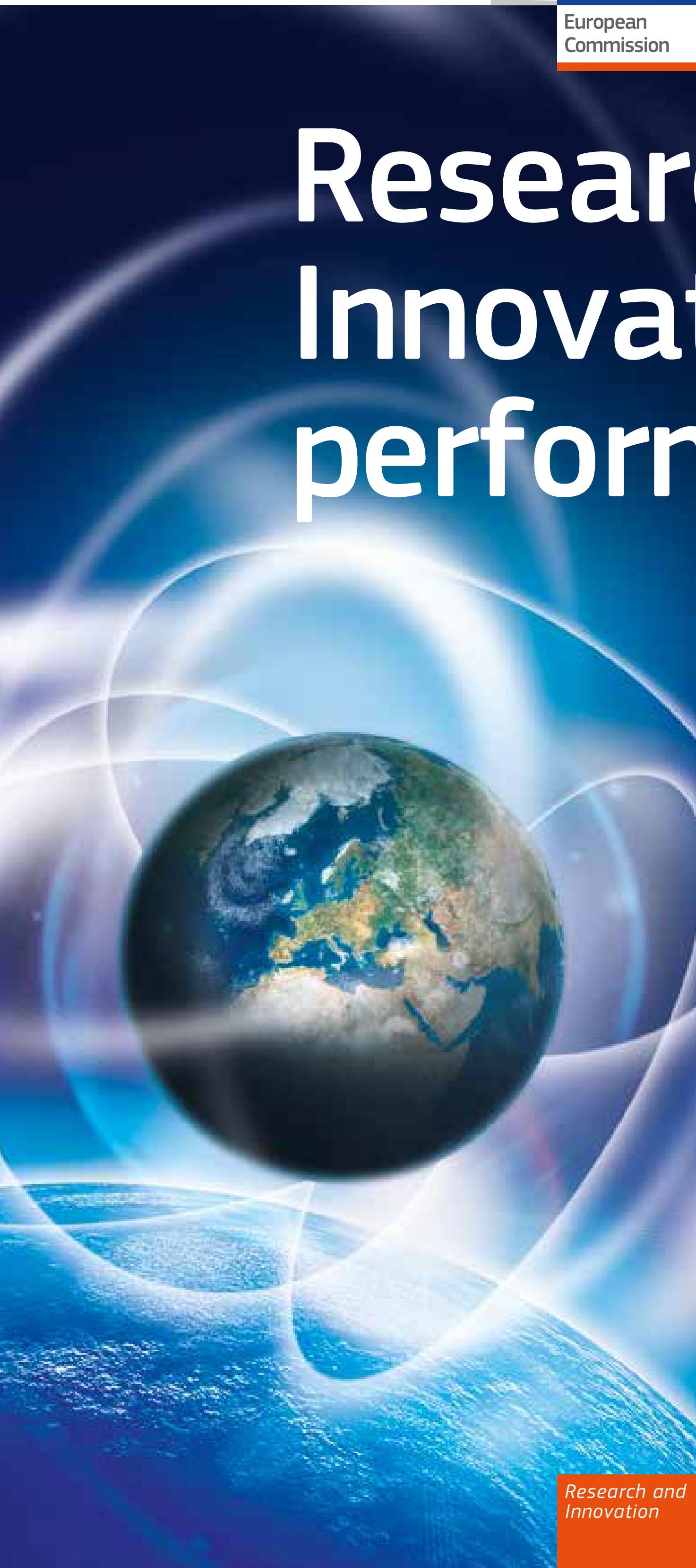
European Commission

Research and Innovation performance in

Germany

Country Profile

2014



Research and Innovation

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Germany

The challenge of maintaining a high innovation capacity for an export-oriented economy

Summary: Performance in research and innovation

The indicators in the table below present a synthesis of research and innovation (R&I) performance in Germany. They relate knowledge investment and input to performance and economic output throughout the innovation cycle. They show thematic strengths in key technologies and also the high-tech and medium-tech contribution to the trade balance. The indicator on excellence in science and technology takes into consideration the quality of scientific production as well as technological development. The Innovation Output Indicator covers technological innovation, skills in knowledge-intensive activities, the competitiveness of knowledge-intensive goods and services, and the innovativeness of fast-growing enterprises, focusing on innovation output. The indicator on knowledge-intensity of the economy focuses on the economy's sectoral composition and specialisation and shows the evolution of the weight of knowledge-intensive sectors and products.

Key indicators of research and innovation performance	
R&D intensity 2012: **2.98 %** (EU: 2.07 %; US: 2.79 %) 2007-2012: **+3.3 %** (EU: 2.4 %; US: 1.2 %)	***Excellence in S&T***[1] 2012: **59.0** (EU: 47.8; US: 58.1) 2007-2012: **+2.2 %** (EU: +2.9 %; US: -0.2)
Innovation Output Indicator 2012: **124.2** (EU: 101.6)	***Knowledge-intensity of the economy***[2] 2012: **47.1** (EU: 51.2; US: 59.9) 2007-2012: **+1.0 %** (EU: +1.0 %; US: +0.5 %)
Areas of marked S&T specialisations: Automobiles, environment, energy, and key production technologies	***HT + MT contribution to the trade balance*** 2012: **9.2 %** (EU: 4.23 %; US: 1.02 %) 2007-2012: **+1.7 %** (EU: +4.8 %; US: -32.3 %)

Germany has expanded its R&I system over the last decade. Expenditure on R&D has grown substantially since 2000 to reach 2.98 % of GDP in 2012, which is already close to the 3 % national target for 2020. Public expenditure represents 30 % of investment in R&D, which is an increase compared to 2008 (28 %), but still below the EU average of 33 %. The government increased the public budget on R&I even during the 2009 economic crisis as part of a policy of prioritising spending on education and research. Business enterprise expenditure on R&D, which represents two-thirds of investment in R&D, also grew as a % of GDP over the period 2007-2011.

