DOCUMENT RESUME

ED 137 061 SE 021 299

TITLE	The Nation's Science and Engineering Manpower Resources: 1974. Science Resources Studies Highlights, June 29, 1976.
INSTITUTION	National Science Foundation, Washington, D.C. Div. of Science Resources Studies.
REPORT NO	NSF-76-312
PUB DATE	29 Jun 76
NOTE	6p.; Not available in hard copy due to marginal legibility of original document
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Employment Statistics; Engineering Education; *Engineers; Manpower Utilization; *Occupational Surveys; Research; Science Education; Scientific Manpower; *Scientists; Statistical Studies
IDENTIFIERS	*National Science Foundation

ABSTRACT

This report presents data compiled by the Manpower Characteristics Study Group of the National Science Foundation (NSF) as part of a comprehensive program to measure and analyze the nation's science and engineering manpower resources for 1974. The data presented are based on three sources: the 1973 Survey of Doctoral Scientists and Engineers; the 1974 National Survey of Scientists and Engineers; and the 1974 Survey of College-Educated Men and Women. Tabulated data present: (1) characteristics of United States scientists and engineers for 1974; (2) distributions of employed scientists and engineers by field and sex; and (3) number of employed scientists and engineers by field and primary work activity. Comparisons between scientists and engineers in terms of demography and employment statistics are given. Results show that one scientist in four has earned a Ph.D. compared with one in twenty among engineers. The industrial sector of the economy provided the largest source of employment for both scientists and engineers, and research and development were the dominant activities of both scientists and engineers. (BT)

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SCIENCE RESOURCES STUDIES HIGHLIGHTS

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The Nation's Science and Engineering Manpower Resources: 1974

The Foundation's Manpower Characteristics System was instituted in July 1972 and became fully operable in 1974. The system is made up of three subsystems, each of which is designed to measure the characteristics of a particular subpopulation. Characteristics of doctoral scientists and engineers were obtained by a survey of a sample selected from the Doctoral Roster which is maintained for the Foundation by the Commission on Human Resources of the National Academy of Sciences. The Bureau of the Census maintains the National Sample of Scientists and Engineers for the Foundation an arrangement which allows periodic surveys of a sample of those scientists and engineers who were in the science and engineering (S/E) labor force at the time of the 1970 Decennial Census. The third subsystem encompasses the Foundation's New Entrants surveys which obtain the characteristics of young scientists and engineers entering the labor force since 1970. This subsystem was operated by the Laboratory for Research on Higher Education of the University of California, Los Angeles.

The data presented below are based on three sources: the 1973 Survey of Doctoral Scientists and Engineers, the 1974 National Survey of Scientists and Engineers (National Sample), and the 1974 Survey of College-Educated Men and Women. This last survey included new entrants to science and engineering from the graduating classes of 1971, 1972, and 1973.

Demographic Characteristics

The total population of scientists and engineers in the United States in the spring of 1974 was estimated to be 1,970,000; 900,000 scientists and 1,070,000 engineers. Slightly less than 1 in 10 were women, although the ratio of women to men among scientists was about 1 in 5, whereas among engineers, less than 1 in 100 were women. Racial minority groups comprised slightly less than 5 percent of the S/E population although their representation among scientists was substantially greater than among engineers.

Although the population of scientists in 1974 was nearly equal that of engineers, their representation in the S/E labor force was considerably smaller; about 94 percent of all engineers as compared with less than 75 percent of all scientists. As a result, the S/E labor force, which numbered 1,680,000, consisted of 3 engineers for every 2 scientists. The reduction in the proportion of scientists in the S/E labor force as compared with that of engineers can be attributed to a number of factors including (1) the larger proportion of scientists who defer entrance into the labor force while pursuing postgraduate studies; (2) a greater acceptance of the bachelor's degree in engineering as the professional qualification for engineers than is the case for a similar degree in science, and (3) the large number of women in the total population of scientists (over 22 times that of women engineers) who frequently elect not to enter the labor force either because of fewer job opportunities or to pursue homemaking careers (table 1).

