



InfoBrief

Foreign R&D Reported by IT-Related Industries Account for About Half or More of U.S.-Owned R&D Performed in India, China, Canada, and Israel

NSF 22-328 | April 2022

Francisco Moris

U.S.-located businesses reported \$104.5 billion in foreign research and development performance ([table 1](#)), compared with \$493.0 billion of business R&D performed in the United States, according to estimates from the 2019 Business Enterprise Research and Development (BERD) survey. From 2011 to 2019, foreign R&D reported by U.S.-located businesses grew at an average annual rate of 5% ([table 2](#)).¹ Foreign employment by these businesses grew at an average annual rate of 1% over the same period.

Table 1

Foreign R&D performed and employment reported by U.S.-located businesses, by selected host country: 2018–19

(Millions of U.S. dollars and thousands of employees)

Country	2018			2019			2018–19 % change			R&D employment intensity ^a	
	Foreign R&D	Foreign employment		Foreign R&D	Foreign employment		Foreign R&D	Foreign employment		2018	2019
		Total	R&D		Total	R&D		Total	R&D		
Total	100,376	10,700	797	104,464	11,083	844	4	4	6	7	8
United Kingdom	11,278	695	68	11,797	736	67	5	6	-1	10	9
India	9,521	867	173	9,846	893	196	3	3	13	20	22
Germany	8,391	454	47	8,879	475	55	6	5	17	10	12
China	7,867	881	73	8,195	989	85	4	12	16	8	9
Canada	6,140	457	40	6,862	522	44	12	14	10	9	8
Israel	5,099	57	23	5,974	59	23	17	4	0	40	39
Switzerland	4,434	71	10	4,536	71	11	2	0	10	14	15
Ireland	4,043	116	14	4,207	113	14	4	-3	0	12	12
Japan	3,986	200	22	4,090	215	21	3	7	-5	11	10
France	3,332	263	21	3,313	284	20	-1	8	-5	8	7

^a R&D employment intensity = (foreign R&D employment / foreign employment) × 100.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey.

Table 2**Domestic and foreign R&D reported by U.S.-located businesses, by selected industry: 2011, 2018, and 2019**

(Millions of U.S. dollars and percent)

Industry	NAICS code	2011		2018		2019		2011–19 AAGR (%)	
		Domestic	Foreign	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
All industries	21–23, 31–33, 42–81	290,240	69,231	441,036	100,376	492,956	104,464	7	5
Manufacturing	31–33	202,363	51,870	274,075	64,878	285,674	64,351	4	3
Chemicals	325	55,853	16,393	84,137	16,749	97,063	18,568	7	2
Plastics and rubber products	326	2,278	362	2,751	428	2,856	503	3	4
Nonmetallic mineral products	327	1,175	253	1,385	181	1,508	192	3	-3
Fabricated metal products	332	1,857	137	2,327	216	2,885	278	6	9
Machinery	333	14,725	3,524	14,799	4,521	15,184	4,251	0	2
Computer and electronic products	334	62,438	17,294	83,697	28,322	86,729	25,452	4	5
Electrical equipment	335	3,624	1,704	4,487	1,693	5,263	1,743	5	0
Transportation equipment	336	41,094	7,933	52,629	7,446	45,375	7,812	1	-0
Nonmanufacturing	21–23, 42–81	87,877	17,361	166,961	35,498	207,283	40,113	11	11
Information	51	42,697	9,586	94,349	17,156	110,227	19,051	13	9
Professional, scientific, and technical services	54	33,307	5,892	44,860	13,307	53,233	14,790	6	12

AAGR = average annual growth rate, NAICS = North American Industry Classification System.

