



Microbusinesses Spent \$4.8 Billion on R&D Performance in the United States in 2016, According to New Survey

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Small businesses contribute to the U.S. economy by bringing growth and innovation and by being more adaptable to changes in the economy. Although extensive research has been done on small businesses—sometimes defined as fewer than 250 or 500 employees—very little is known about the smallest businesses, or microbusinesses.² This InfoBrief provides new information on microbusinesses and their research and development activities, strategies, and drivers of competitiveness.

Microbusinesses are defined in this InfoBrief as businesses with one to four employees.³ According to the U.S. Census Bureau, microbusinesses made up more than one-half (56%) of all U.S. employer businesses in 2016.⁴ In the same year, microbusinesses performed \$4.8 billion of R&D in the United States (table 1), while businesses with five or more employees provide the vast majority (\$375 billion) of R&D expenditures in the United States.⁵ However, the smaller the business, the higher the R&D intensity, that is, the proportion of total sales that is dedicated to R&D (Anderson and Kindlon 2019).

Data for this InfoBrief are from the Microbusiness R&D and Innovation

Survey (BRDI-M), developed and cosponsored by the National Center for Science and Engineering Statistics within the National Science Foundation and by the U.S. Census Bureau. Data from selected industries are highlighted in this InfoBrief. The BRDI-M survey was conducted only once. In the future, R&D data from microbusinesses will be collected by the Annual Business Survey (ABS).⁶ Since 2016 was the first and only year the BRDI-M was conducted, some unknown measurement error is expected.

Characteristics of Microbusiness R&D Performance

By Industry

Microbusiness R&D is highly concentrated within a few industries. In 2016, R&D performance by microbusinesses in the United States was approximately \$4.8 billion (table 1). Of this total, nonmanufacturing businesses reported \$4.3 billion in R&D expenditures (89% overall). Nearly three-quarters (74%) of all microbusiness R&D expenditures are incurred by microbusinesses classified as professional, scientific, and technical services (North American Industry Classification System [NAICS] code 54). This contrasts

with larger businesses of five or more employees, where 67% of R&D expenditures are incurred by manufacturing industries and where professional, scientific, and technical services make up just 10% of all R&D expenditures.⁵

By Type

More than one-half (53%) of microbusiness R&D expenditures in 2016 was spent on development, 38% on applied research, and 8% on basic research. Nearly identical proportions were reported by businesses in manufacturing and nonmanufacturing industries. This differs somewhat from businesses with five or more employees, where 77% of R&D was spent on development, 16% on applied research, and 7% on basic research.⁵ Microbusinesses classified within the social sciences and humanities R&D industry (NAICS 541720) spent 57% of their R&D expenditures on applied research.

By Source of Funds

Most (78%) of the funding for R&D performance by microbusinesses was from the companies' own funds, whereas 8% each came from other U.S. companies or from federal, state, or local governments combined (table 2). Almost one-half (49%) of all government

TABLE 1. Total R&D performance for companies with 1–4 employees, by selected industry and type of R&D: 2016
(Thousands of U.S. dollars)

