



Number of Women with U.S. Doctorates in Science, Engineering, or Health Employed in the United States More Than Doubles since 1997

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In 2017, an estimated 1,103,200 individuals worldwide held a research doctoral degree in a science, engineering, or health (SEH) field that was earned at a U.S. academic institution, an increase of over 55,000 doctorate recipients since 2015. A total of 967,500 (88%) were residing in the United States, and over one-third of them were women (338,400). An additional 135,700 were living abroad, one-fourth (33,700) of whom were women (table 1). Among those doctorate recipients living outside the United States in 2017, a majority (54%) lived in Asia and nearly 20% lived in Europe (including Russia) (figure 1 and table 1).

The labor force participation of U.S.-trained SEH doctorate holders residing in the United States was 86%, compared with 92% among those living abroad (table 1). This difference is due in part to a larger proportion of retirement-aged (65 to 75 years) U.S.-trained SEH doctorate holders residing in the United States than abroad (22% versus 15%).² The business or industry sector employed the largest share of U.S.-trained SEH doctorate holders residing in the United States (48%), whereas

most jobs held by those working abroad were in the education sector (65%).

These findings are from the 2017 Survey of Doctorate Recipients (SDR)—a unique source of information about the educational background, occupational achievements, and career movements of U.S.-trained scientists and engineers in the United States and abroad.³ The SDR, along with several other surveys conducted by the National Center for Science and Engineering Statistics (NCSES) within the National Science Foundation, provide data on the number and representation of women, minorities, and persons with disabilities in post-secondary SEH enrollment, degree awards, and employment outcomes.⁴ This InfoBrief uses data from the 1997 and 2017 survey cycles to highlight the increased prevalence of women with U.S.-earned SEH doctorate degrees in the U.S. workforce.

Trends in Science and Engineering Occupations

Currently, more than one-third (35%) of the U.S.-trained SEH doctorate holders residing and working in the

United States are women, compared with less than one-fourth (23%) 20 years ago. The number of U.S.-trained female SEH doctorate holders residing and working in the United States has more than doubled during this period, from 119,350 in 1997 to 287,250 in 2017 (table 2). In 1997, men outnumbered women in all broad science and engineering (S&E) occupational categories. However, by 2017, the number of female psychologists (44,050) was higher than the number of male psychologists (30,150), with women now making up almost 60% of all psychologists.

In addition to comprising the majority of psychologists, women are also well represented among U.S.-trained life scientists (that is, biological, agricultural, and other life scientists) and social scientists. In 2017, 41% of employed life scientists and 44% of employed social scientists were women, compared with their overall share of 35% among employed SEH doctorate holders. A similar pattern was seen in 1997, when 27% of employed life scientists and employed social scientists were women, compared with 23%

TABLE 1. U.S.-trained SEH doctorate holders, by residence location, sex, employment status, and employment sector: 2017

Residence location	Total	Men	Women	Employment status			Employment sector		
				Employed	Unemployed ^a	Not in the labor force ^b	Educational institution	Business or industry	Government
Worldwide	1,103,200	731,100	372,150	938,250	19,050	145,900	428,650	421,350	88,250
U.S. residing population	967,500	629,100	338,400	815,100	17,100	135,300	349,200	390,300	75,600
New England	80,150	51,100	29,050	69,350	1,500	9,300	30,050	36,350	2,950
Middle Atlantic	133,050	83,750	49,300	114,650	2,100	16,300	51,200	58,300	5,150
East North Central	118,250	78,200	40,000	100,250	1,700	16,250	51,050	43,450	5,750
West North Central	54,600	35,600	18,950	46,350	600	7,650	25,500	18,400	2,450
South Atlantic	189,550	119,800	69,700	157,950	3,200	28,350	62,850	63,200	31,900
East South Central	32,500	21,600	10,900	27,200	550	4,750	16,700	7,600	2,900
West South Central	76,550	52,600	23,950	64,700	1,700	10,200	31,350	28,800	4,500
Mountain	68,000	45,600	22,400	54,550	1,050	12,400	23,550	24,500	6,450
Pacific and U.S. territories	214,900	140,750	74,100	180,050	4,700	30,100	56,900	109,600	13,550
Non-U.S. residing population	135,700	102,000	33,700	123,150	1,950	10,600	79,450	31,050	12,650
Europe ^c	25,250	17,100	8,100	22,950	400	1,850	12,450	7,900	2,600
Asia	73,400	57,050	16,350	68,050	950	4,400	47,100	15,100	5,850
North America ^d	12,350	8,950	3,400	10,600	200	1,600	6,750	2,950	900
Central America ^e	4,500	3,700	800	4,200	S	250	2,550	1,000	650
Caribbean	750	350	400	700	D	S	350	200	150
South America	8,750	6,800	1,950	7,600	150	1,000	4,850	1,500	1,250
Africa	5,700	4,550	1,150	4,950	100	600	2,750	1,450	800
Oceania	4,350	2,950	1,400	3,600	100	700	2,400	800	400

