

C 2 Research and Development⁴⁵⁷

Statistics on research and development (R&D) expenditure indicate the extent to which activities to generate new ideas are developed. R&D intensity, as a share of R&D expenditure in the gross domestic product (for countries) or in turnover (for companies), provides information on the willingness to invest in R&D; the distribution of R&D expenditure across sectors and industries indicates focal points of R&D activity.

The R&D intensity (C 2-1) in Germany, i. e. the share of R&D expenditure in gross domestic product, is 3.19 percent. Thus, Germany continues to demonstrate an increasing R&D intensity. South Korea achieved by far the highest R&D intensity in 2019 of all considered countries with 4.64 percent. The USA's increased from 2.95 percent⁴⁵⁸ in 2018 to 3.07 percent in 2019. China's R&D intensity grew less strongly, increasing by 0.09 percentage points compared to the previous year to 2.23 percent in 2019. Japan is the only one of the selected countries whose R&D expenditure in relation to gross domestic product fell slightly from 2018 to 2019.

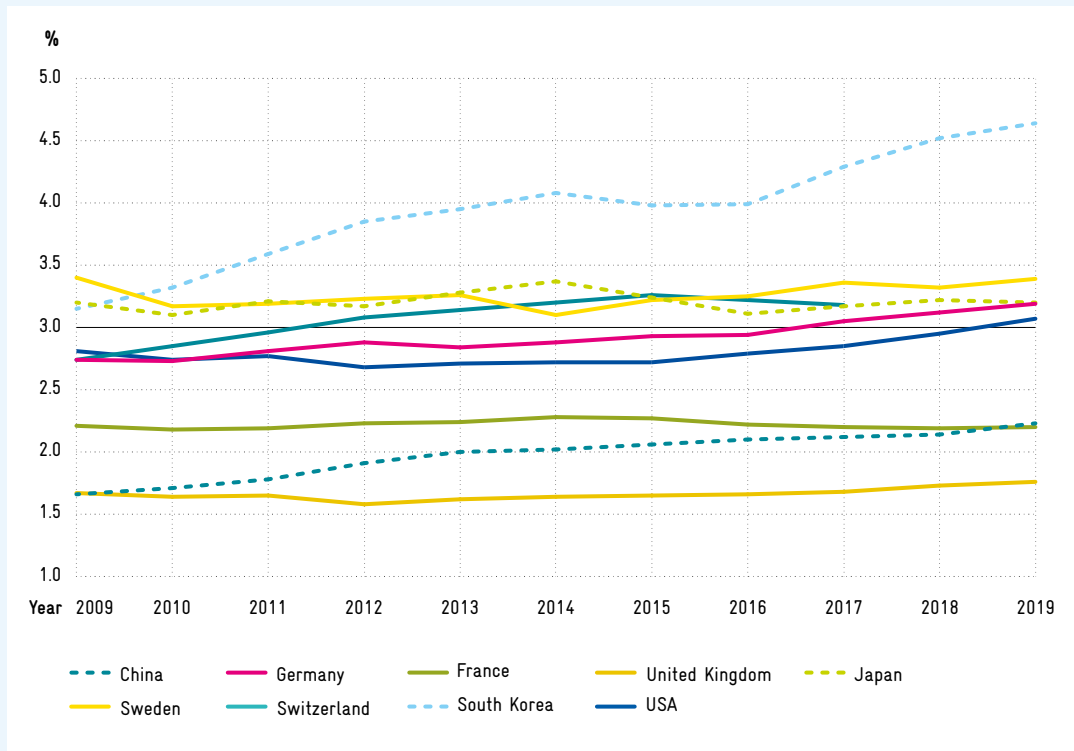
Germany's budget estimate for civil R&D (C 2-2)⁴⁵⁹ increased again compared to 2019, reaching an index value of 137 percent in 2020. This means that the budget allocated in the German national budget for financing R&D has increased by 37 percent between 2010 and 2020. The budget for civil R&D in Japan, Switzerland and South Korea has also risen sharply. For South Korea and Switzerland, however, data are only available up to 2019.

The distribution of gross domestic expenditure on R&D by performing sector (C 2-3) shows that the share of expenditure on R&D performed in the general government sector declined between 2010 and 2019 for all considered countries, except for Switzerland. The share of expenditure fell particularly sharply in the UK (by 2.9 percentage points to 6.6 percent) and in the USA (by 2.8 percentage points to 9.9 percent). In Germany, on the other hand, it decreased by only 1.1 percentage points to 13.7 percent.