Industry	NAICS code	Total	Basic research	Applied research	Development
All industries	21–23, 31–33, 42–81	4,843,494	409,200	1,852,038	2,582,255
Manufacturing industries	31–33	554,091	36,282	222,024	295,786
Chemicals	325	118,986	4,682	57,621	56,682
Fabricated metal products	332	26,848	1,437	12,498	12,913
Machinery	333	114,951	7,167	49,395	58,389
Computer and electronic products	334	134,686	6,232	50,581	77,872
Electrical equipment, appliances, and components	335	23,861	827	7,291	15,743
Transportation equipment	336	29,131	3,943	7,923	17,265
Miscellaneous	339	76,731	8,351	25,868	42,512
Other manufacturing industries	other 31–33	28,898	3,643	10,847	14,409
Nonmanufacturing industries	21–23, 42–81	4,289,402	372,918	1,630,014	2,286,470
Wholesale trade	42	295,290	34,258	95,304	165,728
Electronic shopping and electronic auctions	454111–12	39,818	1,825	15,497	22,496
Information	51	239,024	24,257	73,155	141,611
Publishing	511	108,978	9,649	29,831	69,498
Software publishers	5112	108,978	9,649	29,831	69,498
Telecommunications	517	11,792	4,983	3,322	3,488
Data processing, hosting, and related services	518	63,032	5,772	18,893	38,367
Other information	other 51	55,222	3,854	21,109	30,258
Professional, scientific, and technical services	54	3,577,353	282,465	1,407,771	1,887,117
Architectural, engineering, and related services	5413	381,344	18,364	189,913	173,067
Computer systems design and related services	5415	1,456,420	121,639	493,846	840,934
Scientific research and development services	5417	889,127	67,561	379,770	441,796
Biotechnology research and development	541711	337,866	26,069	151,232	160,565
Physical, engineering, and life sciences (except biotechnology) research and development	541712	529,224	39,067	215,896	274,261
Social sciences and humanities research and development	541720	22,037	2,424	12,642	6,971
Other professional, scientific, and technical services	other 54	850,462	74,900	344,241	431,320
Other nonmanufacturing industries	21–23, 44–49, 52–53, 55–56, 62, 71–72, 81	137,917	30,113	38,287	69,518

NAICS = 2012 North American Industry Classification System.

NOTES: Detail may not add to total because of rounding. Industry classification is based on sample NAICS code. Statistics are representative of companies located in the United States that performed or funded R&D.

SOURCE: National Center for Science and Engineering Statistics, National Science Foundation, and U.S. Census Bureau, Microbusiness R&D and Innovation Survey, 2016.

funding (\$197 million of \$406 million) for microbusiness R&D went to companies in the scientific R&D industry group (NAICS 5417). This government funding accounted for 22% of the funds for R&D that these businesses received.

By State

Microbusiness R&D is concentrated within a small number of states. Five states (California, New York, Texas, Massachusetts, and Florida) accounted for nearly one-half (49%) of all R&D perfor-

mance by microbusinesses in 2016 (table 3). California accounted for 25% of the microbusiness R&D. In each state, microbusinesses R&D is mostly self-funded, as opposed to being paid for by others.

Total Employment and R&D Employees

Over one-half (56%) of R&D expenditures are used to pay for salaries, wages, and benefits; 10% is used for equipment; and 5% is for software purchases and licenses (table 4). The

remaining 30% of R&D costs are for other expenses. Additional information is available in the data tables—see <https://nces.nsf.gov/pubs/nsf19323>.

A small number of microbusinesses can be considered R&D businesses (that is, R&D-performing businesses). Among the R&D businesses, 51% of all workers⁷—including owners (both those who receive a W-2 and those who do not), employees, contractors, and unpaid workers—work on R&D (table 5). Because microbusi-

TABLE 2. Total R&D performance for companies with 1–4 employees, by selected industry and source of funds: 2016
(Thousands of U.S. dollars)