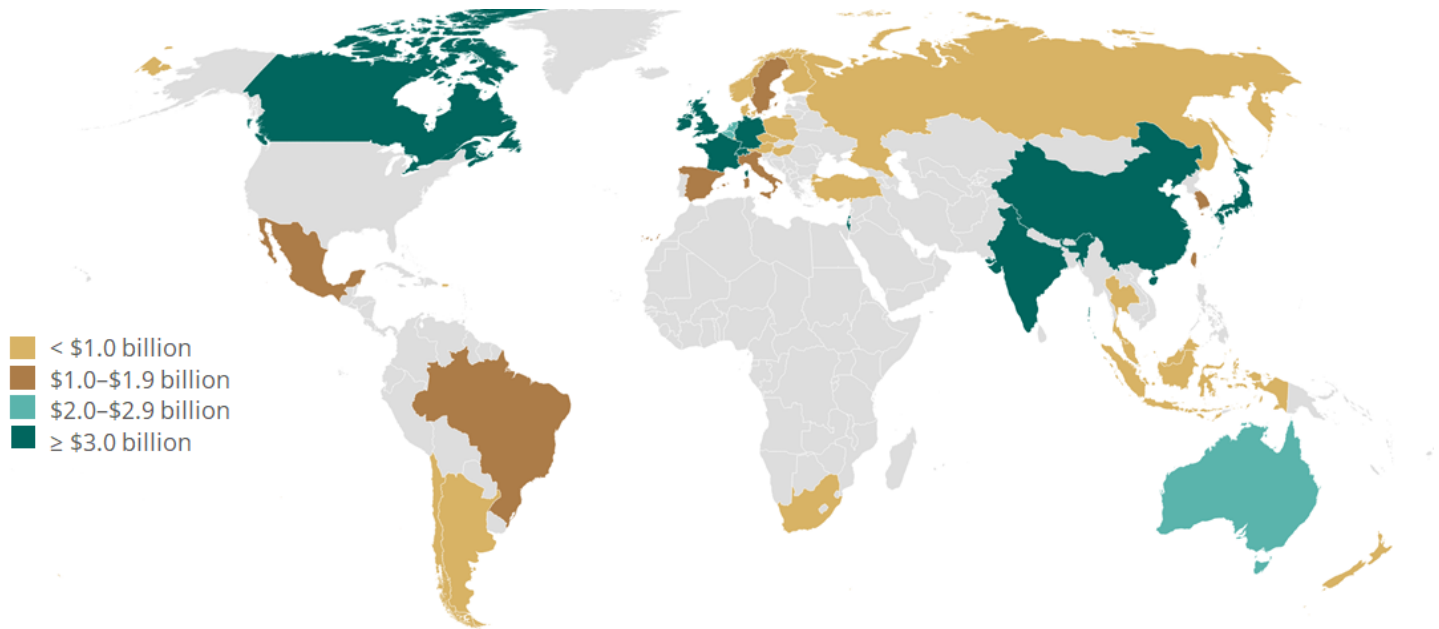
Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey.

This InfoBrief focuses on the geographic and industry distribution of foreign R&D and employment reported by U.S.-located businesses, with a special focus on information technology (IT)-related industries. Foreign R&D refers to R&D performed abroad by U.S.-located companies, also called U.S.-owned foreign R&D in this report. This includes R&D performed by foreign affiliates of U.S. multinational enterprises (majority- or minority-owned affiliates),² as well as spending associated with other ways of providing R&D services abroad.³ Foreign employment and foreign R&D employment refer to workers employed in foreign operations.⁴

Overall Host Country Distribution

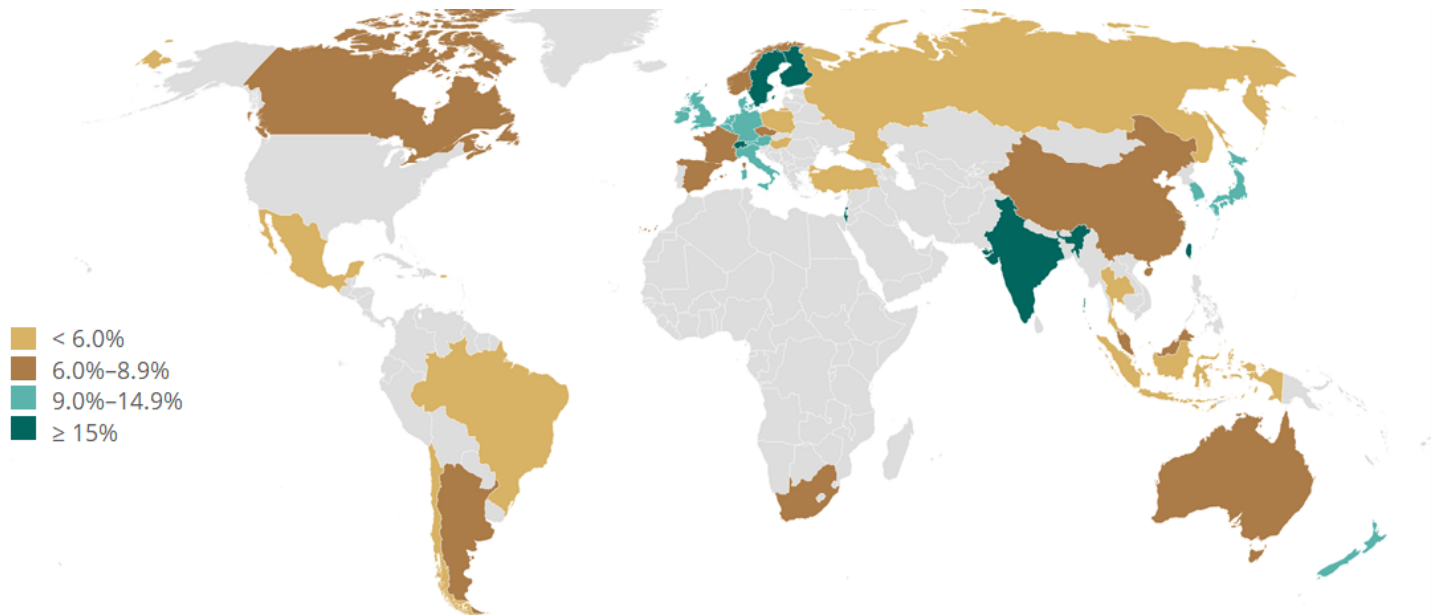
U.S.-located companies reporting foreign R&D employed 11.1 million workers abroad (table 1), based on 2019 BERD statistics.⁵ The 10 countries with the most U.S.-owned foreign R&D performance (more than \$3 billion in U.S. dollars) includes Canada, five European locations (United Kingdom [UK], Germany, France, Ireland, and Switzerland), three Asian countries (China, India, and Japan), and Israel. Other countries in the top 10 at some point since 2011 include Brazil and Singapore.⁶ Figure 1 summarizes the 2019 geographic distribution of these R&D performance statistics.