Table 1. Characteristics of U.S. scientists and engineers: 1974

[In thousands]

Characteristics	Total	Scientists	Engineers
Total	1,973	901	1,072
Sex:			
Men	1,788	724	1,064
Women	185	178	8
Race:			
White/Caucasian	1,886	852	1,034
Black/Negro	32	23	9
American Indian	2	2	—
Oriental	37	17	20
Other	17	9	8
Age:			
24 and under	244	174	70
25-29	369	206	163
30-34	255	121	134
35-39	246	100	145
40-44	227	86	141
45-49	218	73	145
50-54	176	59	118
55-59	110	38	72
60-64	72	25	47
65-69	38	13	25
70 and over	18	7	12
Highest degree:			
Doctorate	274	231	43
Master's	393	188	205
Bachelor's	1,255	474	781
Associate	14	—	14
Other degree	12	9	3
No degree	25	—	25
Employment status:			
Labor force	1,678	669	1,009
Employed	1,662	663	999
Unemployed	16	6	10
Outside labor force	295	232	63

Note: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

(Prepared in the Manpower Characteristics Studies Group, Division of Science Resources Studies)

In 1974 the distribution of scientists, by age, was considerably different from that of engineers. The proportion of scientists under 30 years of age, for example, was almost twice that of engineers. From age 30 the proportion of scientists in each successively older age group declined steadily. Engineers, on the other hand, displayed a dissimilar age profile. Beginning with ages 25 to 29, the proportion of engineers in each age group, up to ages 45 to 49, remained relatively constant. This difference may be accounted for, in part, by the greater stability in the supply of engineers versus that of scientists over the past two decades[1] and possibly in part by less movement to occupations outside their general field by engineers.

Scientists and engineers also show substantial differences with respect to educational attainment. The proportion of scientists with graduate degrees, for example, was twice that of engineers. A very large fraction of this difference was accounted for by those individuals who obtained the Ph.D. Thus, while about one-fifth of both scientists and engineers held the master's degree, more than 1 scientist in 4 had earned the Ph.D. as contrasted with about 1 in 20 among engineers.

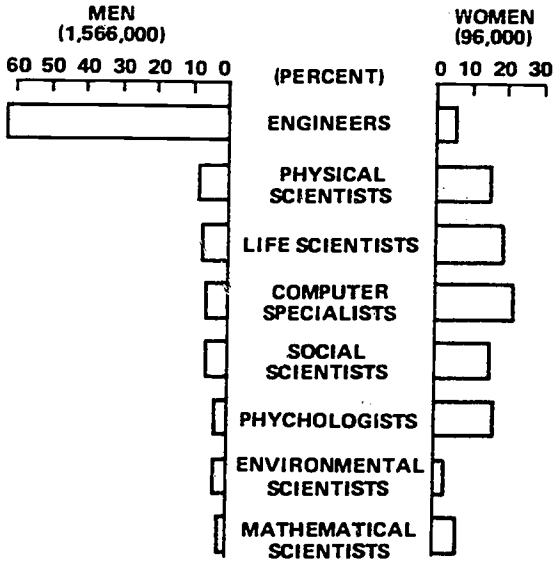
Employment Characteristics

In 1974 the employed labor force of scientists and engineers, including both men and women, numbered 1,660,000, of whom 60 percent were engineers. The distribution of men differed from that of women particularly with respect to engineers; almost two-thirds of the men in the employed S/E labor force were engineers in contrast with 5 percent of the women. As a result, the proportional representation of employed women in all but two of the major fields of science and engineering exceeded that of men (chart 1). Examination of the distribution of scientists, exclusive of engineers, however, reveals a dissimilar set of employment patterns. Thus, the relative proportion of men was substantially greater than that of women among physical and environmental scientists, whereas there were relatively twice as many women psychologists as men. In other broad fields of science, the relative proportion of men was similar to that of women (chart 2).

Research and development was the dominant work activity of scientists and engineers; about two-fifths cited R&D performance or R&D management as their primary work activity. Engineers, however, were more prevalently engaged in these activities than were scientists; 43 percent of all employed engineers versus 33 percent of scientists. In general, the areas of basic and applied research were dominated by scientists in contrast with development work, *per se*, which was the primary work activity of almost one-third of all employed engineers.