The increase in public and private expenditure on research and development in Germany has helped to maintain a high innovation capacity and a strong export performance. The German economy is based to a considerable extent on medium-high technology sectors, such as automobiles, electro-technical products, machinery, and chemical products. However, over the last decade, Germany has lost its strong market position in pharmaceuticals and in optical industries. Recently, it has only produced a few successful new international players in high-tech industries. There is also still underexploited growth potential as regards innovative and knowledge-intensive service economy sectors. Germany has come through the last economic crisis relatively well, partly as the result of a strong export sector. However, the German market position as regards medium-high-tech products may be challenged in the future by new players, such as the BRIC countries (Brazil, Russia, India and China). An ageing population with a declining share of young people represents further challenges for the German economy.

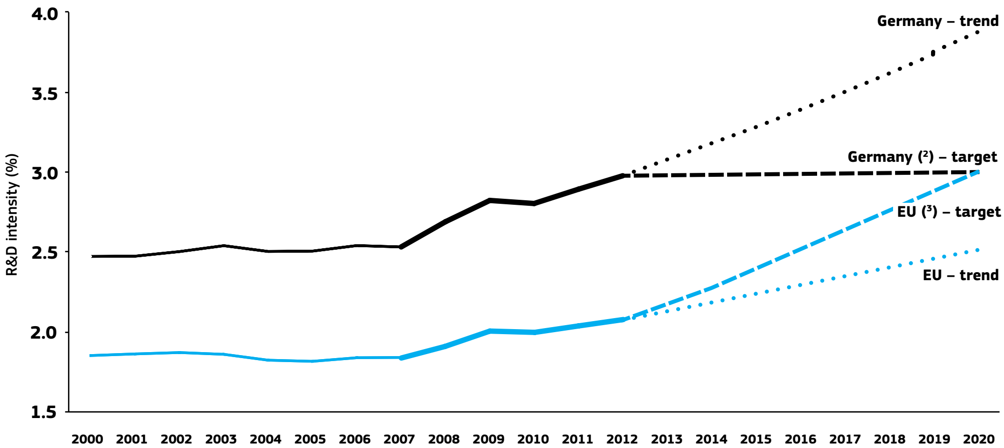
[1] Composite indicator that includes PCT per population, ERC grants per public R&D, top universities and research institutes per GERD and highly cited publications per total publications.

[2] Composite indicator that includes R&D, skills, sectoral specialization, international specialization and internationalization sub-indicators.

The Federal Ministry for Education and Research (BMBF) has developed the so-called High-Tech Strategy to address several important challenges. However, further structural reforms of the education, research and innovation system are required. In view of the demographic situation, a particular focus is required on the quality of human resources and further incentives for excellence and internationalisation are needed. There is room for more public-private cooperation and for implementing targeted supply-side and demand-side measures to foster innovation and fast-growing innovative firms in Germany. Such measures should in particular be targeted at high-tech sectors such as ICT, biotechnology and medical technologies.

Investing in knowledge

Germany – R&D intensity projections: 2000–2020 (1)



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: DG Research and Innovation, Eurostat, Member State
Notes: (1) The R&D intensity projections based on trends are derived from the average annual growth in R&D intensity for 2007–2012.
(2) DE: The projection is based on a tentative R&D intensity target of 3.0 % for 2020.
(3) EU: The projection is based on the R&D intensity target of 3.0 % for 2020.

With an R&D intensity of 2.98 % in 2012, Germany is above the EU average and has almost reached the 3 % national target. The gap of only 0.02 % currently corresponds to EUR 0.5 billion (German GDP amounted to about EUR 2.6 trillion in 2012). About one-third of German R&D expenditure comes from public sources and two-thirds from private sources – a distribution that has remained fairly stable over the last decade.

In the period 2000-2011, the federal public research budgets, which represent more than half of public spending on research, were expanded substantially. Federal spending on research and education increased by a further 7 % in 2011 and by 12 % in 2012. However, at *Länder* level, growth in R&D expenditure, including university expenditure on R&D, was much lower. R&D intensities vary strongly between German *Länder*, ranging from 1.43 % in Schleswig-Holstein and 1.49 % in Saarland and Sachsen-Anhalt to 5.08 % (2011) in Baden-Württemberg, the European region (NUTS 1 level) with the highest research intensity. Berlin (3.56 %) and Bayern (3.16 %) also have R&D intensities that are already above the German national target.

Research intensity is especially high in the automobile sector, which represents nearly one-third of total German business R&D investment. A weak point for German R&D is the relatively low level of spending in high-tech areas such as pharmaceuticals and ICT.