D = suppressed to avoid disclosure of confidential information. S = suppressed for reliability; coefficient of variation exceeds publication standards.

SEH = science, engineering, and health.

^a Unemployed includes individuals who were not working during the survey reference week but had been seeking work in the 4 weeks prior to February 2017 or who were on layoff from their job.

^b Not in the labor force includes retirees and individuals neither working nor looking for work in the 4 weeks prior to February 2017.

^c Europe includes Russia.

^d The United States is listed separately and is not included in the total for North America.

^e Central America includes Mexico.

NOTES: Residence location is based on reported living location on 1 February 2017. The worldwide and non-U.S. residing population totals include an estimated 600 individuals who were living abroad, but in an unspecified location. Educational institution includes 4-year colleges or universities, medical schools (including university-affiliated hospitals or medical centers), university-affiliated research institutes, 2-year colleges, community colleges, technical institutes, precollege institutions, and other educational institutions. Business or industry includes private for profit, private nonprofit, self-employed or business owners in incorporated or nonincorporated business, and employers not broken out separately. Government includes U.S. federal, state, and local government and non-U.S. government at any level. Detail may not sum to total due to rounding.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2017.

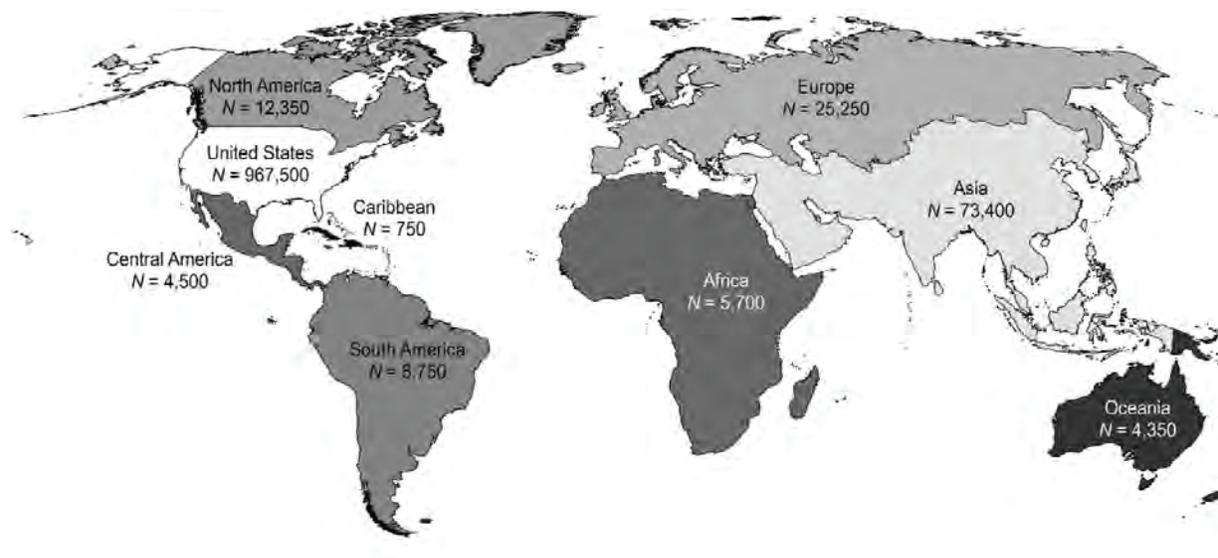
overall among employed SEH doctorate holders. In total, nearly half (46%) of the U.S.-trained female SEH doctorate holders employed in the United States in 2017 were working as a life scientist, social scientist, or psychologist, compared with less than one-third (29%) of their male counterparts.