Figure 1**Geographic distribution of U.S.-owned foreign R&D performance: 2019****Source(s):**

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2019.

The UK remained the top location for U.S.-owned foreign R&D with \$11.8 billion, followed by India, Germany, China, and Canada. These five countries hosted 44% of foreign R&D by U.S.-located companies; the top 10 locations accounted for 65% of this total ([table 1](#)).

Foreign R&D employment reported by U.S.-located companies increased 6% between 2018 and 2019, compared with 4% growth in overall foreign employment and 4% growth for foreign R&D expenditures. Foreign R&D employment by these companies was the largest in India (196,000), China (85,000), and the UK (67,000) in 2019 ([table 1](#)). However, foreign R&D employment intensity (R&D employment as share of total employment) was largest in Israel (39%), India (22%), and Switzerland (15%). [Figure 2](#) shows the global geographic distribution of this intensity measure.

Figure 2**Geographic distribution of R&D employment intensity for U.S.-owned foreign R&D: 2019****Note(s):**

R&D employment intensity = (foreign R&D employment / foreign employment) × 100.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2019.

Overall Industry Distribution

Statistics reported here are based on the North American Industry Classification System (NAICS) code of U.S.-located reporting companies, which may differ from the industry categorization of the foreign-located business. Three sectors—manufacturing (NAICS 31–33); information (NAICS 51); and professional, scientific, and technical services (NAICS 54)—accounted for 94% of U.S.-owned foreign R&D expenditures in 2019.⁷ Three subsectors—computer and electronic products (NAICS 334), chemicals (NAICS 325), and transportation equipment (NAICS 336)—accounted for 81% of the manufacturing sector ([table 2](#)). However, as detailed below, the industry distribution varies across foreign host countries.⁸

Industry Distribution in Top Foreign Locations

Between 2011 and 2019, the share of manufacturing industries in total foreign R&D reported by U.S.-located companies declined from 75% to 62% ([table 2](#)). However, manufacturing industries still accounted for 78% of U.S.-owned foreign R&D in Germany and 72% of U.S.-owned foreign R&D in China in 2019 ([table 3](#)). Manufacturing and nonmanufacturing R&D reported by U.S.-located companies are about evenly split in the UK, India, Canada, and Ireland. This section presents details on the industry distribution of U.S.-owned foreign R&D ([table 3](#) and [table 4](#)) and industry shares within top host countries (within country shares) ([figure 3](#)).

Table 3**Foreign R&D reported by U.S.-located businesses, by selected industry and host country: 2019**

(Millions of U.S. dollars)

Industry	NAICS code	Total outside the United States	United Kingdom	India	Germany	China	Canada	Israel	Switzerland	Ireland	Japan	France
All industries	21-23, 31-33, 42-81	104,464	11,797	9,846	8,879	8,195	6,862	5,974	4,536	4,207	4,090	3,313
Manufacturing industries	31-33	64,351	5,565	4,483	6,917	5,923	3,610	3,894	2,946	2,281	2,722	2,091
Chemicals	325	18,568	2,224	400	1,128	1,043	789	276	1,772	1,454	1,219	711
Pharmaceuticals and medicines	3254	15,868	1,964	350	810	803	684	214	1,724	1,453	1,139	606
Machinery	333	4,251	375	384	678	396	147	363	187	15	190	392
Computer and electronic products	334	25,452	1,422	3,216	2,078	2,470	1,764	3,061	331	507	798	461
Semiconductor and other electronic components	3344	13,007	411	1,549	823	1,530	665	2,207	79	269	326	195
Electrical equipment, appliances, and components	335	1,743	117	50	261	370	286	0-19	67	8	75	52
Transportation equipment	336	7,812	907	226	2,020	999	325	4	8	13	103	167
Motor vehicles, bodies, trailers, and parts	3361-63	6,993	736	212	1,895	989	231	4	0-9	13	99	98
Aerospace products and parts	3364	585	151	0-15	97	0-11	35	0	0-9	0	4	0-54
Nonmanufacturing industries	21-23, 42-81	40,113	6,233	5,364	1,961	2,272	3,252	2,080	1,590	1,926	1,369	1,221
Information	51	19,051	2,984	3,231	636	1,173	1,877	1,346	1,032	851	237-349	549
Publishing	511	6,949	671	1,446	235	690	1,015	468	72	0-332	84	225
Software publishers	5112	6,949	671	1,446	235	690	1,015	468	72	0-332	84	225
Data processing, hosting, and related services	518	5,891	591	1,530	198	347	634	403	0-205	317	44	205
Professional, scientific, and technical services	54	14,790	2,506	1,347	764	774	1,003	554	530	338-457	665	574
Computer systems design and related services	5415	5,370	417	994	322	347	458	463	94	244-365	70	114
Scientific research and development services	5417	9,006	2,050	267	417	403	491	74	435	93	595	425
Research and development in biotechnology	541711	2,793	904	103	131	195	117	24	404	4	145	106