Industry	NAICS code	Total	Paid for by the company	Foreign owner	Another U.S. company	Other ^a
All industries	21–23, 31–33, 42–81	4,843,494	3,779,668	107,587	410,451	545,788
Manufacturing industries	31–33	554,091	417,964	49,121	31,067	55,939
Chemicals	325	118,986	70,375	16,257	3,953	28,402
Fabricated metal products	332	26,848	21,702	0	S	0
Machinery	333	114,951	71,605	16,748	16,253	10,347
Computer and electronic products	334	134,686	112,413	3,831	4,549	13,894
Electrical equipment, appliances, and components	335	23,861	21,002	83	1,035	1,741
Transportation equipment	336	29,131	16,928	12,203	0	0
Miscellaneous	339	76,731	76,572	0	131	27
Other manufacturing industries	other 31–33	28,898	27,367	0	0	1,531
Nonmanufacturing industries	21–23, 42–81	4,289,402	3,361,704	58,466	379,383	489,850
Wholesale trade	42	295,290	252,644	6,579	28,767	7,300
Electronic shopping and electronic auctions	454111–12	39,818	39,070	0	749	0
Information	51	239,024	220,840	2,496	6,785	8,903
Publishing	511	108,978	98,016	2,496	2,952	5,514
Software publishers	5112	108,978	98,016	2,496	2,952	5,514
Telecommunications	517	11,792	11,792	0	0	0
Data processing, hosting, and related services	518	63,032	56,373	0	3,270	3,389
Other information	other 51	55,222	54,658	0	564	0
Professional, scientific, and technical services	54	3,577,353	2,726,802	49,391	337,681	463,477
Architectural, engineering, and related services	5413	381,344	271,796	50	52,118	57,380
Computer systems design and related services	5415	1,456,420	1,202,993	24,629	131,207	97,592
Scientific research and development services	5417	889,127	576,986	14,848	48,832	248,461
Biotechnology research and development	541711	337,866	224,308	5,600	10,915	97,042
Physical, engineering, and life sciences (except biotechnology) research and development	541712	529,224	342,195	9,206	35,710	142,113
Social sciences and humanities research and development	541720	22,037	10,483	41	2,207	9,307
Other professional, scientific, and technical services	other 54	850,462	675,027	9,865	105,524	60,045
Other nonmanufacturing industries	21–23, 44–49, 52–53, 55–56, 62, 71–72, 81	137,918	122,349	0	5,401	10,169

S = suppressed for reliability; standard error exceeds publication standards.

NAICS = 2012 North American Industry Classification System.

^a Other includes U.S. university or college, U.S. non-profit, U.S. federal government, U.S. state or local government or other sources.

NOTES: Detail may not add to total because of rounding. Industry classification based on sample NAICS code. Statistics are representative of companies located in the United States that performed or funded R&D.

SOURCE: National Center for Science and Engineering Statistics, National Science Foundation, and U.S. Census Bureau, Microbusiness R&D and Innovation Survey, 2016.

nesses have so few employees, and most likely few workers, this is to be somewhat expected. For example, if one worker in a two-person company or two workers in a four-person company are working on R&D, that is 50% of the company. Of the about 106,000 R&D workers in microbusinesses, 89% work in the nonmanufacturing industries.

Microbusinesses and Business Strategies

When microbusinesses were asked what gives them a competitive advantage over other companies, they reported that quality is more important than low prices. Nearly 9 of 10 (88%) say that their reputation is very important in gaining a competitive advantage, and

85% say that quality of their goods or services is very important (table 6). Over one-half (53%) said that the convenience that their microbusiness offers is very important, whereas one-half (50%) said that the uniqueness of their goods and services is very important. One-quarter (25%) of microbusiness say that low prices are very important.

TABLE 3. Total R&D performance for companies with 1–4 employees, by state and source of funds: 2016
(Thousands of U.S. dollars)

State	Total	Source of funds	
		Paid for by the company	Paid for by others
All states	4,843,494	3,779,668	1,063,826
Alabama	14,155	8,493	5,663
Alaska	1,154	660	493
Arizona	70,950	62,932	8,018
Arkansas	14,411	7,608	6,803
California	1,194,408	1,003,117	191,292
Colorado	114,389	90,049	24,340
Connecticut	71,880	61,654	10,226
Delaware	7,971	4,675	3,296
District of Columbia	11,965	8,079	3,886
Florida	237,130	198,444	38,686
Georgia	93,933	77,066	16,867
Hawaii	S	S	S
Idaho	S	S	2,064
Illinois	162,022	120,131	41,891
Indiana	50,643	27,120	23,523
Iowa	30,624	20,584	10,040
Kansas	12,771	8,795	3,976
Kentucky	19,640	14,542	5,098
Louisiana	11,229	9,780	1,449
Maine	21,035	S	S
Maryland	150,978	110,817	40,161
Massachusetts	267,037	182,514	84,523
Michigan	67,411	46,677	20,734
Minnesota	121,090	89,470	31,620
Mississippi	3,395	2,623	772
Missouri	23,465	20,140	3,324
Montana	9,629	5,252	4,377
Nebraska	19,053	16,308	2,745
Nevada	48,748	27,515	21,233
New Hampshire	21,715	15,535	6,181
New Jersey	150,029	125,280	24,749
New Mexico	20,260	13,202	7,058
New York	390,061	346,939	43,122
North Carolina	165,762	105,633	60,128
North Dakota	S	S	S
Ohio	89,044	66,674	22,370
Oklahoma	45,354	43,316	2,038
Oregon	43,417	35,574	7,843
Pennsylvania	194,601	123,437	71,164
Rhode Island	15,570	12,545	3,025
South Carolina	38,267	33,657	4,609
South Dakota	5,823	5,542	281
Tennessee	32,301	26,738	5,563
Texas	302,041	235,493	66,547
Utah	43,950	32,448	11,501
Vermont	11,893	S	2,407
Virginia	149,361	95,826	53,536
Washington	131,326	107,777	23,549
West Virginia	1,396	1,270	126
Wisconsin	41,767	34,045	7,722
Wyoming	S	S	703
Undistributed	101	101	0

