## B 5 USING THE OPPORTUNITIES OF KNOWLEDGE-INTENSIVE SERVICES

### Growth through knowledge

In addition to the traditional production factors Labour, Capital, and Natural resources, the "fourth factor" of Information and Knowledge is becoming increasingly important in the 21st century. The concept of the "Quaternary Sector" was proposed for this in the 1970s. Some 40 percent of the German workforce are already involved in knowledge-based activities.

Without doubt, knowledge-intensive services have been a key engine for growth and employment for at least a decade in Germany (Fig. 07). The same applies for most other industrial countries. The competition between the federal states in Germany has already begun, as shown by "WissensWirtschaft. NRW – Looking for the best knowledge-intensive services in the value-creation chain."[84] The question is how German businesses should best make use of the opportunities of structural change in the face of international competition.

The EFI Report 2008 drew attention to the importance of services for the economic performance of Germany, and called for more attention to be paid to the services components in all sectors of the High-Tech Strategy, in particular for product-related services. In addition it called for services-related innovations research to be strengthened: there are still deficits here. In 2008, the Expert Commission commissioned two studies on knowledge-intensive services and the effects of the organisation of services on innovations.[85] The results of these investigations have been drawn on for the following assessment.

### Knowledge-intensive services as element of the economic structure

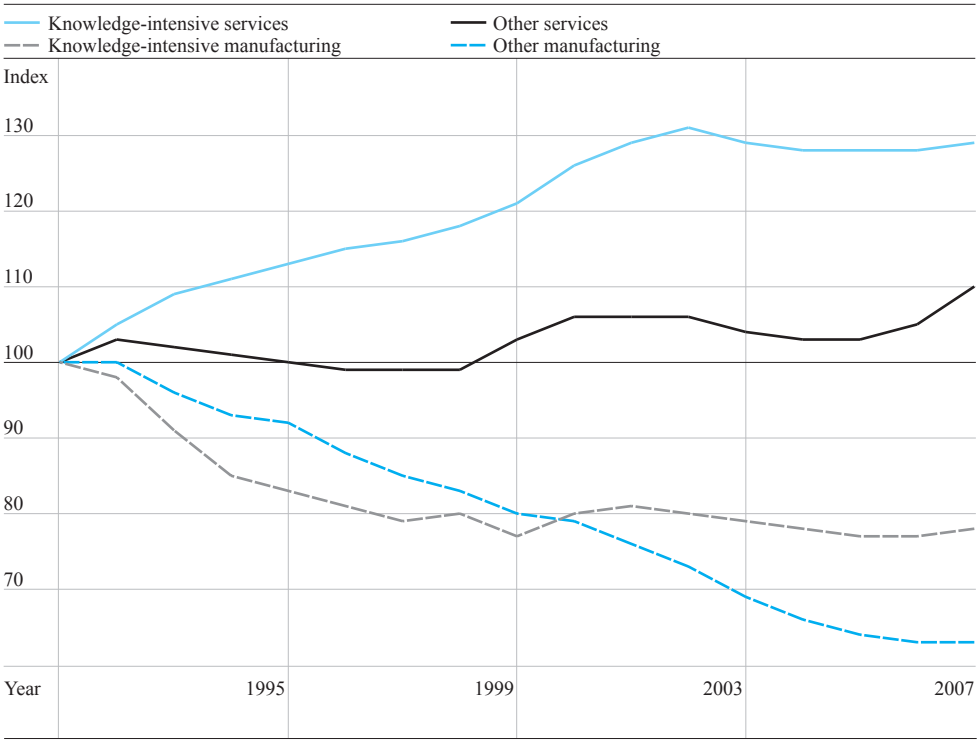
Overall, services in Germany in 2006 accounted for 62 percent of gross value-creation,[86] with knowledge-intensive services making up 37 percent. Fig. 08 shows how health- and business-oriented services dominate the knowledge-intensive services sector. The insurance and credit sectors and data processing in Germany are relatively less important in an international comparison. Fig. 08 shows sectors registering a part of the knowledge-intensive services, because in all industrialised countries a considerable part of the knowledge-intensive services are also provided by companies in the manufacturing sector and are allocated to this sector in the statistics.