Structural Funds are an important source of funding for R&I activities. Of the EUR 25.5 billion of Structural Funds allocated to Germany over the 2007-2013 programming period, around EUR 5.0 billion (20 % of the total) relate to RTDI[3].

[3] RTDI includes the following sectors: (01) RTD activities in research centres, (02) RTD infrastructures and centres of competence, (03) Technology transfer and improvement of cooperation of networks, (04) Assistance to RTD, particularly in SMEs (and RTD services in research centres), (06) Assistance to SMEs for the promotion of environmentally friendly products and processes, (07) Investment in firms directly linked to research and innovation, (09) Other methods to stimulate research and innovation and entrepreneurship in SMEs, and (74) Developing human potential in the field of research and innovation.

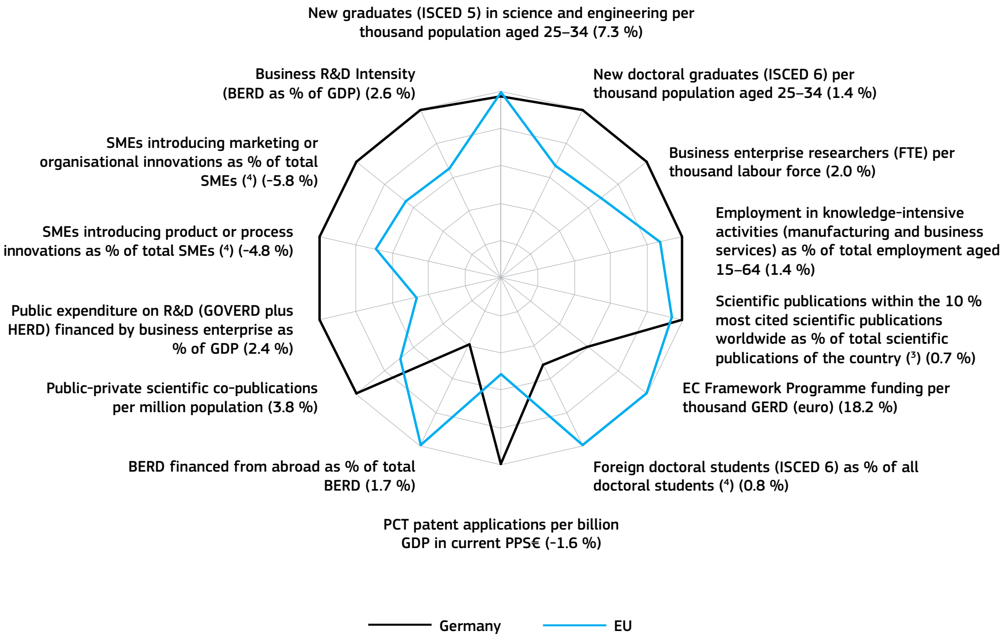
Germany counts 11 000 participants in the EU Seventh Framework Programme and receives the highest amount of FP7 funding in absolute terms (EUR 4.3 billion). Its application success rate is above average (24 % compared to an EU average of 20.4 %), but FP7 funding as a % of GDP is below the EU average.

An effective research and innovation system building on the European Research Area

The graph below illustrates the strengths and weaknesses of the German R&I system. Reading clockwise, the graph provides information on human resources, scientific production, technology valorisation, and innovation. Average annual growth rates from 2000 to the latest available year are given in brackets.

Germany, 2012 (1)

In brackets: average annual growth for Germany, 2007–2012 (2)



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: DG Research and Innovation, Eurostat, OECD, Science-Metrix/Scopus (Elsevier), Innovation Union Scoreboard
Notes: (1) The values refer to 2012 or to the latest available year.
(2) Growth rates which do not refer to 2007–2012 refer to growth between the earliest available year and the latest available year for which comparable data are available over the period 2007–2012.
(3) Fractional counting method.
(4) EU does not include EL.

In general, Germany's R&I system performs very well. However, the international dimension is below the EU average, in particular in relation to foreign investment in business R&D and EU Framework Programme funding. Possible explanations relate to the country-size effect, as well as to the high level of German domestic public and private expenditure on R&D. Despite the easy access to and relative abundance of national funding for research, Germany could better use the opportunities offered within the ERA and more specifically within the Framework Programme.

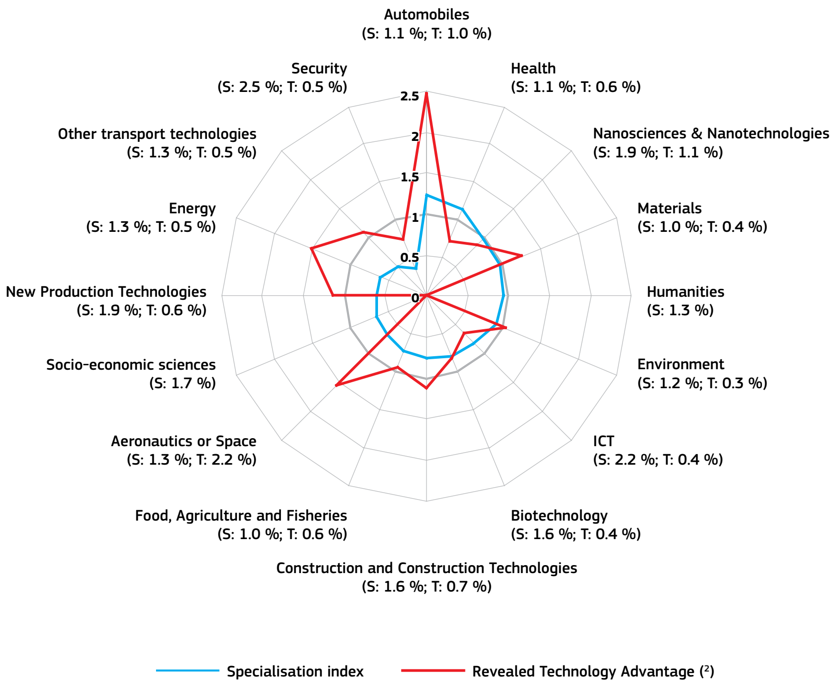
Germany has a particular strength in business R&D, especially in innovative small and medium-sized enterprises (SMEs), many of which are world leaders in their particular small market segments. However, the data above show a decline in the innovation rate of SMEs since 2007. The high level of patenting is an indication of industrial leadership in several domains, most notably in medium-high-tech industries, including engineering industries, automobiles and chemicals and also in environmental and energy technologies.