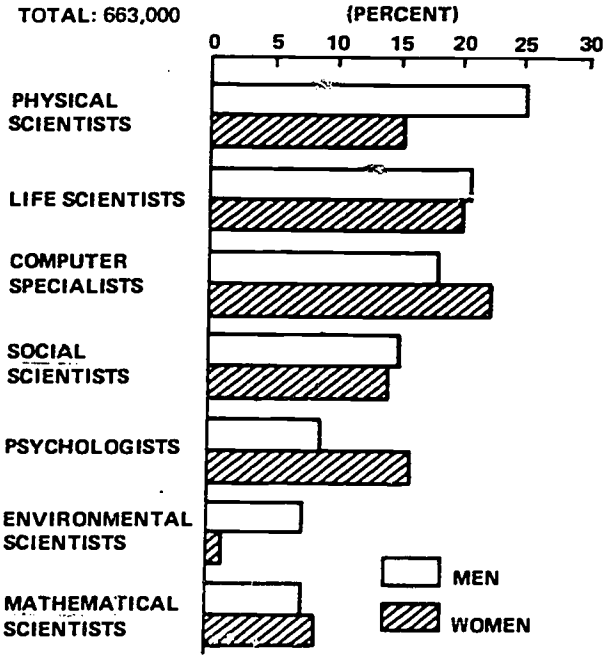
[1] During the 1954-74 period, the number of bachelor's and first-professional degrees granted in engineering essentially doubled while the number of similar degrees granted in the sciences more than quadrupled. See National Center for Education Statistics, Department of Health, Education, and Welfare, *Earned Degrees Conferred*, annual series (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office).

CHART 1. DISTRIBUTION OF EMPLOYED SCIENTISTS AND ENGINEERS, BY FIELD AND SEX: 1974



SOURCE: NATIONAL SCIENCE FOUNDATION

CHART 2. DISTRIBUTION OF EMPLOYED SCIENTISTS, BY FIELD AND SEX: 1974



SOURCE: NATIONAL SCIENCE FOUNDATION

Table 2. Number of employed scientists and engineers, by field and primary work activity: 1974

FIELD	Total	Research and Development				Management or Administration			Teaching	Consulting	Production/ inspection	Reporting, statistical work, and computing applications
		Total	Basic research	Applied research	Development	Total	Of R&D	Other than R&D				
Total	1,662	501	58	91	352	400	149	252	123	96	213	175
Physical scientists	156	66	22	22	22	33	21	12	20	4	18	5
Chemists	113	47	14	15	18	24	15	9	12	2	16	3
Physicists/astronomers	35	16	7	5	3	7	4	2	7	1	1	2
Other physical scientists	8	3	1	1	1	2	1	1	1	1	(1)	1
Mathematical scientists	45	7	2	2	2	8	3	4	13	1	2	11
Mathematicians	32	5	2	2	2	6	2	3	11	1	2	6
Statisticians	13	1	(1)	1	(1)	2	1	1	2	(1)	1	6
Computer specialists	122	10	1	2	6	12	4	8	5	5	4	79
Environmental scientists	44	12	4	6	1	9	3	5	5	4	3	4
Earth scientists	38	10	4	5	1	8	3	5	4	4	3	3
Oceanographers	2	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Atmospheric scientists	4	1	(1)	1	(1)	1	(1)	(1)	(1)	(1)	(1)	1
Engineers	999	335	5	32	298	276	93	183	20	55	163	55
Life scientists	136	41	15	16	11	31	12	19	26	7	10	8
Biological scientists	69	25	9	9	7	11	5	5	17	2	4	4
Agricultural scientists	50	11	2	6	3	16	4	12	5	4	6	3
Medical scientists	17	5	3	1	1	4	2	2	4	1	1	1
Psychologists	61	9	3	3	3	11	4	6	13	15	6	3
Social scientists	100	21	5	8	8	22	8	14	23	5	7	10
Economists	39	9	2	4	3	10	4	6	7	2	3	5
Sociologists/anthropologists	22	4	1	1	2	4	1	2	8	1	1	2
Other social scientists	39	8	2	3	4	9	3	6	8	2	4	3

[1] Less than 500

Note: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Table 2. Number of employed scientists and engineers, by field and primary work activity: 1974