Table 3**Foreign R&D reported by U.S.-located businesses, by selected industry and host country: 2019**

(Millions of U.S. dollars)

Industry	NAICS code	Total outside the United States	United Kingdom	India	Germany	China	Canada	Israel	Switzerland	Ireland	Japan	France
Research and development in the physical, engineering, and life sciences (except biotechnology)	541712	6,205 i	1,146 i	163 i	286 i	208 i	374	49 i	31 i	89 i	449 i	320 i

i = > 50% of the estimate is a combination of imputation and reweighting to account for nonresponse.

NAICS = North American Industry Classification System.

Note(s):

An estimate range may be displayed in place of a single estimate to avoid disclosing operations of individual companies.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2019.

Table 4**Foreign R&D reported by U.S.-located businesses, by IT-related industries and selected host country: 2019**

(Millions of U.S. dollars and percent)

Industry	NAICS code	Total outside the United States	United Kingdom	India	Germany	China	Canada	Israel	Switzerland	Ireland	Japan	France
All industries	21-23, 31-33, 42-81	104,464	11,797	9,846	8,879	8,195	6,862	5,974	4,536	4,207	4,090	3,313
IT-related industries	na	49,873	4,823	7,441	3,036	3,990	4,099	4,870	1,457	1,358	868	1,124
Computer and electronic products	334	25,452 i	1,422	3,216	2,078	2,470	1,764	3,061	331	507	798	461 i
Semiconductor and other electronic components	3344	13,007 i	411	1,549	823	1,530	665	2,207	79	269	326	195 i
Information	51	19,051	2,984	3,231	636	1,173	1,877	1,346	1,032	851	237 - 349	549
Software publishers	5112	6,949	671	1,446	235	690	1,015	468	72	0 - 332	84	225
Data processing, hosting, and related services	518	5,891	591	1,530	198	347	634	403	0 - 205	317	44	205

Table 4**Foreign R&D reported by U.S.-located businesses, by IT-related industries and selected host country: 2019**

(Millions of U.S. dollars and percent)

Industry	NAICS code	Total outside the United States	United Kingdom	India	Germany	China	Canada	Israel	Switzerland	Ireland	Japan	France
Computer systems design and related services	5415	5,370	417	994	322	347	458	463	94	244 - 365	70	114
Share of IT-related	na	48	41	76	34	49	60	82	32	32	21	34

i = > 50% of the estimate is a combination of imputation and reweighting to account for nonresponse, na = not applicable.

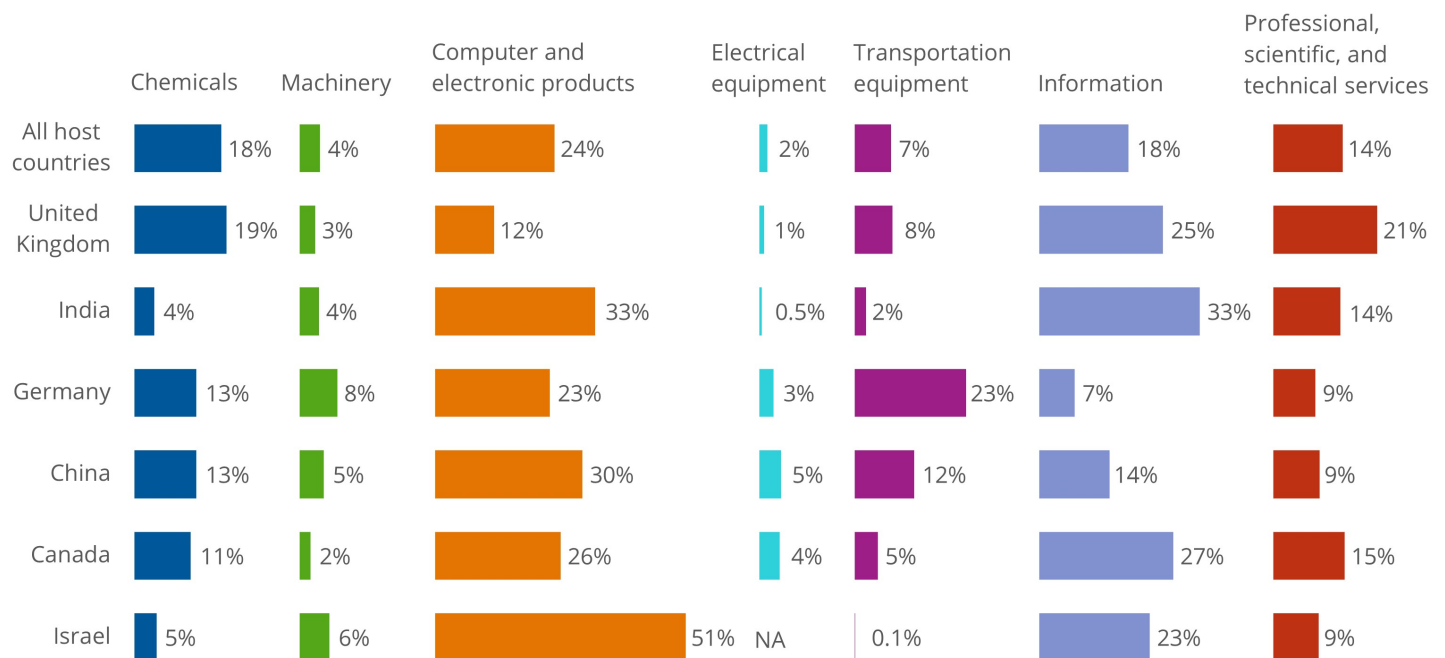
IT = information technology; NAICS = North American Industry Classification System.