The R&D intensity of the German Länder (C 2-4) indicates the share of R&D expenditure in the gross domestic product of the Länder for 2009 and 2019. R&D intensity increased between 2009 and 2019 in all Länder except Berlin and Mecklenburg-Western Pomerania. Baden-Württemberg recorded the highest R&D intensity, improving from 4.62 percent in 2009 to 5.79 percent in 2019.

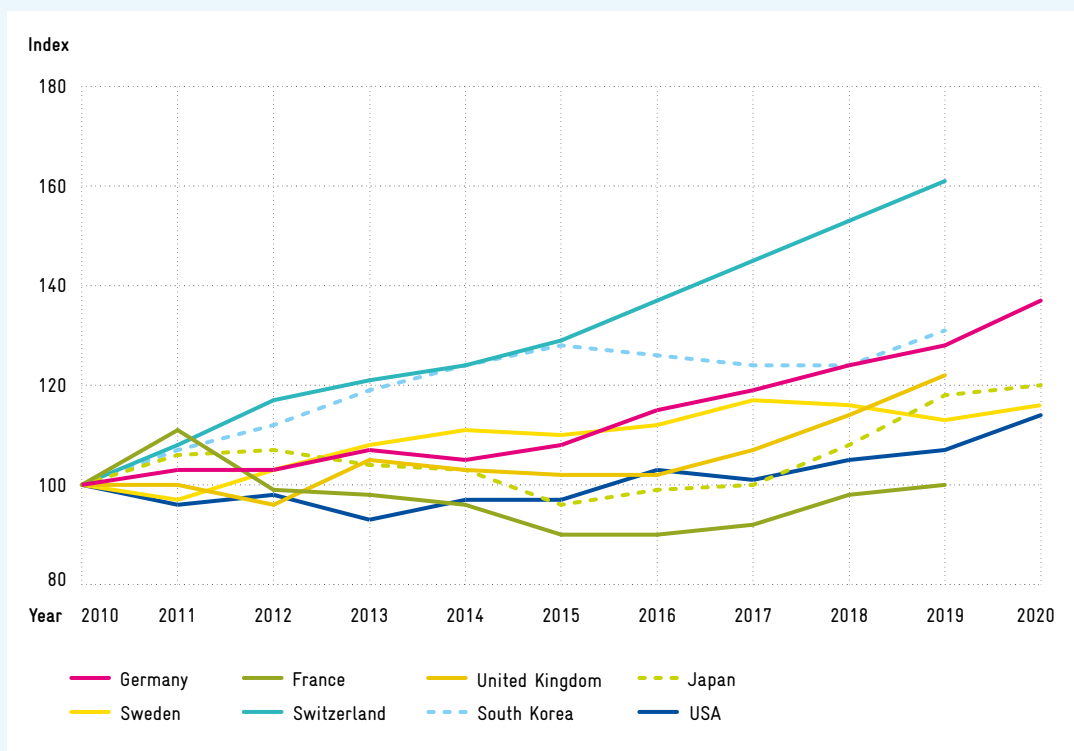
The internal R&D expenditure of companies in Germany (C 2-5) amounted to more than €75.8 billion in 2019, of which more than €30.2 billion went to vehicle manufacturing, far ahead of electronics with more than €11.4 billion. Internal R&D expenditure as a percentage of total turnover (C 2-6)⁴⁶⁰ increased from 2.8 percent to 3.0 percent on average for the manufacturing sector from 2017 to 2019.

Fig. C2-1 R&D intensity in selected countries 2009–2019 in percent



R&D intensity: percentage of an economy's gross domestic product (GDP) spent on R&D. Data for Switzerland are only available up to 2017.
Source: OECD. Calculations and estimates by DIW Berlin in Kladroba et al (2022).
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Fig. C2-2 State budget estimates for civil R&D in selected countries 2010–2020 (index values)



R&D budget estimates: the chart shows the amounts set aside in the budget to finance R&D.
Index: 2010 = 100, data partly based on estimates.
Source: OECD, Eurostat. Calculations and estimates by DIW Berlin in Kladroba et al (2022).
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Tab. C2-3 Distribution of gross domestic expenditure on R&D (GERD) by performing sector in selected countries in 2010 and 2019