On the other hand, patenting in relation to GDP has fallen in recent years. Public-private cooperation in publications and in research is functioning well and is further supported by the federal government in the current new programme activities for innovation outlined in the High-Tech Strategy. While Germany performs well in terms of new doctoral graduates, its performance as regards new science and engineering graduates has only recently surpassed the EU average, and there is the risk of slower growth in the long term as a result of demographic trends, like the shrinking number of young people. In the long term, the risk of a scarcity of qualified human resources could endanger the strong German export position in engineering and science-based industries. In recent years, there has been an increase in the number of students in science and engineering subjects (MST/MINT), but efforts should be maintained to further reduce drop-out rates and improve the gender balance in terms of students and teaching staff.

Germany's scientific and technological strengths

The graph below illustrates the areas, based on the Framework Programme thematic priorities, where Germany shows scientific and technological specialisations. Both the specialisation index (SI, based on the number of publications) and the revealed technological advantage (RTA, based on the number of patents) measure the country's scientific (SI) and technological (RTA) capacity compared to that at the world level. For each specialisation field it provides information on the growth rate in the number of publications and patents.

Germany – S&T National Specialisation (1) in thematic priorities, 2000–2010
in brackets: growth rate in number of publications (3) (S) and in number of patents (4) (T)

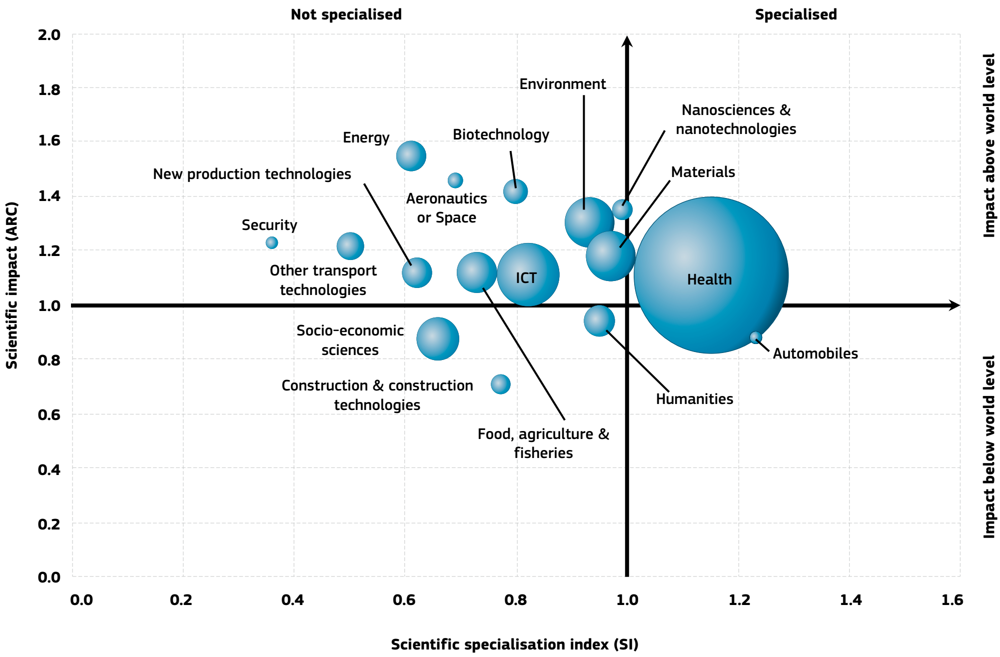


Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Science-Metrix Canada; Bocconi University, Italy
Notes: (1) Values over 1 show specialisation; values under 1 show a lack of specialisation.
(2) The Revealed Technology Advantage (RTA) is calculated based on the data corresponding to the WIPO-PCT number of patent applications by country of inventors. For the thematic priorities with fewer than 5 patent applications over 2000–2010, the RTA is not taken into account. Patent applications in 'Aeronautics or Space' refer only to 'Aeronautics' data.
(3) The growth rate index of the publications (S) refers to the periods 2000–2004 and 2005–2009.
(4) The growth rate in number of patents (T) refers to the periods 2000–2002 and 2003–2006.