Note(s):

An estimate range may be displayed in place of a single estimate to avoid disclosing operations of individual companies.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2019.

Figure 3**Industry distribution of U.S.-owned foreign R&D in top host countries (within country shares): 2019**

NA = not available.

Note(s):

Data are for U.S.-owned foreign R&D.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2019.

Computer and electronic products manufacturing (NAICS 334), including communications equipment and semiconductors; information (NAICS 51), including software publishers and data processing, hosting, and related services; and computer systems design and related services (NAICS 5415), are defined here as *IT-related industries*. They are major suppliers of IT and communications equipment and services for applications including mobile, cloud, and artificial intelligence (AI) services. Foreign R&D reported by these IT-related industries accounted for almost half or more of U.S.-owned R&D in India, China, Canada, and Israel in 2019 ([table 4](#)).

U.S.-located companies classified in computer and electronic products (NAICS 334) accounted for the largest share of U.S.-owned foreign R&D across all locations abroad at 24% in 2019. Furthermore, in Israel, this industry accounted for more than half of U.S.-owned foreign R&D and for at least a third of U.S.-owned foreign R&D in China and in India. In the services area, information (NAICS 51) accounted for about a third of U.S.-owned R&D in India and between a fifth and up to a little over a fourth of U.S.-owned R&D in Canada, UK, Switzerland, and Israel. And the largest within country shares of U.S.-owned foreign R&D classified in computer systems design and related services (NAICS 5415) were in India (10%), Israel (8%), and Canada (7%) in 2019 ([table 4](#)).

U.S.-located companies classified in chemicals manufacturing (NAICS 325), which includes pharmaceutical companies, performed between 30% and 40% of U.S.-owned foreign R&D in Switzerland, Ireland, and Japan in 2019, compared with the 18% share of this industry in U.S.-owned R&D across all foreign locations ([table 3](#)).

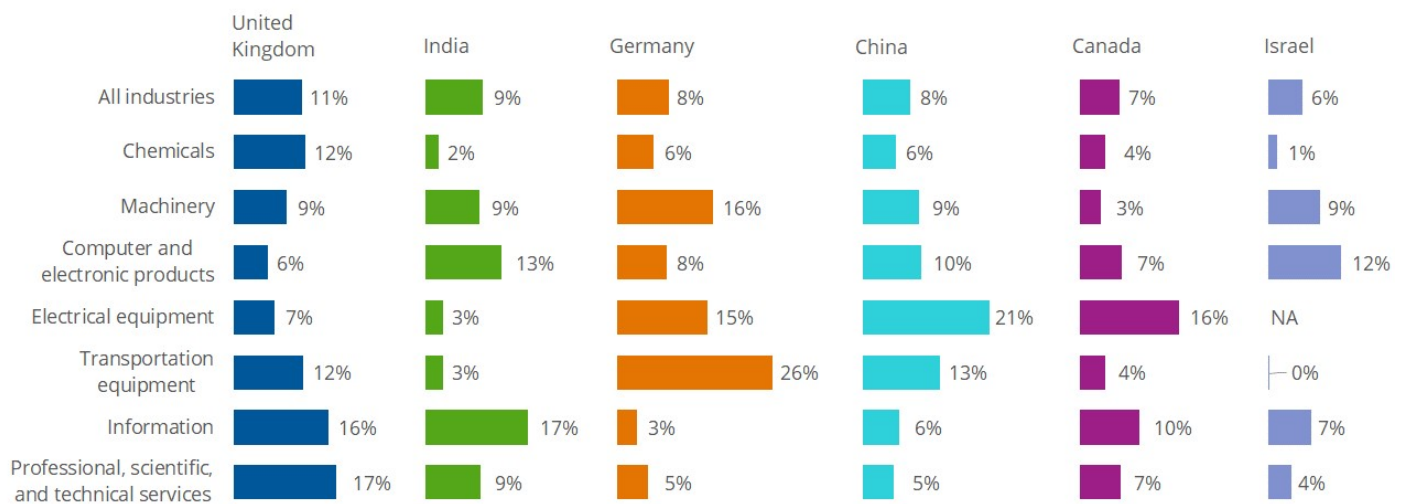
Lastly, transportation equipment (NAICS 336) (which includes automobiles and aerospace) accounted for 23% of U.S.-owned R&D in Germany, 18% in Italy,⁹ and 12% in China, compared with 7% across all foreign locations reported by U.S.-located companies in 2019 ([table 3](#)).

