C 7 PRODUCTION, VALUE CREATION AND EMPLOYMENT

Overview

Successful innovations generate added value and create jobs. Highly developed economies can earn well in global markets by specialising in technical innovations and in goods and services with outstanding quality standards. When countries achieve such success, their domestic workforces enjoy high real-income levels, and their companies experience growth in production and employment. As these relationships indicate, countries that achieve technological prowess do so on the basis of R&D-intensive products and knowledge-intensive services. By offering such products and services, highly developed countries make the best use of their advantages, such as high technical standards, extensive investments in R&D and highly qualified workforces.

To develop successfully in the economic sphere, countries today have to undergo sectoral structural change, toward R&D-intensive industries and knowledge-intensive services.

In terms of gross value creation and employment, Germany's knowledge-intensive manufacturing sectors have been developing considerably more dynamically than its non-knowledge-intensive sectors. In the area of services, the differences between knowledge-intensive and non-knowledge-intensive sectors are less pronounced. All in all, a trend towards tertiarisation, i.e. the growing importance of services, is apparent.

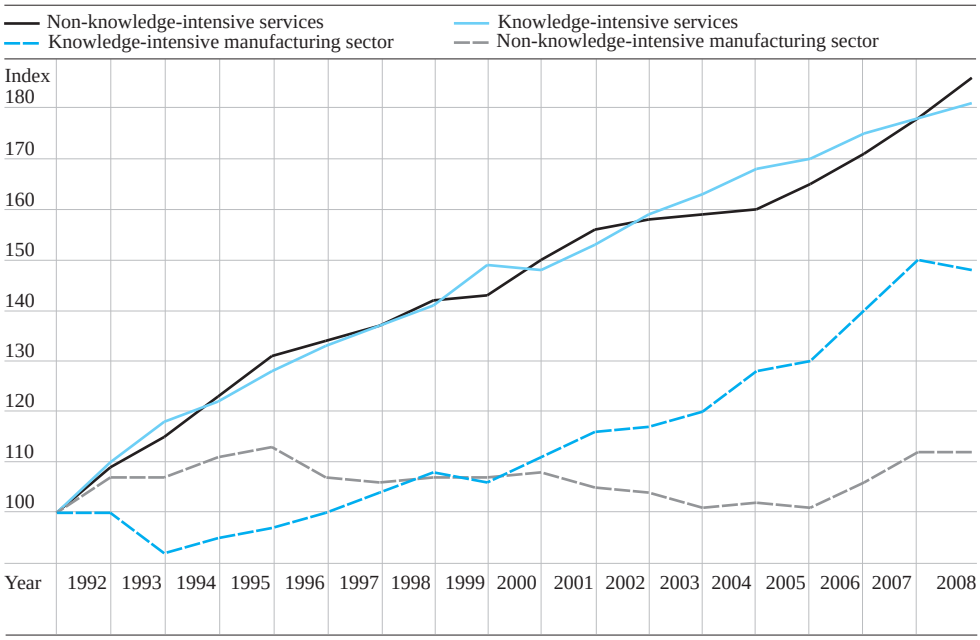
In comparison with the situations in other OECD countries, technology-intensive and knowledge-intensive economic sectors in Germany have especially high shares of overall value creation, employment and exports. In 2007, Germany had the world's largest shares of global trade in the categories of both industrial goods and research-intensive goods. At the same time, the advantages that Germany enjoys as a result of specialisation in trade with industrial goods are shrinking over time. Increasingly, German companies are having to compete with foreign companies in their own domestic markets. Germany has never really specialised in selling cutting-edge-technology goods. Because research-intensive sectors are strongly dependent on foreign trade, the global financial crisis also brought an economic downturn in Germany. However, in comparison to the recoveries in other countries, Germany's recovery has been faster and more pronounced.

Indicators studied:

- Gross value creation in in Germany's business economy
- Employment in the business sector in Germany
- Value added in the R&D-intensive industries and non R&D-intensive industries
- Labour input and value added in the knowledge economy
- Germany's foreign-trade specialisation in R&D-intensive goods
- Net contribution of R&D-intensive goods to foreign trade for selected OECD countries

GROSS VALUE CREATION IN GERMANY'S BUSINESS ECONOMY

C 7–1



Index: 1991 = 100.
Source: Federal Statistical Office, Fachserie 18, Reihe 1.4. Calculations of the NIW.