Countries	2010					2019				
	GERD in US\$m	of which (%) carried out by ...				GERD in US\$m	of which (%) carried out by ...			
	Business sector	Tertiary education institutions	Public sector	Private non-profit*	Business sector	Tertiary education institutions	Public sector	Private non-profit*		
China	212,138	73.4	8.5	18.1	0.0	525,693	76.4	8.1	15.5	0.0
Germany	87,036	67.0	18.2	14.8	0.0	148,150	68.9	17.4	13.7	0.0
France	50,901	63.2	21.6	14.0	1.2	73,287	65.8	20.1	12.4	1.8
United Kingdom	37,568	60.9	27.0	9.5	2.5	56,936	66.6	23.1	6.6	2.3
Japan	140,566	76.5	12.9	9.0	1.6	173,267	79.2	11.7	7.8	1.3
Sweden	12,554	68.7	26.3	4.9	0.0	19,269	71.7	23.7	4.5	0.1
Switzerland ¹⁾	10,917	73.5	24.2	0.7	1.6	18,566	71.0	28.2	0.8	2.3
South Korea	52,166	74.8	10.8	12.7	1.7	102,521	80.3	8.3	10.0	1.4
USA	410,093	68.0	14.7	12.7	4.5	657,459	73.9	12.0	9.9	4.3

1) For Switzerland, 2017 was used as the latest available year.

* Non-profit organizations included in "Public sector" in some countries.

Source: OECD. Calculations by DIW Berlin in Kladroba et al (2022).

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Tab. C2-4 R&D intensity of the Länder and Germany 2009 and 2019 in percent

Länder	2009				2019			
	Total	Business sector	Public sector	Tertiary education institutions	Total	Business sector	Public sector	Tertiary education institutions
Baden-Württemberg	4.62	3.68	0.43	0.52	5.79	4.84	0.42	0.53
Bavaria	3.04	2.35	0.28	0.41	3.41	2.61	0.33	0.47
Berlin	3.37	1.38	1.14	0.85	3.33	1.33	1.17	0.83
Brandenburg	1.40	0.35	0.72	0.32	1.81	0.65	0.78	0.39
Bremen	2.65	0.98	0.91	0.76	3.01	0.99	1.23	0.79
Hamburg	2.11	1.18	0.45	0.49	2.18	1.22	0.38	0.57
Hesse	2.97	2.36	0.22	0.39	3.10	2.30	0.34	0.47
Mecklenburg-Western Pomerania	1.84	0.58	0.71	0.54	1.81	0.51	0.65	0.65
Lower Saxony	2.60	1.72	0.40	0.49	3.14	2.24	0.35	0.55
North Rhine-Westphalia	1.97	1.19	0.31	0.47	2.16	1.26	0.33	0.57
Rhineland-Palatinate	2.03	1.48	0.16	0.38	2.62	1.97	0.21	0.45
Saarland	1.26	0.50	0.37	0.38	1.90	0.89	0.44	0.58
Saxony	2.73	1.20	0.83	0.70	2.99	1.31	0.83	0.85
Saxony-Anhalt	1.37	0.44	0.48	0.45	1.54	0.41	0.54	0.59
Schleswig-Holstein	1.29	0.58	0.35	0.36	1.68	0.79	0.35	0.53
Thuringia	2.18	1.06	0.53	0.59	2.35	1.16	0.53	0.66
Germany	2.74	1.85	0.41	0.49	3.19	2.20	0.44	0.56

R&D intensity: Länder expenditure on research and development as a percentage of their gross domestic product, broken down by performing sector. GDP as of 22 Oct. 2021.

Source: SV Wissenschaftsstatistik and statistical offices of the Federal Government and the Länder. Calculations by SV Wissenschaftsstatistik in Kladroba et al (2022).