As illustrated by the graph above, there is a notable difference in performance between scientific production (publications) and technological production (patents) in Germany. As regards publications, Germany shows specialisations only in the fields of automobiles and health. There is a lack of specialisation in the energy, other transport technology and security sectors. As regards patents (technological output), Germany displays strengths in automobiles, materials, aeronautics, new production technologies and energy.

The graph below illustrates the positional analysis of German publications showing the country's situation in terms of scientific specialisation and scientific impact over the period 2000-2010. The scientific production of the country is reflected by the size of bubbles, which corresponds to the share of scientific publications from a science field in the country's total publications.

Germany – Positional analysis of publications in Scopus (specialisation versus impact), 2000–2010



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Science-Metrix Canada, based on Scopus
Note: Scientific specialisation includes 2000–2010 data; the impact is calculated for publications of 2000–2006, citation window 2007–2009.

Germany shows a high specialisation in publications in the fields of health and automobiles. However, in both areas the scientific impact is only at or below the world average. As regards the other areas, Germany shows no specialisation. However, for energy, aeronautics/space and biotechnology the impact of publications are noticeably above world level.

Policies and reforms for research and innovation

The High-Tech Strategy 2020, launched in August 2006 and updated in July 2010, is seen as an instrument to improve cooperation between science and industry, and to improve the conditions for innovation with a view to enhancing the international competitiveness of technology-intensive manufacturing products in key sectors of the German economy. The 2010 update of the High-Tech Strategy prioritises the targeting by public-private partnerships of prospective markets related to important societal challenges in 10 so-called forward-looking projects (Zukunftsprojekte). Strategic priorities of the High-Tech Strategy 2020 are health, nutrition, climate and energy security, and communication and mobility.

Another important element in the research policy of the federal government and the *Länder* is the 'Pakt für Forschung und Innovation' (Pact for research and innovation). In 2005, the Federal Government and the *Länder* agreed to regularly increase their joint funding for the major public German research organisations: the Fraunhofer Society, the Helmholtz Association of German Research Laboratories, the Leibniz Association, the Max Planck Society, as well as the German Research Foundation, which is the major funder for universities. The initiative aims to enable science organisations to continue to improve strategic measures, enhance the quality and quantity of existing instruments, and develop, test and establish new instruments. In 2009, the initiative was updated and the annual growth of institutional funding increased from 3 % to 5 % between 2011 and 2015.

As regards fiscal policies, Germany is one of the few countries that have not introduced R&D tax credits. Such credits tend to be requested by large international companies.

The university system, which is the responsibility of the *Länder*, is meeting challenges, given the recent strong increase in student numbers and limited funding at *Länder* level. Because of a significant rise in the number of new entrants in recent years, the Hochschulpakt (higher education pact) – voluntary agreements between the federal and the *Länder* levels – has been set up. This pact was renewed in 2009 and additional resources were allocated in March 2011 and June 2013.

As regards human resources, Germany has taken measures to remove restrictions on in-bound researcher mobility in view of a skills shortage in some science and technology domains. The federal government recently decided to reform the Immigration Act to facilitate the processing of residence permits, on an action programme to ensure an adequate supply of labour, and on programmes for enhancing international mobility. The legal parameters for the employment of foreign graduates from German universities have been improved and new initiatives are facilitating recognition of qualifications acquired abroad. This could help to increase the share of professors (2012: 6.3 %) coming from abroad. Researcher salaries in Germany are above the EU average, but below those in the United States and Switzerland, one of the reasons for a net outmigration to these countries. Better conditions for career planning and greater transparency of academic pathways could enhance the attractiveness of German universities for foreign researchers.

In June 2008, a national pact to attract more women to science and engineering (Komm mach MINT-mehr Frauen in MINT-Berufen) was set up on the initiative of the Research Ministry (BMBF) and a second phase of this pact was launched in December 2011.

In operation since 2008, the BMBF's Female Professors Programme promotes outstanding women researchers. Since then, 270 additional women professors have been appointed in German higher education institutions. In 2012, following a positive evaluation of the programme's contribution to developing equal opportunities in higher education institutions, the Joint Science Conference of the Federal Government and the Heads of Government of the *Länder* (GWK) decided to continue the programme for a second period of five years until 2017. The programme aims to promote the equality of men and women at universities, increase the representation of women at all levels of qualification in the research system on a long-term basis, and boost the number of female scientists in leading positions in the science system.

