing care activities 87.2 Residential care activities for mental retardation, mental health and substance abuse 87.3 Residential care activities for the elderly and disabled 87.9 Other residential care activities **88 Social work activities without accommodation** 88.1 Social work activities without accommodation for the elderly and disabled 88.9 Other social work activities without accommodation
92 Recreational, cultural and sporting activities **92.1 Motion picture and video activities** **92.2 Radio and television activities** **92.3 Other entertainment activities** **92.4 News agency activities** **92.5 Library, archives, museums and other cultural activities** **92.6 Sporting activities** **92.7 Other recreational activities**	**90 Creative, arts and entertainment activities** 90.0 Creative, arts and entertainment activities **91 Libraries, archives, museums and other cultural activities** 91.0 Libraries, archives, museums and other cultural activities **92 Gambling and betting activities** 92.0 Gambling and betting activities **93 Sports activities and amusement and recreation activities** 93.1 Sports activities 93.2 Amusement and recreation activities

Annex Overview SIW deliverables

Overview of the deliverables from the Europe INNOVA Sectoral Innovation Watch

Deliverables can be downloaded from www.europe-innova.eu

Task 1 Innovation Performance Sectoral Reports

Ploder, M., C. Hartmann, E. Veres, B. Bertram (2010) Sectoral Innovation Performance in the Automotive Sector, Final Report Task 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, June 2010, revised December 2010

Enzing, C.M. and T. van der Valk (2010) Sectoral Innovation Performance in the Biotechnology Sector, Final Report Task 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, November 2010

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Gotsch, M., C. Hipp, J. Gallego and L. Rubalcaba (2010) Sectoral Innovation Performance in the Knowledge Intensive Business Services, Final Report Task 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, June 2010

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Broek, van den T. and A. van der Giessen (2010 Sectoral Innovation Foresight - Electrical and Optical Equipment Sector, Final Report Task 2, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2010

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Dachs, B. (2010) Sectoral Innovation Foresight – Knowledge Intensive Business Services Sector, Final Report Task 2, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2010

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Zahradnik, G., B, Dachs and M. Weber (2010 Sectoral Innovation Foresight - Textiles and Clothing Sector, Final Report Task 2, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2010

Giesecke, S. and P. Schaper-Rinkel (2010) Sectoral Innovation Foresight - Wholesale and Retail Trade Sector, Final Report Task 2, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2010

Task 3 Market and Regulatory Factors

Montalvo, c. and O. Koops (2011) Analysis of market and regulatory factors influencing innovation: Sectoral patterns and national differences, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

Montalvo, C., K. Pihor and M. Ploder (2011) Analysis of market and regulatory factors influencing sector innovation patterns – Automotive Sector, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

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Montalvo, C., K. Pihor and T. van den Broek (2011) Analysis of market and regulatory factors influencing sector innovation patterns – Electrical and Optical Equipment Sector, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

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Montalvo, C., F. Diaz Lopez, M. Gotsch and C. Hipp (2011) Analysis of market and regulatory factors influencing sector innovation patterns – Knowledge Intensive Business Services Sector, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

Montalvo, C., A. van der Giessen and F. Brandes (2011) Analysis of market and regulatory factors influencing sector innovation patterns – Space and Aeronautics Sectors, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

Montalvo, C., K. Pihor and B. Dachs (2011) Analysis of market and regulatory factors influencing sector innovation patterns – Textiles and Clothing Sector, Final Report Task 3, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

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Task 4 Horizontal Reports

H. Grupp†, D. Fornahl, C.A.Tran, J. Stohr, T. Schubert, F. Malerba, Montobbio F., L. Cusmano, E. Bacchiocchi, F. Puzone, (2010) National Specialisation and Innovation Performance, Final Report Task 4 Horizontal Report 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, March 2010

H. Grupp†, D. Fornahl, C.A.Tran, J. Stohr, T. Schubert, F. Malerba, Montobbio F., L. Cusmano, E. Bacchiocchi, F. Puzone (2010) Appendix to National Specialisation and Innovation Performance, Final Report Task 4 Horizontal Report 1, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, March 2010

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Dachs, B., I. Wanzenböck, M. Weber, J. Hyvönen and H. Toivanen (2011) Lead Markets, Final Report Task 4, Horizontal Report 3, for DG Enterprise and Industry, European Commission, March 2011

Montalvo, C., Diaz Lopez F.J., and F. Brandes, (2011) Potential for eco-innovation in nine sectors of the European economy, Final Report Task 4, Horizontal Report 4, Europe INNOVA Sectoral Innovation Watch, DG Enterprise and Industry, European Commission, December 2011

Mitusch K. and A. Schimke (2011) Gazelles – High-Growth Companies, Final Report Task 4, Horizontal Report 5, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, January 2011

Task 5 Input and Output Papers

Mitusch, K., C.A. Tran, J. Stohr, F. Montobbio, L. Cusmano and F. Malerba (2010) National Specialisation Report, Input Paper to the workshop ´Tomorrow's innovative industries: Regional and national specialisation patterns and the role of the regional business environment', Task 5, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, May 2010

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Rubalcaba L., J. Gallego and Hipp C. (2011) Organisational innovation, service innovation, and the value chain: New trends and policy implications. Input paper for the Workshop on the 25th of January 2011, Task 5, Europe INNOVA Sectoral Innovation Watch, DG Enterprise and Industry, European Commission, January 2011

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Mitusch, K. and A. Schimke (2011) Gazelles – High-Growth Companies, Workshop Output Paper 'Gazelles as drivers for job creation and innovation: How to support hem best?', Task 5, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, February 2011

Final Sectoral Reports

Ploder, M. (2011) Sectoral Innovation Watch – Automotive Sector, Final Sector Report, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011

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Dachs, B., G. Zahradnik and M. Weber (2011) Sectoral Innovation Watch – Textiles and Clothing Sector, Final Sector Report, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, December 2011

Final Synthesis Report

Montalvo C. and A. van der Giessen (2011) Sectoral Innovation Watch – Synthesis Report, Europe INNOVA Sectoral Innovation Watch, for DG Enterprise and Industry, European Commission, December 2011.