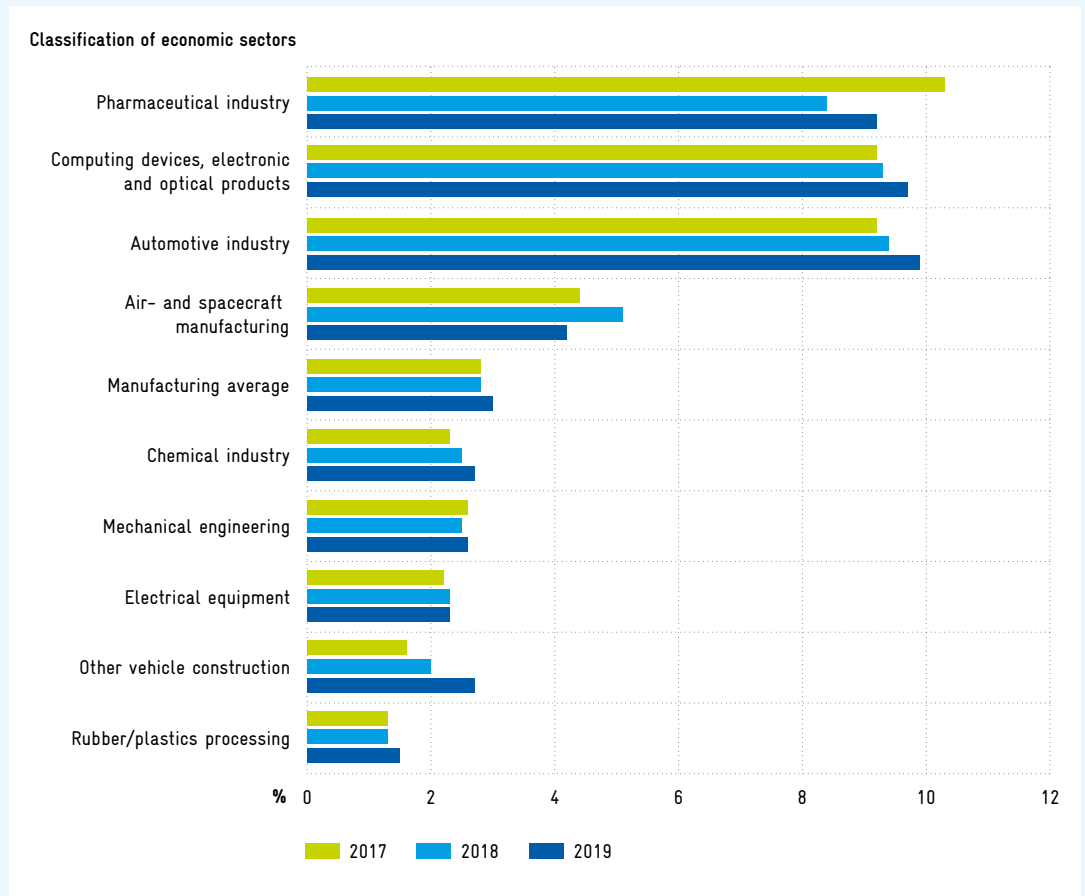
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Tab. C2-5 Internal corporate R&D expenditure by origin of funds, economic sectors, company size and technology category in 2019

	Internal R&D expenditure				
	in total	of which funded by			
		Business sector	Public sector	Other domestic entities (e.g. universities)	Foreign entities
	in 1,000 euro	in percent			
All researching companies	75,830,367	88.2	3.2	0.1	8.5
Manufacturing	64,361,021	89.0	2.0	0.1	8.9
Chemical industry	4,411,372	92.7	1.4	0.0	5.9
Pharmaceutical industry	5,433,856	82.4	0.9	0.0	16.6
Plastics, glass and ceramics	1,708,901	90.6	2.8	0.1	6.6
Metal production and processing	1,567,668	80.3	9.8	0.3	9.5
Electrical engineering/electronics	11,416,474	88.2	3.1	0.0	8.7
Mechanical engineering	7,450,294	94.5	2.5	0.3	2.7
Vehicle construction	30,230,207	88.9	1.1	0.2	9.8
Other manufacturing industries	2,142,249	90.5	3.5	0.1	5.9
Remaining economic sectors	11,469,346	83.4	10.1	0.2	6.3
< 100 employees	3,815,854	70.2	23.2	0.5	6.0
100–499 employees	6,265,028	85.3	7.3	0.2	7.2
500–999 employees	4,189,250	90.5	2.5	0.1	7.0
≥ 1,000 employees	61,560,235	89.4	1.6	0.1	8.9
Technology categories in industry					
Cutting-edge technology (> 9 percent of costs/turnover spent on R&D)	16,239,674	84.3	3.6	0.0	12.0
High-value technology (3–9 percent of costs/turnover spent on R&D)	42,032,649	90.8	1.0	0.2	8.0

Internal R&D: R&D that is conducted within the company, either for the company's own purposes or commissioned by a third party.
Source: SV Wissenschaftsstatistik in Kladroba et al. (2022).
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Fig. C2-6 Internal corporate R&D expenditure as a percentage of turnover 2017–2019



Internal R&D: R&D that is conducted within the company, either for the company's own purposes or commissioned by a third party. Internal R&D expenditure is reported as a percent of total turnover and not as a percent of turnover from own products. Figures net, without input tax.
 Source: SV Wissenschaftsstatistik, Federal Statistical Office. Calculations by SV Wissenschaftsstatistik in Kladroba et al (2022).
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