In Germany, a much lower proportion of value is created by the services sector than in most other developed economies and many observers speak of a services gap.[87] The economic structure analysis also shows that knowledge-intensive services in particular are weak in Germany in international comparisons (Fig. 08). These structural differences

**Technology concepts and definitions** BOX 22

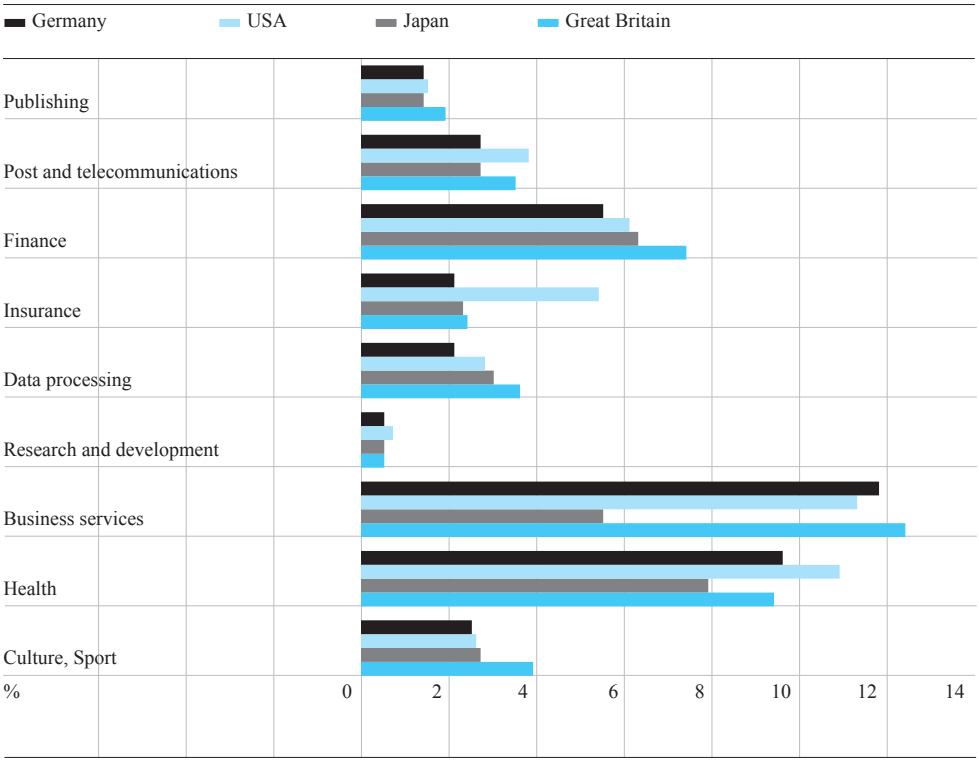
Cutting-edge technology goods are R&D-intensive goods for which more than 7 percent of annual revenues is spent on R&D. Examples include active pharmaceutical substances, IT-equipment, aircraft and space vehicles.
High-value technology goods are R&D-intensive goods for which more than 2.5 percent, but not more than 7 percent of annual revenue is spent on R&D. Examples are pharmaceutical products, engines, filters, machine tools, medical technology, motor vehicles, and rail vehicles.
Knowledge-intensive activities can be provided in all sectors. However, it has proved advantageous to separate out the services sectors which mainly involve value-creation on the basis of knowledge-intensive activities. Knowledge-intensive services are those involving a high proportion of university graduates (above 11 percent) and/or an above-average proportion of natural scientists and engineers (more than 4.5 percent).
Examples of sectors of knowledge-intensive services are: telecommunications, software services, insurances, financial services, architectural and engineering services, legal, fiscal and management consultancy, veterinary and health services, communications, libraries, archives, museums.
Research- and knowledge-intensive sectors are the research-intensive industrial sectors and the knowledge-intensive services (also simply referred to as the knowledge-intensive sectors).
Section D of this report contains a full list of R&D-intensive industrial sectors and knowledge-intensive services.