Shares of gross value creation in 2008: knowledge-intensive manufacturing sector, 21 percent; non-knowledge-intensive manufacturing sector, 17 percent; knowledge-intensive services, 36 percent; non-knowledge-intensive services, 27 percent.

Growth in gross value creation in services and knowledge-intensive industry

The German economy has been restructuring as a result of increasing links between industry and services. Since 1991, both knowledge-intensive and non-knowledge-intensive services have been growing consistently. At the same time, many services have become more and more technology-dependent, as a result of their own internal R&D activities, and of their broad application of industrial-sector technologies.

The long-term growth outlook for the manufacturing sector is less rosy, however. The manufacturing sector is more strongly dependent on the economy as a whole than is the services sector. At the same time, knowledge-intensive and non-knowledge-intensive individual sectors can differ in the degree they are affected by such dependence. As a result of the global recession that occurred in the early 1990s, knowledge-intensive sectors suffered sharp downturns, while non-knowledge-intensive sectors (especially consumer goods and durable goods) profited from the special economic benefits occurring via German reunification. As of 1993, a fundamental change began to emerge. Industrial sectors that were less knowledge-intensive began to stagnate or even decline, while knowledge-intensive sectors embarked on a lasting upswing, with growth that almost matched that of the services sector. On the other hand, trends in the most recent years being considered were also positive for industry sectors that are less knowledge-intensive.

C 7–2 EMPLOYMENT TRENDS IN THE BUSINESS SECTOR IN GERMANY[378]

	WZ03			WZ08					
	2002	2005	2008	2008	2009	2002–05	2005–08	2008–09	2002–08
	In 1.000s					Changes in percent			
Manufacturing sector	**9,421**	**8,554**	**8,724**	**8,646**	**8,493**	**–3.2**	**0.7**	**–1.8**	**–1.3**
Knowledge-intensive sectors	3,510	3,376	3,521	3,083	3,045	–1.3	1.4	–1.2	0.1
Non-knowledge-intensive sectors	5,910	5,178	5,203	5,564	5,447	–4.3	0.2	–2.1	–2.1
Services	**13,418**	**13,037**	**13,983**	**14,136**	**14,056**	**–1.0**	**2.4**	**–0.6**	**0.7**
Knowledge-intensive sectors	5,504	5,379	5,556	5,522	5,569	–0.8	1.1	0.9	0.2
Non-knowledge-intensive sectors	7,914	7,657	8,427	8,614	8,487	–1.1	3.2	–1.5	1.1
Industry	**22,839**	**21,590**	**22,707**	**22,782**	**22,549**	**–1.9**	**1.7**	**–1.0**	**–0.1**
Knowledge-intensive sectors	9,015	8,755	9,077	8,604	8,615	–1.0	1.2	0.1	0.1
Non-knowledge-intensive sectors	13,842	13,350	13,631	14,178	13,934	–2.4	0.7	–1.7	–0.3

Source: Federal Employment Agency. *Sonderauswertung der Beschäftigtenstatistik* (special evaluation of employment statistics). Calculations and estimates of the NIW.

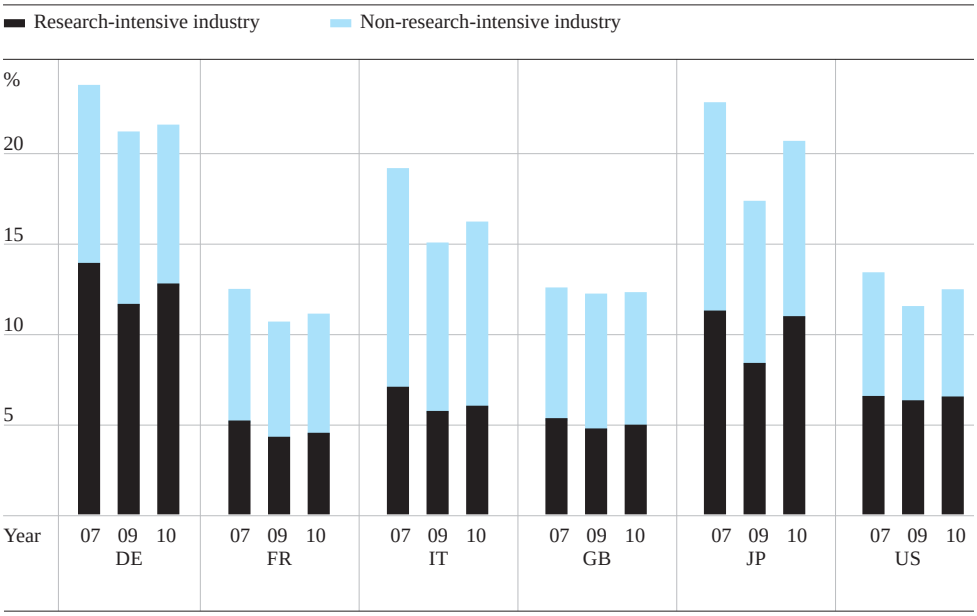
Industry: not including agriculture, public administration and services, education, private households, etc.