In contrast, U.S.-trained female SEH doctorate holders traditionally have been less well represented in the four

broad occupations of computer scientist, mathematical scientist, physical scientist (that is, physical and related scientist), and engineer. However, women have significantly increased their numbers and shares of employment in three of these occupations since 1997. For example, the number of female doctoral engineers more than tripled from about 4,650 (7%) of an estimated 69,750 U.S.-trained engineers in 1997 to 16,950 (16%) of the

107,900 U.S.-trained engineers in 2017. The low proportion of women among mathematical scientists also changed significantly over the past 2 decades, with the share nearly doubling from 16% in 1997 to 28% in 2017. A similar substantial gain occurred among those employed as physical scientists (13% in 1997 to 23% in 2017). Although women significantly increased their presence in engineering, physical sciences, and mathematical sciences, women's

FIGURE 1. U.S.-trained SEH doctorate holders, by residence location: 2017



NOTES: Europe includes Russia. Central America includes Mexico. The United States is listed separately and is not included in the total for North America.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients: 2017.

TABLE 2. Employed U.S.-trained SEH doctorate holders residing in the United States, by broad occupation and sex: 1997 and 2017

Occupation	1997					2017				
	Total employed	Male Number	Male %	Female Number	Female %	Total employed	Male Number	Male %	Female Number	Female %
All occupations	518,450	399,100	77.0	119,350	23.0	815,100	527,850	64.8	287,250	35.2
S&E occupations	388,900	302,150	77.7	86,750	22.3	568,650	380,400	66.9	188,200	33.1
Biological, agricultural and other life scientist	97,550	71,350	73.1	26,200	26.9	144,550	85,400	59.1	59,150	40.9
Computer scientist	25,950	22,600	87.0	3,350	13.0	54,750	45,450	83.0	9,300	17.0
Mathematical scientist	19,400	16,250	83.7	3,150	16.3	38,350	27,600	72.0	10,750	28.0
Physical and related scientist	72,250	63,100	87.4	9,150	12.6	83,300	63,950	76.7	19,350	23.3
Psychologist	60,650	32,200	53.1	28,450	46.9	74,150	30,150	40.6	44,050	59.4
Social scientist	43,350	31,550	72.8	11,800	27.2	65,600	36,950	56.3	28,650	43.7
Engineers	69,750	65,100	93.4	4,650	6.6	107,900	90,950	84.3	16,950	15.7
S&E-related occupations ^a	29,500	18,350	62.3	11,100	37.7	97,650	56,600	58.0	41,050	42.0
Non-S&E occupations	100,100	78,600	78.5	21,500	21.5	148,800	90,800	61.0	57,950	39.0

S&E = science and engineering. SEH = science, engineering, and health.

^aS&E-related occupations include health-related occupations, S&E managers, S&E pre-college teachers, S&E technicians and technologists, and other S&E occupations. In 2003, NCSSES revised the taxonomy for these occupations, which partially accounts for the differences in population estimates between 1997 and 2017.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients.

representation among computer scientists remains low and showed only a modest gain over the past 2 decades (13% in 1997 to 17% in 2017).

The increased number and share of women employed in these broad S&E occupations over the past 2 decades are associated with similar growth in the number and share of women earning research doctorate degrees from U.S. institutions in the corresponding broad SEH fields of study.⁵

Trends in Employment Sector

The overall growth in the number and share of employed U.S.-trained female SEH doctorate holders in the United States since 1997 varied by sector of employment. The largest gain in representation was observed within the U.S. federal government, where women nearly doubled their share, increasing from 19% of all federally employed SEH doctorate holders in 1997 to 35% in 2017 (table 3). Similarly, the share of women employed in the 4-year educational

institution sector increased substantially, from 25% in 1997 to 38% in 2017.

However, women's representation in the business or industry for-profit sector was low in comparison to their share overall in both 1997 (15% in this sector versus 23% overall) and in 2017 (27% in this sector versus 35% overall). In contrast, the business or industry nonprofit sector had higher shares of women (33% in 1997 to 45% in 2017).