S = suppressed for reliability; standard error exceeds publication standards.

NOTES: Detail may not add to total because of rounding. Statistics are representative of companies located in the United States that performed or funded R&D.

SOURCE: National Center for Science and Engineering Statistics, National Science Foundation, and U.S. Census Bureau, Microbusiness R&D and Innovation Survey, 2016.

TABLE 4. Total R&D performance for companies with 1–4 employees, by selected industry and type of cost: 2016
(Thousands of U.S. dollars)

Industry	NAICS code	Total	Salaries, wages, and fringe benefits	Equipment	Software purchases and licenses	Other
All industries	21–23, 31–33, 42–81	4,843,494	2,713,154	467,592	227,276	1,435,472
Manufacturing industries	31–33	554,091	267,299	81,796	23,489	181,507
Chemicals	325	118,986	50,219	11,449	2,378	54,940
Fabricated metal products	332	26,848	15,349	S	S	S
Machinery	333	114,951	63,660	14,459	S	30,022
Computer and electronic products	334	134,686	68,224	19,200	6,465	40,796
Electrical equipment, appliances, and components	335	23,861	12,102	4,508	881	6,370
Transportation equipment	336	29,131	S	6,923	D	D
Miscellaneous	339	76,731	24,740	16,928	D	D
Other manufacturing industries	other 31–33	28,898	15,288	2,218	D	D
Nonmanufacturing industries	21–23, 42–81	4,289,402	2,445,855	385,796	203,787	1,253,964
Wholesale trade	42	295,290	141,129	52,086	10,203	91,873
Electronic shopping and electronic auctions	454111–12	39,818	14,182	S	1,791	19,749
Information	51	239,024	166,281	11,544	11,110	50,089
Publishing	511	108,978	78,954	4,803	5,342	19,879
Software publishers	5112	108,978	78,954	4,803	5,342	19,879
Telecommunications	517	11,792	6,013	1,910	415	3,455
Data processing, hosting, and related services	518	63,032	38,629	2,825	2,553	19,025
Other information	other 51	55,222	42,685	2,006	2,800	7,730
Professional, scientific, and technical services	54	3,577,353	2,060,127	294,449	178,130	1,044,647
Architectural, engineering, and related services	5413	381,344	227,603	45,313	21,414	87,014
Computer systems design and related services	5415	1,456,420	901,215	99,020	92,751	363,434
Scientific research and development services	5417	889,127	377,600	90,677	15,865	404,986
Biotechnology research and development	541711	337,866	120,159	26,759	5,506	185,442
Physical, engineering, and life sciences (except biotechnology) research and development	541712	529,224	244,199	62,841	9,632	212,552
Social sciences and humanities research and development	541720	22,037	13,241	1,077	727	6,992
Other professional, scientific, and technical services	other 54	850,462	553,709	59,439	48,100	189,214
Other nonmanufacturing industries	21–23, 44–49, 52–53, 55–56, 62, 71–72, 81	137,918	64,137	23,622	2,553	47,607

D = data withheld to avoid disclosing operations of individual companies. S = suppressed for reliability; standard error exceeds publication standards.