ABB 07 **Development of employment in various sectors in Germany**




1991 = 100. Proportion of overall employment in 2007: Knowledge-intensive manufacturing 15 percent, Other manufacturing 23 percent, Knowledge-intensive services 24 percent, Other services 38 percent. Source: Bundesagentur für Arbeit, Statistik der sozialversicherungspflichtig Beschäftigten. Calculations and estimates by NIW.

ABB 08 **Share of total value creation of knowledge-intensive services sectors in 2005 in an international comparison**




Proportion of knowledge-intensive services in 2005 Total: Great Britain 45.1 percent, Japan 32.4 percent, USA 45.1 percent, Germany 37.1 percent. Source: EUKLEMS Database. Calculations by NIW.

are often explained by the dominance of industrial value-creation in Germany.

The services gap is appreciable. Measured against western industrialised countries[88] the German services sector ought to account for 7 percent more of value-creation. In Germany in 2005, this would have corresponded to a value-creation of 70 billion euros. If the services sector in Germany was to be raised to an average international level, it would require an increase equivalent to the entire value created by the automotive sector. With regard to knowledge-intensive services, the gap relative to the total value-creation was nearly 4 percent or 38 billion euros, which would correspond to the value-creation in the sectors electrical engineering, electronics, telecommunications and media technology.

These statistical results are regarded as problematical by some industry associations. It is, after all, possible that knowledge-intensive services in Germany are provided internally by industrial companies more frequently than in other countries. Statistics based on sectoral distinctions would then give a misleading impression.

The Expert Commission asked for this possibility to be examined more closely in the above-named studies. Analyses were conducted of intermediate performances and the workforce profile in the manufacturing sector and the extent of product-related services, in order to determine whether knowledge-intensive services in Germany were adequately registered in an international comparison. These various investigations all lead to the conclusion that with a very high probability the services gap is not a statistical artefact.

For knowledge-intensive services, R&D activities increase the innovation potential considerably less than for material goods. Important exceptions worldwide are the Internet, data processing and software services, which are among the most R&D-intensive sectors of the economy. Innovations in services are otherwise frequently part of the production processes. It is practically impossible to measure the R&D share of unique performances provided specifically for a customer.

Apart from R&D, the development of innovative services makes more use of additional channels of knowledge than the creation of material innovations, e.g. the acquisition of equipment and software, as well as further training and qualifications. In the services sector they speak of an “inverted product cycle”: a high openness to innovation is linked above all with the adoption of technology from the manufacturing sector. Following on from this, knowledge-intensive service providers gradually begin their own R&D-activities. For businesses trading with cutting-edge technology products, it is often observed that at a later stage they begin their own production of advanced products which previously had “only” been introduced, marketed and maintained: the service providers become in part manufacturing companies. Despite the weakness in the creation of knowledge-intensive services relative to world levels, Germany has a lead in innovations in this sector in Europe, but this lead is by no means as great as in the manufacturing sector (Fig. 09).