The largest employment sectors for women with SEH doctorate degrees from a U.S. institution were the 4-year educational institution sector (57,250 in 1997 and 120,650 in 2017), followed by the business or industry for-profit sector (25,500 in 1997 and 80,700 in 2017). In contrast, although the 4-year educational institution sector was also the largest employer of U.S.-trained male SEH doctorate holders in 1997 (172,750), the business or industry for-profit sector was the largest employment sector for this group of men in 2017 (215,900).

Trends in Primary Work Activities

As the number and share of women with U.S.-earned SEH doctorate degrees residing and working in the United States increased over the years, the proportion of women involved in research and development (R&D) as their primary work activity also increased significantly. Persons engaged in R&D activities are employed U.S.-trained SEH doctorate holders who report basic research, applied research, development, or design⁶ as their primary work activity—that is, more of their hours are spent on an R&D activity during a typical week than on any other work activity. Overall, in 2017, 30% of U.S.-trained SEH doctorate holders performing an R&D activity as their primary work activity were women; in 1997, the proportion was 19% (table 4).

One of the largest proportional gains for women in these R&D activities was observed among those who reported their primary work activity

TABLE 3. Employed U.S.-trained SEH doctorate holders residing in the United States, by employment sector and sex: 1997 and 2017

Employment sector	1997					2017				
	Total employed	Male		Female		Total employed	Male		Female	
		Number	%	Number	%		Number	%	Number	%
All employment sectors	518,450	399,100	77.0	119,350	23.0	815,100	527,850	64.8	287,250	35.2
Four-year educational institution ^a	230,000	172,750	75.1	57,250	24.9	319,400	198,750	62.2	120,650	37.8
Other educational institution ^b	16,850	9,950	59.2	6,850	40.8	29,800	14,400	48.3	15,400	51.7
Business or industry, for profit ^c	166,650	141,150	84.7	25,500	15.3	296,600	215,900	72.8	80,700	27.2
Business or industry, self-employed, nonincorporated ^d	25,100	15,900	63.4	9,200	36.6	44,650	24,600	55.1	20,000	44.9
Business or industry, nonprofit	26,350	17,650	67.0	8,700	33.0	55,150	30,500	55.4	24,600	44.6
Federal government	38,050	30,900	81.2	7,150	18.8	51,950	33,600	64.6	18,400	35.4
State or local government	15,450	10,800	69.8	4,650	30.2	17,550	10,100	57.5	7,450	42.5

SEH = science, engineering, and health.

^a Includes 4-year colleges or universities, medical schools (including university-affiliated hospitals or medical centers), and university-affiliated research institutes.

^b Includes 2-year colleges, community colleges, technical institutes, and other precollege institutions.

^c Includes those self-employed in an incorporated business, working for a for-profit company, and working for other types of employer not otherwise classified. Data from the 2017 Survey of Doctorate Recipients include non-U.S. government employers that were not educational institutions.

^d Self-employed or business owner in a nonincorporated business.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients.

TABLE 4. Primary work activities among U.S.-trained SEH doctorate holders residing in the United States, by sex: 1997 and 2017

Primary work activity	1997					2017				
	Total employed	Male		Female		Total employed	Male		Female	
		Number	%	Number	%		Number	%	Number	%
Primary work activity, total ^a	518,450	399,100	77.0	119,350	23.0	815,100	527,850	64.8	287,250	35.2
Research and development	210,850	170,150	80.7	40,700	19.3	338,500	237,550	70.2	100,950	29.8
Basic research	69,200	52,950	76.5	16,300	23.5	90,250	61,550	68.2	28,750	31.8
Applied research	100,750	81,350	80.8	19,350	19.2	159,200	107,400	67.5	51,800	32.5
Development	28,800	24,900	86.5	3,900	13.5	65,550	49,350	75.3	16,200	24.7
Design	12,100	10,950	90.4	1,150	9.6	23,500	19,250	82.1	4,200	17.9
Managing or supervising people or projects	58,550	48,150	82.2	10,400	17.8	119,050	77,550	65.1	41,500	34.9
Professional services ^b	61,100	36,850	60.3	24,250	39.7	97,450	49,750	51.0	47,700	49.0
Teaching	113,050	83,550	73.9	29,500	26.1	153,450	89,150	58.1	64,300	41.9
All other primary work activities ^c	74,900	60,450	80.7	14,500	19.3	106,650	73,850	69.2	32,800	30.8

SEH = science, engineering, and health.