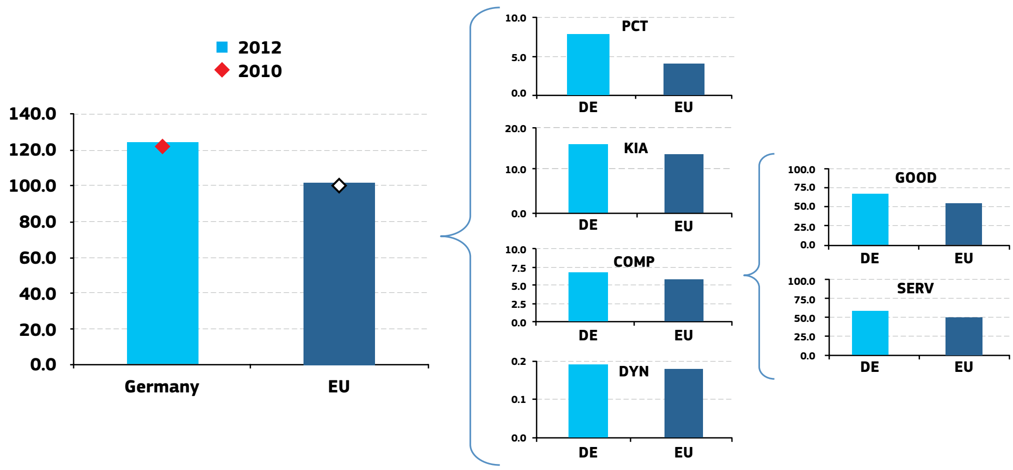
As regards the 'knowledge triangle' and fostering innovation activities, the BMBF and the Federal Ministry for Economic Affairs (BMWi) are taking steps to better focus their activities. The BMBF fosters public/private partnerships through activities such as the 'Leading-edge cluster competition' (Spitzencluster-Wettbewerb), which promotes the formation of clusters of business and science to boost Germany's innovative strengths in specific areas and, more recently (August 2011), the 'Research Campus' (Forschungscampus), a competitive funding scheme to strengthen cooperation between companies and research organisations. The BMWi uses the EXIST programme to stimulate an entrepreneurial environment at universities and research institutions. This programme is aimed at increasing the number of technology and knowledge-based business start-ups. The Hightech Gründerfonds stimulates start-ups and young technology companies by providing venture capital.

To help SMEs to enhance R&I, a Central Innovation Programme for SMEs (ZIM, Zentrales Innovationsprogramm Mittelstand) was set up in 2008 and will run until 2014. Funding is provided for individual research projects and for national and international cooperation between research organisations and companies as well as between companies. More than 5000 projects are financed each year.

Innovation Output Indicator

The Innovation Output Indicator, launched by the European Commission in 2013, was developed at the request of the European Council to benchmark national innovation policies and to monitor the EU's performance against its main trading partners. It measures the extent to which ideas stemming from innovative sectors are capable of reaching the market, providing better jobs and making Europe more competitive. The indicator focuses on four policy axes: growth via technology – (patents); jobs (knowledge-intensive employment); long-term global competitiveness (trade in mid/high-tech commodities); and future business opportunities (jobs in innovative fast-growing firms). The graph below enables a comprehensive comparison of Germany's position regarding the indicators' different components:

Germany– Innovation Output Indicator



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat, OECD, Innovation Union Scoreboard 2014, DG JRC
Notes: All data refer to 2012 except PCT data, which refer to 2010.
PCT = Number of PCT patent applications per billion GDP, PPS.
KIA = Employment in knowledge-intensive activities in business industries as % of total employment.
DYN = Innovativeness of high-growth enterprises (employment-weighted average).
COMP = Combination of sub-components GOOD and SERV, using equal weights.
GOOD = High-tech and medium-high-tech products exports as % total exports. EU value refers to EU-28 average (extra-EU = 59.7 %).
SERV = Knowledge-intensive services exports as % of total service exports. EU value refers to EU-28 average (extra-EU = 56 %).

Germany is the top EU performer in the European innovation indicator. This is a result of good performance as regards all the indicator's components.

The country's performance is notably high on patents and on the share of medium-high/high-tech exports in total goods exports, where it is the second best performer in the EU.

The good performance in patents is explained by the above-average share of industries with a high patent intensity in Germany (ICT, automobile industry, medical equipment, and energy technology). Companies like Siemens, Bosch and BASF are among the top patent producers in Europe. The large and export-oriented automobile and machinery industry also explains the high score as regards the contribution of medium-high/high-tech exports to trade balance[4]. When it comes to the export share of knowledge-intensive services, the good performance is partially explained by the fact that Germany is an important transportation hub for air and waterborne transport (both classified as KIS), an important software exporter, and a major exporter of research, professional and technical services. Germany also performs above the EU average in the share of knowledge-intensive activities as the result of a high share of employment in the manufacture

[4] Germany also performs above the EU average in Community trademarks and designs, but the difference compared to the EU average is smaller than for patents.

of electronic and optical production, in publishing activities and in employment activities.

Germany performs well as regards the innovativeness of fast-growing firms. This is the result of a high share of activities with high innovativeness scores, such as computer programming and information service activities, among the fast-growing firms.

Framework conditions for entrepreneurship in Germany have improved, as indicated by the country's improved ranking in the World Bank's 'ease of doing business index'. Germany has also made progress in reducing the administrative burden related to reporting obligations in the business sector. In 2011, the Bureaucracy Reduction and Better Regulation programme was extended to cover other compliance costs. However, Germany remains at around the EU average regarding the administrative burden of the regulatory framework.