Country Distribution for Top Industries

[Figure 4](#) shows the geographic distribution of U.S.-owned foreign R&D within industries. U.S.-owned companies classified in computer and electronic products manufacturing (NAICS 334) reported their largest 2019 foreign R&D performance in India, China, and Israel. Companies classified specifically in semiconductor and other electronic components manufacturing (NAICS 3344) reported \$13.0 billion in foreign R&D, with 17% performed in Israel, 12% in China, and 12% in India ([table 3](#)).

Figure 4

Host country distribution of U.S.-owned foreign R&D in top industries (within industry shares): 2019



NA = not available.

Note(s):

Data are for U.S.-owned foreign R&D.

Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey, 2019.

For IT-related service industries, India hosts a significant share of U.S.-owned foreign R&D. The country accounted for 21% of \$6.9 billion in total U.S.-owned foreign R&D by software publishers (NAICS 5112); 26% of \$5.9 billion in data processing, hosting, and related services (NAICS 518); and 19% of \$5.4 billion in computer systems design and related services (NAICS 5415) ([table 3](#)).¹⁰

Industries engaged in life sciences performed a significant share of U.S.-owned foreign R&D in the UK and Switzerland. U.S.-owned foreign R&D in these locations accounted for 12% and 11%, respectively, of the \$15.9 billion of U.S.-owned foreign R&D in pharmaceuticals and medicines manufacturing (NAICS 3254) in 2019. U.S.-located companies classified in R&D in biotechnology (NAICS 541711) reported \$2.8 billion in foreign R&D. Of this amount, about a third was performed in the UK and 14% in Switzerland ([table 3](#)).

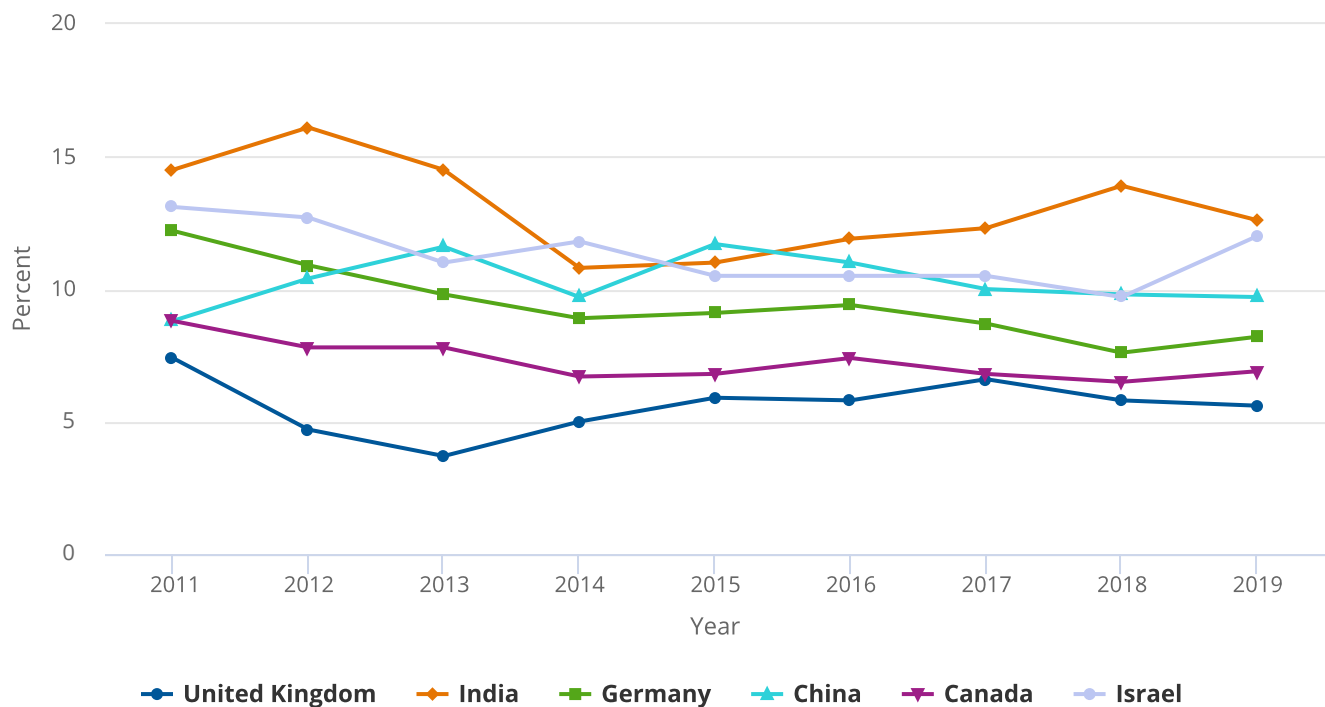
U.S.-located companies classified in transportation equipment manufacturing (NAICS 336) reported over a quarter of their foreign R&D in Germany, whereas over a fifth of U.S.-owned foreign R&D classified in electrical equipment, appliance, and component manufacturing (NAICS 335) was performed in China in 2019 ([table 3](#) and [figure 4](#)).