^a Derived from question A31: "On which two activities in question A30 did you work the most hours during a typical week on this job?" Question A30 presents a selection of 14 work activities. Respondents are asked to indicate which work activities "occupied at least 10 percent of your time during a typical work week on this job."

^b Includes health care, counseling, financial services, and legal services.

^c All other primary work activities include accounting, computer programming, human resources, production, sales, quality management, or other activities not otherwise classified.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients.

as development. In 1997, women made up only 14% of the U.S.-trained SEH doctorate holders reporting development as their primary work activity, with the proportion increasing to 25% in 2017. Female representation among those reporting applied research also showed a significant gain over time, from 19% in 1997 to 33% in 2017. Women also showed gains in the share reporting basic research as their primary work activity, from 24% in 1997 to 32% in 2017. Overall, in 2017, 35% of the U.S.-trained women were performing one of the four R&D activities as their primary work activity, compared with 45% of the men.

Another primary work activity with a significant increase in female representation was managing or supervising people or projects. Among the doctorate holders reporting this to be their primary work activity, the percentage that were women increased from 18% in 1997 to 35% in 2017. In 2017, an equal proportion of men and women (about 15%) reported managing

or supervising people or projects as their primary activity, whereas in 1997, a slightly higher proportion of men than women were managing or supervising people or projects (12% versus 9%).

Consistent with women's employment predominately in the 4-year educational institution sector, the proportion of women reporting teaching as their primary work activity also increased markedly (26% in 1997 to 42% in 2017). In 2017, 22% of U.S.-trained female SEH doctorate recipients reported teaching as their primary work activity, compared with 17% of the men. However, in 1997, when working in a 4-year educational institution was the most common employment sector for both men and women, slightly higher percentages of men (21%) and women (25%) reported teaching as their primary work activity.

Primary Work Activities by Career Stage

In 2017, among the nearly 305,000 U.S.-trained SEH early career doctorate

holders who received their doctoral degree between 2006 and 2015 and were working in the United States, 42% were women. In comparison, among the mid- and late-career doctorate holders with degrees earned before 2006, only 31% were women (table 5). Both men and women who are early career doctorate holders are more likely to report one of the four R&D activities as their primary work activity than are mid- and late-career doctorate holders. Among early career doctorate holders, 44% of women and 54% of men report a primary work activity of basic research, applied research, development, or design. Among mid- and late-career doctorate holders, 28% of women and 40% of men report being involved with R&D as their primary work activity.

Mid- and late-career doctorate holders were more likely than early career doctorate holders to be engaged in managing or supervising people or projects as their primary work activity (17% versus 10%).

TABLE 5. Primary work activities among U.S.-trained SEH doctorate holders residing in the United States, by sex and career stage: 2017

Primary work activity	Mid- and late-career doctorate holder ^a					Early career doctorate holder ^a				
	Total employed	Male Number	Male %	Female Number	Female %	Total employed	Male Number	Male %	Female Number	Female %
Primary work activity, total ^b	510,550	350,950	68.7	159,600	31.3	304,550	176,900	58.1	127,650	41.9
Research and development	186,700	141,700	75.9	45,000	24.1	151,800	95,850	63.1	55,950	36.9
Basic research	46,400	34,150	9.7	12,250	7.7	43,850	27,400	15.5	16,450	12.9
Applied research	88,950	65,300	18.6	23,650	14.8	70,250	42,100	23.8	28,150	22.0
Development	37,650	30,100	8.6	7,550	4.7	27,900	19,250	10.9	8,650	6.8
Design	13,650	12,200	3.5	1,500	0.9	9,800	7,100	4.0	2,700	2.1
Managing or supervising people or projects	88,250	60,850	17.3	27,400	17.2	30,800	16,700	9.4	14,100	11.1
Professional services ^c	70,850	38,450	11.0	32,400	20.3	26,600	11,250	6.4	15,350	12.0
Teaching	98,850	62,200	17.7	36,700	23.0	54,550	27,000	15.3	27,600	21.6
All other primary work activities ^d	65,900	47,700	13.6	18,150	11.4	40,800	26,150	14.8	14,650	11.5

SEH = science, engineering, and health.