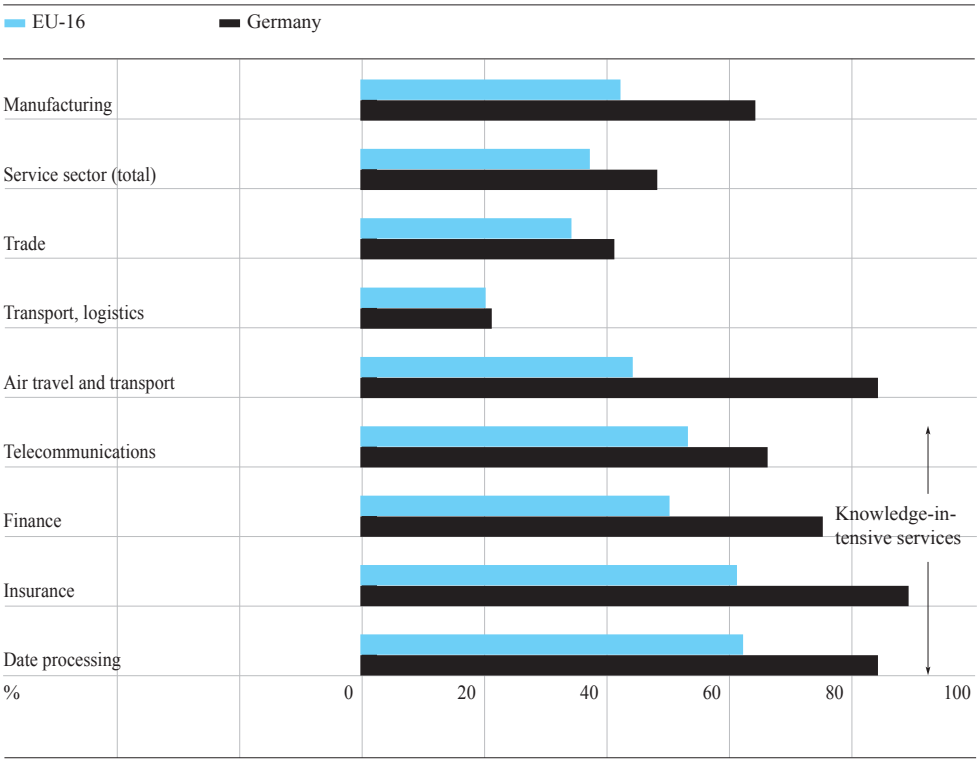
**Foreign trade with knowledge-intensive services**

Knowledge-intensive services companies are increasingly export oriented, both with regard to the export rate as well as in the number of exporting companies. Particular company-related services benefit from an extension of cross-border trade. The global trade volume of commercial services for companies has doubled since 2000, and in 2007 represented some 9 percent of world trade in goods and services. In Germany, the export of services in 2006 had a value of 131 billion euros, which was 13 percent of all exports. The export value of knowledge-intensive services was 45 billion euros, which corresponds to a share of 4.4 percent.[89] In comparison, knowledge-intensive services in the USA accounted for 7.2 percent of exports in 2006.

The foreign share of the revenue of German companies in the knowledge-intensive branches is still quite low in comparison with most other European economies. Germany was for a long time a net-importer of knowledge-intensive services. Whereas in the year 2000 only 60 percent of the expenditures were balanced with revenues, this situation has equalised by 2007 (Fig. 10).

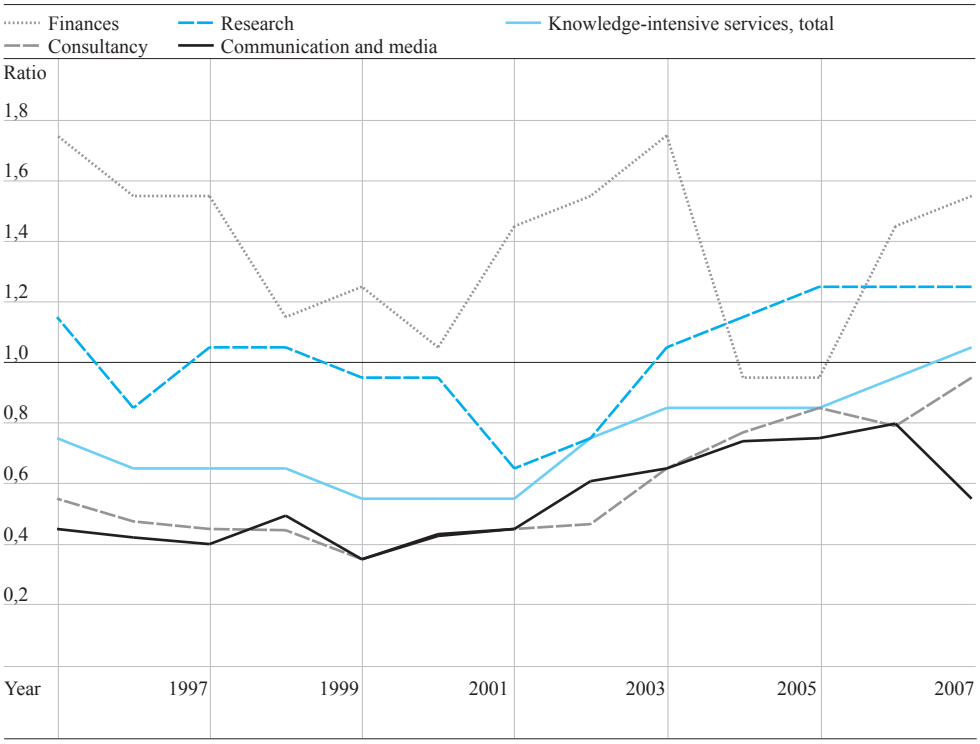
In the EU, Germany is by no means the largest provider of cross-border knowledge-intensive services, which it is in the case of trade with industrial goods. On