Employment in knowledge-intensive services rides out the crisis

Obvious restructuring to the benefit of the services sector continues in Germany's employment market. In the period 2002 through 2008, the number of employees in the services sector increased by an average of 0.7 percent per year (for a total of 570,000 persons), while employment in the manufacturing sector decreased by –1.3 percent per year (–700,000). Differentiation of economic sectors by knowledge-intensity and consideration of economic sub-periods enhance insight into employment trends. In the sub-period 2002 through 2005, jobs subject to social-insurance requirements decreased by nearly 2 percent per year, as a result of weak economic growth. In non-knowledge-intensive sub-sectors, the employment losses were considerably greater (–2.4 percent) than in knowledge-intensive sectors (–1 percent), however. In non-knowledge-intensive sectors of the manufacturing sector, the decrease, at 4.3 percent per year, was particularly pronounced. On the other hand, non-knowledge-intensive economic sectors, especially services sectors, profited from the broad-based job growth that took place in the period 2005 through 2008. During that period, knowledge-intensive economic sectors in particular increasingly encountered shortages of skilled personnel. In spite of the sharp drops in growth that took place in 2008/2009, employment decreased by only 1 percent in Germany. In knowledge-intensive services, it even increased. When the period in question is compared with other periods of economic weakness, it is seen to have taken an extremely favourable course.

VALUE ADDES IN R&D-INTENSIVE INDUSTRIES AND NON-R&D-INTENSIVE INDUSTRIES 2007 AND 2010

C 7–3



Source: EUKLEMS Datenbasis 2010. Calculations and estimates of DIW Berlin (German Institute for Economic Research).

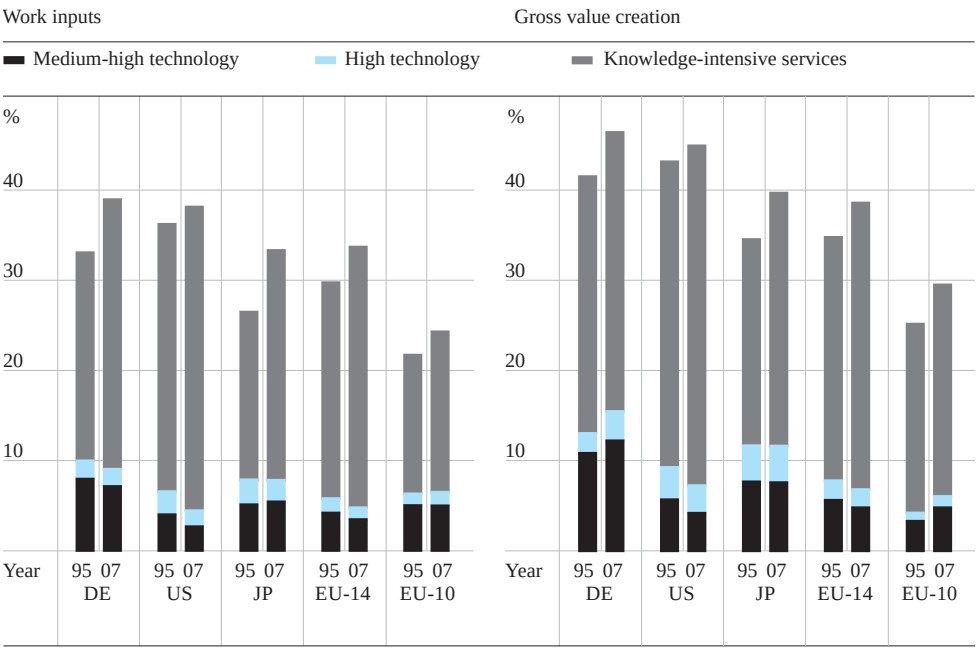
Value creation: Value of production of economic units, less the relevant preliminary outlays.