NAICS = 2012 North American Industry Classification System.

NOTES: Detail may not add to total because of rounding. Industry classification based on sample NAICS code. Statistics are representative of companies located in the United States that performed or funded R&D.

SOURCE: National Center for Science and Engineering Statistics, National Science Foundation, and U.S. Census Bureau, Microbusiness R&D and Innovation Survey, 2016.

Developing a good or service that will improve the current customer’s experience was reported to be very important by 42% of microbusinesses. Nearly an identical percentage (41%) reported that updating or improving their existing goods and services was very important to their future success. Providing individualized goods or services (32%) or developing goods or services that will save customers money (30%) was

determined to be very important to almost one-third of microbusinesses. However, having a business strategic plan in writing was very important to only 13% of microbusinesses. Partnerships were not considered as important to microbusinesses’ future success—13% said partnerships with other businesses were very important, and only 3% said partnerships with universities were very important.

Survey Information and Data Availability

In this InfoBrief, expenditures are expressed in current U.S. dollars and are not adjusted for inflation. For BRDI-M, a microbusiness is defined as a business organization located in the United States, either U.S. owned or a U.S. affiliate of a foreign parent company, with at least one establishment under common ownership or control,

TABLE 5. Total number of R&D workers at R&D performing companies for companies with 1–4 employees, by selected industry: 2016
(Number)

Industry	NAICS code	Total number of R&D workers at R&D companies	Total number of workers at R&D companies
All industries	21–23, 31–33, 42–81	105,906	206,152
Manufacturing industries	31–33	11,809	25,160
Chemicals	325	1,238	3,010
Fabricated metal products	332	1,257	2,359
Machinery	333	2,064	3,846
Computer and electronic products	334	2,480	4,494
Electrical equipment, appliances, and components	335	477	1,005
Transportation equipment	336	663	1,291
Miscellaneous manufacturing	339	1,872	4,735
Other manufacturing industries	other 31–33	1,758	4,417
Nonmanufacturing industries	21–23, 42–81	94,097	180,993
Wholesale trade	42	11,623	26,752
Electronic shopping and electronic auctions	454111–12	1,770	3,658
Information	51	5,823	12,642
Publishing	511	1,939	3,616
Software publishers	5,112	1,939	3,616
Telecommunications	517	299	864
Data processing, hosting, and related services	518	1,433	2,656
Other information	other 51	2,151	5,505
Professional, scientific, and technical services	54	71,987	132,691
Architectural, engineering, and related services	5,413	10,928	17,482
Computer systems design and related services	5,415	26,669	48,473
Scientific research and development services	5,417	9,525	15,158
Biotechnology research and development	541,711	3,304	5,459
Physical, engineering, and life sciences (except biotechnology) research and development	541,712	5,700	8,932
Social sciences and humanities research and development	541,720	520	769
Other professional, scientific, and technical services	other 54	24,865	51,577
Other nonmanufacturing industries	21–23, 44–49, 52–53, 55–56, 62, 71–72, 81	2,895	5,222

NAICS = 2012 North American Industry Classification System.

NOTES: Detail may not add to total because of rounding. Industry classification based on sample NAICS code. Statistics are representative of companies located in the United States that performed or funded R&D. Workers includes owners, employees who receive a W-2, other paid workers, including contractors, consultants and temporary workers, and unpaid workers.

SOURCE: National Center for Science and Engineering Statistics, National Science Foundation, and U.S. Census Bureau, Microbusiness R&D and Innovation Survey, 2016.

and with one to four employees. The survey was administered to companies regardless of whether they were known to have R&D activity. BRDI-M collected detailed statistics from businesses on domestic R&D expenditures, R&D employees, intellectual property, business strategies, and innovation activities.