Trends for IT-related industries

The relative ranking of the top five locations for foreign-performed R&D reported by U.S.-located companies classified in computer and electronic product manufacturing (NAICS 334) has changed little from 2011 to 2019, with offsetting up and down movements in their shares over this period ([figure 5](#)). For information (NAICS 51), which includes software publishers and data processing and hosting services, the shares of U.S.-owned foreign R&D performed in India are now on par with the corresponding UK shares since 2014 ([figure 6](#)).¹¹

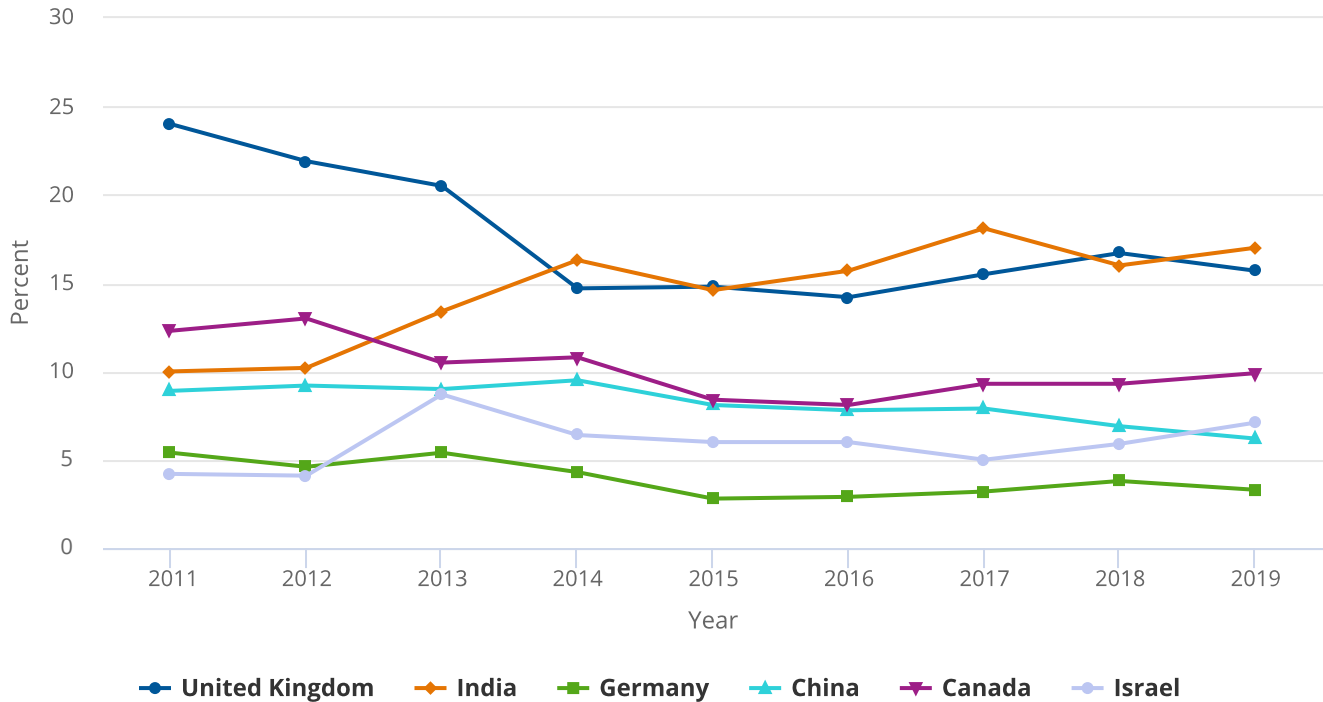
Figure 5

Host country shares of U.S.-owned foreign R&D for the computer and electronic products industry, by selected country: 2011–19



Source(s):

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey.

Figure 6**Host country shares of U.S.-owned foreign R&D for the information industry, by selected country: 2011–19****Source(s):**

National Center for Science and Engineering Statistics and Census Bureau, Business Enterprise Research and Development Survey.

Data Sources and Limitations

In this InfoBrief, monetary amounts are expressed in current U.S. dollars. Foreign R&D and employment by industry are based on the 2012 NAICS code classification of U.S.-located company respondents to annual BERD surveys. Country detail was not collected from companies reporting less than \$1 million of R&D paid for by the company or reporting less than \$1 million of R&D paid for by others.