^a Mid- and late-career doctorate holder defined by academic year of doctorate receipt before 2006. Early career doctorate holder defined by academic year of doctorate receipt between 2006 and 2015. Academic year is defined from July 1 to June 30, with the academic year being the one including June 30.

^b Derived from question A31: "On which two activities in question A30 did you work the most hours during a typical week on this job?" Question A30 presents a selection of 14 work activities. Respondents are asked to indicate which work activities "occupied at least 10 percent of your time during a typical work week on this job."

^c Includes health care, counseling, financial services, and legal services.

^d All other primary work activities include accounting, computer programming, human resources, production, sales, quality management or other activities not otherwise classified.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, Survey of Doctorate Recipients, 2017.

Among early career doctorate holders, teaching as a primary work activity continues to be more common among woman than among men (22% versus 15%). Similarly, female early career doctorate holders were more likely than their comparison group of men to report professional services (e.g., health care, counseling, financial services, legal services) as their primary work activity (12% versus 6%). Some of these differences in primary work activities between men and women, regardless of career stage, may be associated with differences in their broad occupational categories and sectors of employment.

Data Sources, Limitations, and Availability

Data presented here are from the 2017 SDR, which collects data on individuals who earned research doctoral

degrees in SEH fields from U.S. institutions. The target population of the SDR consists of all U.S.-trained SEH doctoral graduates who were younger than 76 years of age and not institutionalized or terminally ill on 1 February 2017. The SDR has been conducted since 1973 and is sponsored by NCSES and by the National Institutes of Health. The estimates in this InfoBrief are based on responses from a sample of the population and may differ from actual values because of sampling variability. As a result, apparent differences between the estimates for two or more groups may not be statistically significant. All comparative statements in this report have undergone statistical testing and are significant at the 90% confidence level. In addition, the estimates presented are rounded to the nearest 50, although percentage calculations are based on unrounded estimates.

More information on the SDR can be found at (<https://www.nsf.gov/statistics/srvydoctoratework/>).

Notes

1. Daniel J. Foley, Human Resources Statistics Program, National Center for Science and Engineering Statistics, National Science Foundation, 2415 Eisenhower Avenue, Suite W14200, Alexandria, VA 22314 (dfoley@nsf.gov; 703-292-7811). Lance A. Selfa and Karen H. Grigorian are with NORC at the University of Chicago.

2. Age group estimates are generated from public use data (available at <https://ncesdata.nsf.gov/datadownload/>) from the National Science Foundation, National Center for Science and Engineering Statistics, *Survey of Doctorate Recipients: 2017*. A table reporting the results of the age

group analysis is available upon request to the first author of this InfoBrief.

3. The National Center for Science and Engineering Statistics within the National Science Foundation refreshed and more than doubled the sample size for the Survey of Doctorate Recipients in the 2015 cycle. This expanded sample allowed the survey to report employment outcomes on a larger number of fields of study and to fully represent internationally residing U.S.-trained science, engineering, and health research doctorate holders.

4. National Science Foundation, National Center for Science and Engineering Statistics. 2017. *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2017*. Special Report NSF 17-310. Arlington,

VA. Available at <https://www.nsf.gov/statistics/2017/nsf17310/digest/>.

5. More information on trends in the broad fields of U.S. doctorates awarded among men and women are available through the National Center for Science and Engineering Statistics' Survey of Earned Doctorates (<https://www.nsf.gov/statistics/2018/nsf18304/datatables/tab15.htm>).

6. For the R&D activities, applied research is study directed toward gaining scientific knowledge to meet a recognized need. Basic research is study directed toward gaining scientific knowledge primarily for its own sake. Development is defined as using knowledge gained from research for the production of materials and devices. Design refers to the design of

equipment, processes, structures, or models.

This SDR typology of R&D activities differs from that adopted by the Organisation for Economic Co-operation and Development (OECD) *Frascati Manual 2015* that only identifies three types of R&D activities: basic research, applied research, and experimental development. In the *Frascati Manual*, design activities play a key role in the development and implementation of innovations, but they do not meet its R&D definition of creative and systematic work undertaken to increase the stock of knowledge and to devise new applications of available knowledge. See https://www.oecd-ilibrary.org/science-and-technology/frascati-manual-2015/concepts-and-definitions-for-identifying-r-and-d_9789264239012-4-en.