The sample for BRDI-M was selected to represent all for-profit businesses that have at least 1 but fewer than 10 paid employees in the United States. These businesses must also have at least one establishment that is in business during the survey year, be in the United States, and be classified in certain industries based on the 2012

NAICS. The survey sample focused on industries where it is expected that companies perform R&D in the United States. Only data on microbusinesses (those with one to four employees) are presented in this InfoBrief. The statistics from the survey are based on a sample, and as such, they are subject to both sampling and non-sampling errors

Table 6. Importance of strategies for companies with 1–4 employees: 2016
(Percent)

Strategies	Companies (number)	Very important	Somewhat important	Not at all important
For competitive advantage				
Your low prices	2,030,920	24.7	42.2	33.1
The quality of your goods or services	2,049,881	85.0	7.4	7.5
Your unique goods or services	2,032,351	50.2	28.4	21.4
The convenience you offer	2,033,359	52.6	30.3	17.2
Your reputation	2,043,038	88.0	6.1	5.8
For future success				
Updating or improving an existing good or service	2,042,265	41.0	36.2	22.8
Developing a good or service that will save customers money	2,037,931	30.0	33.0	37.0
Developing a good or service that will improve current customers' experience	2,036,507	41.7	30.2	28.1
Having a formal business strategic plan in writing	2,037,473	12.6	29.5	57.9
Partnerships with other businesses	2,036,341	12.5	24.8	62.6
Partnerships with one or more universities	2,029,269	3.3	9.7	87.0
Providing individualized goods or services	2,035,762	31.6	27.0	41.4

NOTES: Detail may not add to total because of rounding. Statistics are representative of companies located in the United States.

SOURCE: National Center for Science and Engineering Statistics, National Science Foundation, and U.S. Census Bureau, Microbusiness R&D and Innovation Survey, 2016.

(see technical notes in the data tables at <https://nces.nsf.gov/pubs/nsf19323>).

For 2016, a total of 199,991 companies were sampled to represent the population of 3,460,816 companies. The response rate for the 2016 BRDI-M was 77%.

The full set of data tables from this survey will be available in the report *Microbusiness R&D and Innovation: 2016*. Additional tables with relative standard errors and imputation rates from the 2016 survey are available from the author.

Note that the 2016 cycle of BRDI-M is the only time this survey will be administered. ABS, co-sponsored by NCSES and Census, will produce statistics for 2017 and beyond. In addition to R&D, the ABS will collect data on innovation and intellectual property.

Notes

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neering Statistics, National Science Foundation, 2415 Eisenhower Avenue, Suite W14200, Alexandria, VA 22314 (akindlon@nsf.gov; 703-292-2332).

2. Anderson G, Kindlon A. 2019. *Indicators of R&D in Small Businesses: Data from the 2009–15 Business R&D and Innovation Survey*. InfoBrief NSF 19-316. Alexandria, VA: National Center for Science and Engineering Statistics, National Science Foundation. Available at <https://www.nsf.gov/statistics/2019/nsf19316/>.

3. The Business R&D and Innovation Survey (BRDIS) refers to businesses with five to nine employees as micro-businesses, but in this InfoBrief, micro-businesses are defined exclusively as businesses with one to four employees.

4. U.S. Census Bureau, Business Dynamic Statistics. Firm Characteristics Data Tables. Retrieved from https://www.census.gov/ces/dataproducts/bds/data_firm2016.html. Accessed February 2019.

5. Wolfe R. 2018. *Businesses Spent \$375 Billion on R&D Performance in the United States in 2016*. InfoBrief 18-312. Alexandria, VA: National Center for Science and Engineering Statistics, National Science Foundation. Available at <https://www.nsf.gov/statistics/2018/nsf18312/>.

6. The ABS, first fielded in 2018, is the primary source of information on R&D expenditures for businesses with one to nine employees. The ABS also collects data related to innovation, intellectual property, technology, and business owner characteristics from those businesses with one or more employees. For additional information on the ABS, please see <https://www.nsf.gov/statistics/srvyabs/>.

7. A distinction must be made between *workers*, which includes owners who do not receive a W-2, contractors, and unpaid workers, and *employees*. Micro-businesses have between one and four employees, but they may have more workers.