Research-intensive industry stands firm in the economic and financial crisis

For years, Germany's research-intensive industries have been the main drivers of the country's overall economic development. And they continued to register above-average growth until well into 2008. However, the crisis of confidence triggered by the turbulence in financial markets led to a worldwide slump in demand for investment goods. Production in export-intensive high-technology areas declined dramatically. That proved to be the start of the worst recession in Germany's post-war history. In 2010, then, growth took off again in all sectors of research-intensive industry, causing such sectors' share of total value creation in Germany to increase markedly. At the same time, that share probably did not reattain its pre-crisis level in 2010 (in light of available figures extrapolated for the year as a whole).

Similar crisis-related trends in economic structures have emerged in other major OECD countries as well, although Europe's other major economies have not been keeping pace in the recovery process for their research-intensive industries. In the UK and the U.S., the relevant swings have proven to be more moderate. In those countries, research-intensive industries and the economy as a whole differed little in terms of the shrinkage and growth impetus they experienced. The largest changes in shares of value creation occurred in Japan. Its pertinent losses in 2009, and its relevant share gains in 2010, were larger than the corresponding losses and gains in Germany. By 2010, Japan's research-intensive industries' share of total value creation had almost returned to its pre-crisis level.

C 7–4 LABOUR INPUT AND VALUE ADDED IN THE KNOWLEDGE ECONOMY



Source: EUKLEMS Database (2010). OECD STAN (2010). Calculations and estimates of DIW Berlin (German Institute for Economic Research).

Work inputs, measured in hours of work, are used as part of economic input measurement in a given sector, while nominal value creation measures the corresponding output side. "EU-14" refers to the "old" EU countries, except for Germany, while "EU-10" refers to the new EU countries, except for Romania and Bulgaria.

Germany with a strong international position in knowledge-intensive sectors

Inter-country comparison of work inputs and value creation in research-intensive and knowledge-intensive sectors highlight those sectors' importance with regard to employment and economic growth. From 1995 to 2007, work inputs in the area of knowledge-intensive services increased in all countries and regions considered. That trend is a reflection of the economy's growing dependence on knowledge. At the same time, a relative loss of importance has been seen in research-intensive industries. On the output side (value creation) as well, knowledge-intensive services have, in general, tended to have higher growth rates. Other trends have taken place in eastern European countries; they have experienced above-average growth rates especially in research-intensive industries. In an international comparison of overall work inputs and value creation in research-intensive sectors, Germany emerges with the highest ranking. The primary reason for that position is that high-value technologies account for an unusually large share of Germany's economy, in comparison to the corresponding shares in competing countries.

The relatively small significance of services in Germany was long considered to be a competitive disadvantage. Now, however, the strength of Germany's industrial sector is proving to be a bastion in the context of global structural change. What is more, Germany's high-technology industrial sector is providing a solid foundation for the development of complementary services. As shown above, that foundation has been enabling knowledge-intensive services to grow continuously in importance in Germany.

GERMANY'S FOREIGN-TRADE SPECIALISATION IN R&D-INTENSIVE GOODS C 7–5

Year	DE	US	JP	FR	GB	DK	SE	FI	CH	IT	EU-14
Comparison of export and import structures (Revealed Comparative Advantage – RCA)											
1995	24	13	64	8	11	–22	–16	–50	17	–17	–5
2000	14	17	49	10	13	–6	–7	–29	15	–20	–2
2005	13	24	46	13	17	–3	–3	–19	19	–18	2
2009	12	13	45	13	19	5	–4	–15	26	–15	3
Relative world-trade share of imports (Relative Import Advantage – RMA)											
1995	–9	9	–29	–5	4	–16	8	7	–7	–9	–4
2000	–2	2	–19	–4	2	–23	3	3	–11	–9	–3
2005	3	–2	–16	–4	–3	–18	–3	2	–5	–7	–3
2009	3	3	–18	–3	–7	–24	–3	–3	–7	–6	–4
Relative world-trade share of exports (Relative Export Advantage – RXA)											
1995	16	22	35	3	15	–38	–8	–43	10	–25	–8
2000	14	19	30	6	14	–30	–5	–25	4	–29	–4
2005	15	22	30	8	14	–20	–7	–17	14	–25	–1
2009	16	16	31	10	12	–19	–6	–18	19	–22	–1

Japan's 2009 share of RXA is its value for 2008.
Source: DIW-*Außenhandelsdaten* (foreign-trade data). Calculations of DIW Berlin (German Institute for Economic Research).