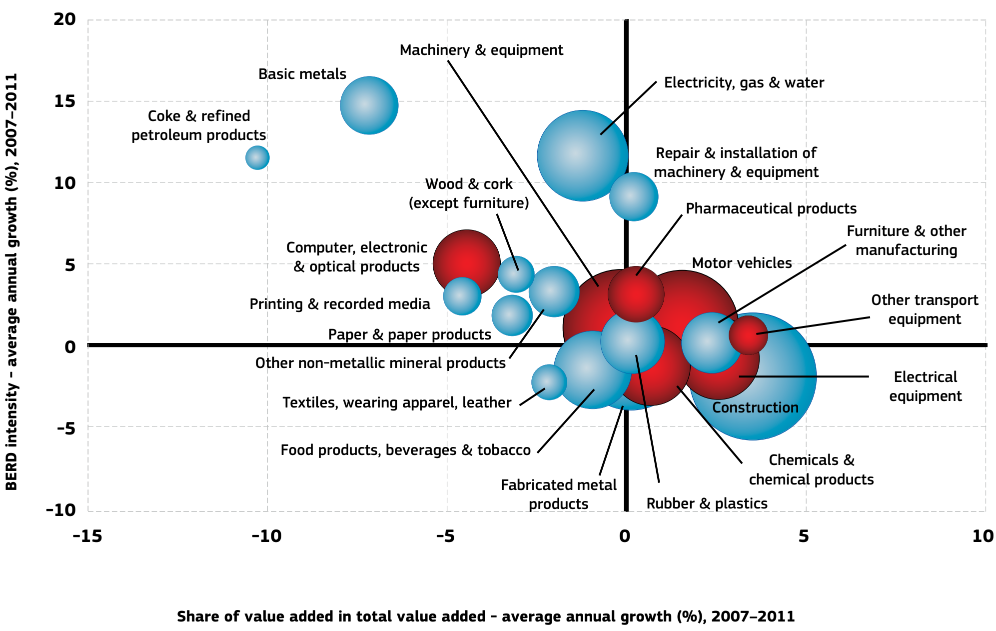
Labour productivity in the country is high and SMEs' access to bank lending is above the EU average. The quality of the infrastructure is good and the legal and regulatory framework is perceived as appropriate by business. Any remaining weak points concern the availability of broadband and use of e-government services. Furthermore, the availability of venture capital in Germany (0.19 % of GDP in 2012) remains below the EU average (0.29 %).

In the Global Competitiveness Report 2013-14, Germany is ranked second highest among EU countries (after Finland) in capacity for innovation, second highest (after Finland) in company spending on R&D, and fourth in the EU on university-industry collaboration on R&D.

Upgrading the manufacturing sector through research and technologies

The graph below illustrates the upgrading of knowledge in different manufacturing industries. The position on the horizontal axis illustrates the changing weight of each industry sector in value added over the period. The general trend of moving to the left-hand side reflects the decline in manufacturing in the overall economy. The sectors above the x-axis are those where research intensity has increased over time. The size of the bubble represents the sector share (in value added) in manufacturing (for all sectors presented in the graph). The red sectors are high-tech or medium-high-tech sectors.

Germany – Share of value added versus BERD intensity: average annual growth, 2007–2011



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat
Note: (1) High-tech and medium-high-tech sectors (NACE Rev. 2 – two-digit level) are shown in red.

The German economy is characterised by a relatively strong manufacturing industry. Nevertheless, as in many countries, the trend in manufacturing industries' share of value added in total value added is one of decline (illustrated by a shift to the left in the graph above). This is linked to rationalisation and a relative fall in the price levels of manufactured goods, the expanding services sector, and also to globalisation and competition from lower-wage, emerging economies.

The distribution of business expenditure on R&D reflects the concentration of German industry in medium-high-tech sectors, with more than 30 % of R&D spending carried out by the automobile sector alone. Other important medium-high-tech sectors in terms of R&D expenditure are machinery and equipment and chemicals excluding pharmaceuticals. These three sectors represent around 50 % of business expenditure on R&D in Germany. Spending levels are relatively lower in high-tech areas with pharmaceuticals, radio, TV and communication equipment, and medical precision and optical instruments together accounting for only around 20 % of business expenditure on R&D. Furthermore, research is concentrated in large companies and research intensity is lower in the services sector than in manufacturing.

Compared to other EU Member States, the German manufacturing industries present an above-average dynamic of upgrading knowledge through R&D. Since 2007, growth in business research intensity has been moderate, although still faster than the EU average. The motor vehicles industry, a key sector of the German economy, has maintained its high research intensity and has succeeded in increasing its share of value added. A second important medium-high-tech sector, machinery and equipment, has kept its share of the economy and its research intensity stable. The computer, electronics and optical products sector has increased research intensity but its share of value added has declined, partly as a result of falling product prices. Research intensity has increased strongly in a number of medium- and low-tech sectors such as basic metals and coke and refined petroleum products, although from a low level.