ABB 09 **Proportion of innovative companies[90] in selected sectors in a European comparison[91]**




Source: Eurostat-CIS4. Compiled by ZEW. Calculations and estimates by NIW.

ABB 10 **Export/import cover ratio in German foreign trade with knowledge-intensive services**




Cover ratio = Exports/Imports. Cover ratio/Balance in billion euros 2007: Communications and media 0.6/–2.1. Finances 1.6/12.7; Research 1.3/7.1. Consultancy 1.0/–0.9; Total 1.1/87.5. Sources: OECD-Stat, Dataset Trade in Services by Category; Deutsche Bundesbank, IMF. Calculations and estimates by NIW, RWI and Fraunhofer ISI.

the world market for these services, Germany with 15 percent is only half as important as Great Britain (more than 30 percent). India has the same export volume as Germany. Analogous to domestic value-creation, Germany has a weaker position with foreign trade with services in an international comparison than it does with R&D-intensive goods.

Some observers regard the middle ranking of Germany in an international comparison for the foreign trade with knowledge-intensive services as a negative sign. In particular they view the extensive intake of knowledge from other countries as problematic for the development of Germany as an innovation location. The Expert Commission supports the view that, with the foreseeable expansion of knowledge-intensive services, there is considerable potential for boosting exports of this sort. However, the foreign trade with knowledge-intensive services is not only relevant to innovation in terms of the intake of knowledge, because there is also the outflow of knowledge to consider. It is necessary to weigh up the opportunities and risks in each individual case, and there can be no general guidelines and recommendations. This applies above all for research and consultancy.

**Better investigation of the knowledge-intensive services sector**

Although the overall image of the position of Germany for knowledge-intensive services seems quite clear, when viewed more closely some aspects remain blurred. If an attempt is made to investigate individual sectors, it soon becomes impossible to make a systematic international comparison. The data situation is particular difficult for services provided by manufacturing companies. Considerable work is needed on the problems of R&D and innovation statistics. It is regrettable that any more precise analysis of this part of the economy is so restricted by the inadequacy of the data situation, even though it meanwhile has a considerably higher volume than manufacturing.

**Great potential of knowledge-intensive services for economic development**

The Expert Commission recommends that greater importance is attached to the segment of very-high-value services, internally and in international competition. The competition which has begun between the federal states in Germany about the question of offering the best location for a company can act as a stimulus and ease the way for Public-Private initiatives.

There is also considerable potential for exploiting the fact that many knowledge-intensive services are linked to produced goods. On the basis of the German strength in product-related services, the international market for knowledge-intensive services could be served to a greater extent in this segment in particular. In addition to market-related aspects, the Expert Commission sees a need for action concerning social attitudes, which can also have a considerable influence on the next generation of skilled and qualified personnel. The public perception of innovation as related to material products and "tangible" technology should be widened to include a greater openness to "soft" services. There should be greater general awareness that the economy does not only need as many original technical inventions as possible, but that it is also advanced by innovations in the services sector. The philosophy of the public sector on the provision of support should incorporate these ideas quickly.

The account here does not address in detail the microeconomic aspects of the provision of services, in particular product-related services. Interested readers are referred to Lay et al. (2009).