BERD samples are selected to represent all U.S.-located, for-profit, nonfarm companies that were publicly or privately held and had 10 or more U.S. employees since the 2017 survey year (5 or more U.S. employees for prior years). Statistics are subject to sampling and nonsampling errors. For additional information, see the technical notes in the annual BERD data tables at <https://www.nsf.gov/statistics/srvyberd/#tabs-2>.

Notes

1 Domestic R&D performed by all U.S.-located businesses grew at an average annual rate of 7% over the same period. For related domestic statistics, see Wolfe R; National Center for Science and Engineering Statistics (NCSES). 2021. *U.S. Businesses Reported Nearly a Half Trillion Dollars for R&D Performance in the United States During 2019, an 11.8% Increase from 2018*. InfoBrief NSF 22-303. Alexandria, VA: National Science Foundation. Available at <http://ncses.nsf.gov/pubs/nsf22303>.

- 2** A multinational enterprise (MNE) refers to a parent company and their foreign affiliates. A majority-owned foreign affiliate of a U.S. MNE is a foreign business enterprise in which the combined ownership of all U.S. parents, either directly or indirectly, exceeds 50%. For data on operations and foreign direct investment (FDI) by MNEs, see Bureau of Economic Analysis (BEA) statistics at <https://www.bea.gov/data/intl-trade-investment/activities-us-multinational-enterprises-mnes>. For information on comparisons of BEA MNE statistics and National Center for Science and Engineering Statistics BERD statistics, see <https://www.nsf.gov/statistics/rdlink/>.
- 3** For example, foreign R&D performance reported in the BERD survey may include spending by companies that send U.S. workers for temporary R&D assignments overseas.
- 4** For companies reporting foreign activities in the BERD survey, a worker is effectively counted only once as either a domestic or foreign employee, given that internal survey processing ensures that the sum of domestic and foreign employment equals the reported company's worldwide employment. R&D employment is processed similarly. For detailed BERD data, see annual publications available at <https://www.nsf.gov/statistics/srvyberd/#tools&infdsts&tabs-3>.
- 5** Two-fifths of this total foreign employment in the BERD survey was accounted for by five countries: China, India, Mexico, UK, and Canada. More generally, employment in majority-owned foreign affiliates of U.S. MNEs, regardless of their R&D activity status, was 14.6 million in 2019 based on BEA statistics (<https://www.bea.gov/news/2021/activities-us-multinational-enterprises-2019>, accessed 12 November 2021).
- 6** The increased dispersion of U.S. MNE R&D from G7 countries to other regions since the 1990s has long been documented (though R&D stocks of U.S. MNEs remain larger in G7 countries), driven by market (demand), technology supply/skills capability factors, and evolving MNE innovation strategies. See Papanastassiou M, Pearce R, Zanfei A. 2020. Changing Perspectives on the Internationalization of R&D and Innovation by Multinational Enterprises: A Review of the Literature. *Journal of International Business Studies* 51, 623–64.
- 7** For domestic U.S. business R&D performance, the same three sectors accounted for 91% in 2019.
- 8** Spatial and sectoral specialization of foreign MNE R&D and investment has been documented by studies on the geography of innovation clusters and in international business research. See Kim M, Lampert CM, Roy R. 2020. Regionalization of R&D Activities: (Dis)economies of Interdependence and Inventive Performance. *Journal of International Business Studies* 51, 1054–75.
- 9** In 2019, U.S.-owned foreign R&D performance in Italy was \$1.6 billion, the 11th largest location. The latter amount included \$298 million in foreign R&D reported by U.S. companies classified in transportation equipment (NAICS 336).
- 10** For related BEA MNE and United States Patent and Trademark Office (USPTO) patent statistics, see Branstetter LG, Glennon BM, Jensen JB. 2018. *The IT Revolution and the Globalization of R&D*. NBER Working Paper No. 24707.
- 11** This report does not provide a BERD times series for NAICS 5415 (computer systems design and related services), since 2019 is the first year with foreign R&D details for this IT-related industry.

Suggested Citation

Moris F; National Center for Science and Engineering Statistics (NCSES). 2021. *Foreign R&D Reported by IT-Related Industries Account for About Half or More of U.S.-Owned R&D Performed in India, China, Canada, and Israel*. NSF 22-328. Alexandria, VA: National Science Foundation. Available at <https://ncses.nsf.gov/pubs/nsf22328/>.

Contact Us

Report Author

Francisco Moris
Senior Analyst
Research and Development Statistics Program, NCSES
Tel: (703) 292-4678
E-mail: fmoris@nsf.gov

NCSES

National Center for Science and Engineering Statistics
Directorate for Social, Behavioral and Economic Sciences
National Science Foundation
2415 Eisenhower Avenue, Suite W14200
Alexandria, VA 22314
Tel: (703) 292-8780
FIRS: (800) 877-8339
TDD: (800) 281-8749
E-mail ncsesweb@nsf.gov