"EU-14" refers to EU-15, without Germany, in trade with third countries. The RCA indicator refers to the ratio between exports and imports, in a specific goods sector, in relation to the corresponding ratio for all of a country's exports and imports. The indicators RMA and RXA denote similar relationships for imports and exports, respectively.

German imports of R&D-intensive goods growing

Scores achieved for the RCA specialisation indicator confirm the leading positions of Japan, the U.S., Switzerland, the UK, Germany and France in the area of international trade in R&D-intensive goods. In those countries, comparative advantages in the area of R&D-intensive goods (RCA values larger than ten) result from above-average specialisation in exports (high RXA values).

At the same time, Germany's comparative advantages in this area have been decreasing continually. The reason for this is that Germany's imports of R&D-intensive goods from countries that are catching up have been growing in the middle and lower price segments; Germany's RMA index changed from a clearly negative value (-9) in 1995 to a slightly positive value (3) in 2009. The countries that are catching up can be expected to become even stronger in this area in the medium term. A similar trend is seen in Japan, where proximity to China is having added impacts. Finland and Denmark, on the other hand, have markedly improved their net positions in the area of R&D-intensive goods – as their growing RCA values indicate. They have achieved those improvements primarily via intensified exports of R&D-intensive goods. In countries with only slight changes of net position, with regard to specialisation in R&D-intensive goods – the U.S., France, the UK, Sweden and Switzerland – the relevant values have been decreasing for both exports and imports.

C 7–6 NET CONTRIBUTION OF R&D-INTENSIVE GOODS TO FOREIGN TRADE FOR SELECTED OECD COUNTRIES

Year	DE	US	JP	FR	GB	DK	SE	FI	CH	IT	EU-14
						R&D-intensive goods					
1995	70	28	199	23	30	–50	–43	–135	50	–50	–14
2000	49	43	170	31	36	–18	–23	–91	43	–58	–5
2005	50	58	158	37	47	–7	–12	–57	60	–50	6
2009	47	28	146	38	54	8	–12	–45	81	–44	8
						High technology					
1995	–24	21	47	5	26	–12	–14	–51	11	–44	–9
2000	–36	38	4	6	19	2	4	–12	7	–50	–7
2005	–33	34	–21	11	36	7	2	7	46	–43	1
2009	–19	–10	–36	26	31	12	11	–28	94	–43	4
						Medium-high technology					
1995	94	8	151	18	4	–39	–30	–84	39	–6	–5
2000	85	5	165	24	17	–19	–27	–79	37	–8	3
2005	83	24	179	26	10	–13	–14	–64	14	–7	4
2009	66	38	182	11	23	–4	–22	–18	–13	–1	4

Source: DIW-*Außenhandelsdaten* (foreign-trade data). Calculations of DIW Berlin (German Institute for Economic Research).

A positive / negative value in the category of net contribution to foreign trade is indicative of a country's comparative advantages / disadvantages in this area. Net contribution = contribution to exports, minus contributions to imports.

Medium-high technology remains Germany's export forte

R&D-intensive goods continue to play an important role in Germany's foreign trade, and that role is due primarily to strengths in the area of high-value technologies; Germany has marked weaknesses in foreign trade in the area of cutting-edge technologies.

Since the mid-1990s, noticeable shifts have occurred in a number of highly developed countries in the relationship between high technology and medium-high technology. The U.S., long the most important country in high technology, lost considerable ground in this category between 2005 and 2009, while it strengthened its position in the area of medium-high technology. In Switzerland, the trend has gone in the opposite direction, toward high technology. High technology has also grown in importance in France, the UK, Denmark and Sweden.

Overall, Switzerland and – especially – Japan have leading positions in foreign trade with R&D-intensive goods. In the case of Japan, that leadership is clearly due to medium-high technology, while its index score for high technology, which was still clearly positive in 1995, is now negative. In interpretation of foreign trade data, it must be remembered that such data reflect only part of a country's economic strength, and, as shown above, that knowledge-intensive services make key contributions to economic strength. Such services play only a subordinate role in foreign trade, however. Analysis of foreign trade in the area of services shows that Germany's position in this category has been improving continually.[379]