Key indicators for Germany

GERMANY	2000	2005	2006	2007	2008	2009	2010	2011	2012	Average annual growth 2007–2012 ([1]) (%)	EU average ([2])	Rank within EU
ENABLERS												
Investment in knowledge												
New doctoral graduates (ISCED 6) per thousand population aged 25–34	2.12	2.59	2.53	2.52	2.65	2.64	2.68	2.79	2.70	1.4	*1.81*	2
Performance in mathematics of 15-year-old students: mean score (PISA study)	:	:	504	:	:	513	:	:	514	9.7 ([3])	495 ([4])	6 ([4])
Business enterprise expenditure on R&D (BERD) as % of GDP	1.74	1.74	1.78	1.77	1.86	1.91	1.88	1.96	*2.02*	*2.6*	1.31	4
Public expenditure on R&D (GOVERD + HERD) as % of GDP	0.73	0.77	0.76	0.76	0.83	0.92	0.92	0.94	*0.96*	*4.8*	*0.74*	4
Venture capital as % of GDP	0.23	0.12	0.15	0.33	0.29	0.11	0.19	0.17	0.19	-10.5	0.29 ([5])	8 ([5])
S&T excellence and cooperation												
Composite indicator on research excellence	:	:	:	52.9	:	:	:	:	59.0	2.2	47.8	8
Scientific publications within the 10% most cited scientific publications worldwide as % of total scientific publications of the country	:	11.5	11.7	11.5	11.7	11.6	:	:	:	0.7	11.0	7
International scientific co-publications per million population	:	517	542	588	609	654	689	729	746	4.9	343	14
Public–private scientific co-publications per million population	:	:	:	65	63	66	73	76	:	3.8	53	9
FIRM ACTIVITIES AND IMPACT												
Innovation contributing to international competitiveness												
PCT patent applications per billion GDP in current PPS (EUR)	7.2	7.8	7.8	7.9	7.1	7.8	7.5	:	:	-1.6	3.9	3
License and patent revenues from abroad as % of GDP	0.16	0.26	0.24	0.25	0.30	0.54	0.45	0.41	0.40	9.7	0.59	11
Community trademark (CTM) applications per million population	119	134	165	189	189	197	224	244	245	5.3	152	5
Community design (CD) applications per million population	:	36	38	42	41	40	41	43	43	0.4	29	7
Sales of new-to-market and new-to-firm innovations as % of turnover	:	:	19.2	:	17.4	:	15.5	:	:	-5.5	14.4	4
Knowledge-intensive services exports as % total service exports	:	49.7	51.0	53.9	55.1	53.1	55.8	55.6	:	0.8	45.3	5
Contribution of high-tech and medium-tech products to the trade balance as % of total exports plus imports of products	9.23	8.00	7.78	8.48	8.90	7.67	7.76	8.54	9.24	-	4.23 ([6])	1
Growth of total factor productivity (total economy): 2007 = 100	94	96	98	100	100	94	98	100	99	-1 ([7])	97	6
Factors for structural change and addressing societal challenges												
Composite indicator on structural change	:	:	:	44.8	:	:	:	:	47.1	1.0	51.2	14
Employment in knowledge-intensive activities (manufacturing and business services) as % of total employment aged 15–64	:	:	:	:	14.9	15.4	15.3	15.0	15.8	1.4	13.9	7
SMEs introducing product or process innovations as % of SMEs	:	:	52.8	:	53.6	:	48.6	:	:	-4.8	33.8	1
Environment-related technologies: patent applications to the EPO per billion GDP in current PPS (EUR)	1.03	0.78	0.81	0.80	0.91	1.06	:	:	:	14.8	0.44	2
Health-related technologies: patent applications to the EPO per billion GDP in current PPS (EUR)	1.06	1.13	1.04	1.01	0.90	0.93	:	:	:	-4.0	0.53	3
EUROPE 2020 OBJECTIVES FOR GROWTH, JOBS AND SOCIETAL CHALLENGES												
Employment rate of the population aged 20–64 (%)	68.8	69.4 ([8])	71.1	72.9	74.0	74.2	74.9	76.3	76.7	1.0	68.4	3
R&D intensity (GERD as % of GDP)	2.47	2.51	2.54	2.53	2.69	2.82	2.80	2.89	*2.98*	*3.3*	*2.07*	4
Greenhouse gas emissions: 1990 = 100	84	81	81	79	79	74	77	74	:	-5 ([9])	83	9 ([10])
Share of renewable energy in gross final energy consumption (%)	:	6.0	7.0	8.3	8.4	9.2	10.7	12.3	:	10.3	13.0	14
Share of population aged 30–34 who have successfully completed tertiary education (%) ([10])	25.7	26.1 ([8])	25.8	26.5	27.7	29.4	29.8	30.7	32.0	3.8	35.7	17
Share of population aged 18–24 with at most lower secondary education and not in further education or training (%)	14.6	13.5 ([8])	13.7	12.5	11.8	11.1	11.9	11.7	10.6	-3.2	12.7	15 ([10])
Share of population at risk of poverty or social exclusion (%)	:	18.4	20.2	20.6	20.1	20.0	19.7	19.9	19.6	-1.0	24.8	9 ([10])

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat, DG JRC – Ispra, DG ECFIN, OECD, Science Metrix / Scopus (Elsevier), Innovation Union Scoreboard
Notes: ([1]) Average annual growth refers to growth between the earliest available year and the latest available year for which compatible data are available over the period 2007–2012.
([2]) EU average for the latest available year.
([3]) The value is the difference between 2012 and 2006.
([4]) PISA (Programme for Internatonal Student Assessment) score for EU does not include CY and MT. These Member States were not included in the EU ranking.
([5]) Venture capital: EU does not include EE, HR, CY, LV, LT, MT, SI and SK. These Member States were not included in the EU ranking.
([6]) EU is the weighted average of the values for the Member States.
([7]) The value is the difference between 2012 and 2007.
([8]) Break in series between 2005 and the previous years.
([9]) The value is the difference between 2011 and 2007. A negative value means lower emissions.
([10]) The values for this indicator were ranked from lowest to highest.
([11]) Values in italics are estimated or provisional.

2014 Country-specific recommendation on R&I adopted by the Council in July 2014

"Use the available scope for increased and more efficient public investment in infrastructure, education and research."

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