Total	Research and Development				Management or Administration			Teaching	Consulting	Production/ inspection	Reporting, statistical work, and computing applications	Other	No report
	Total	Basic research	Applied research	Development	Total	Of R&D	Other than R&D						
1,662	501	58	91	352	400	149	252	123	96	213	175	112	43
156	66	22	22	22	33	21	12	20	4	18	5	7	3
113	47	14	15	18	24	15	9	12	2	16	3	7	2
35	16	7	5	3	7	4	2	7	1	1	2	1	1
8	3	1	1	1	2	1	1	1	1	(1)	1	(1)	(1)
45	7	2	2	2	8	3	4	13	1	2	11	2	1
32	5	2	2	2	6	2	3	11	1	2	6	1	(1)
13	1	(1)	1	(1)	2	1	1	2	(1)	1	6	1	1
122	10	1	2	6	12	4	8	5	5	4	79	3	4
44	12	4	6	1	9	3	5	5	4	3	4	7	2
38	10	4	5	1	8	3	5	4	4	3	3	6	2
2	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
4	1	(1)	1	(1)	1	(1)	(1)	(1)	(1)	(1)	1	1	(1)
999	335	5	32	298	276	93	183	20	55	163	55	73	23
136	41	15	16	11	31	12	19	26	7	10	8	10	3
69	25	9	9	7	11	5	5	17	2	4	4	5	1
50	11	2	6	3	16	4	12	5	4	6	3	4	1
17	5	3	1	1	4	2	2	4	1	1	1	(1)	(1)
61	9	3	3	3	11	4	6	13	15	6	3	3	2
100	21	5	8	8	22	8	14	23	5	7	10	6	5
39	9	2	4	3	10	4	6	7	2	3	5	3	1
22	4	1	1	2	4	1	2	8	1	1	2	1	1
39	8	2	3	4	9	3	6	8	2	4	3	3	3

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Table 3. Number of employed scientists and engineers by field and type of employer: 1974

[In thousands]

Field	Total	Business & industry	Educational institutions	Nonprofit organizations	Federal Government	Military/ Comm Corps	State & local gov't	Other gov't	Other	No report
TOTAL	1,662	959	205	66	157	8	120	27	111	8
Physical scientists	156	70	35	8	14	(1)	8	1	18	1
Chemists	113	62	20	4	6	(1)	6	1	13	1
Physicists/astronomers	35	6	14	4	6	(1)	1	(1)	4	(1)
Other physical scientists	8	2	1	(1)	2	(1)	1	(1)	1	(1)
Mathematical scientists	45	12	18	1	6	(1)	4	(1)	3	(1)
Mathematicians	32	9	15	1	4	(1)	2	(1)	1	(1)
Statisticians	13	4	2	(1)	2	(1)	2	(1)	1	(1)
Computer specialists	122	80	6	4	8	1	7	3	11	1
Environmental scientists	44	18	8	1	8	(1)	4	1	4	(1)
Earth scientists	38	17	7	1	6	(1)	3	1	3	(1)
Oceanographers	2	(1)	1	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Atmospheric scientists	4	1	1	(1)	1	(1)	(1)	(1)	(1)	(1)
Engineers	999	713	29	20	84	5	68	19	58	4
Life scientists	134	34	47	8	22	(1)	13	1	8	1
Biological scientists	69	13	30	5	7	(1)	7	1	5	(1)
Agricultural scientists	50	19	9	1	14	(1)	6	(1)	2	(1)
Medical scientists	17	2	8	3	1	(1)	1	(1)	1	(1)
Psychologists	61	7	27	14	2	(1)	5	(1)	4	(1)
Social scientists	100	24	35	9	12	(1)	12	1	4	2
Economists	39	13	11	2	7	(1)	3	1	2	(1)
Sociologists/anthropologists	22	4	12	1	1	(1)	2	(1)	1	(1)
Other social scientists	39	6	12	6	4	(1)	7	(1)	2	1

[1] Less than 500

Note: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Other work activities displayed similar imbalances with respect to the employment of scientists versus engineers. Engineers engaged primarily in production and inspection activities, for example, outnumbered scientists more than 3 to 1. But in the areas of teaching and reporting, statistical, and computing activities, scientists represented the dominant group, particularly in teaching where their representation was 5 times that of engineers.

Almost three-fifths of the scientists and engineers in the employed labor force in 1974 were affiliated with business and industry, which accounted for over a quarter of a million more jobs for scientists and engineers than all other employers combined. But while the industrial sector of the economy provided the largest source of employment for *both* scientists and engineers, engineers alone accounted for almost three-fourths of the total of all such personnel. The employment of scientists, on the other hand, was more nonindustrially oriented. Thus, about three-eighths of all employed scientists were industrially employed, about one-half the proportion of that for engineers.

Employment patterns within the industrial sector were in marked contrast with those in the academic and nonprofit sectors. Educational institutions which accounted for the employment of about one-eighth of all scientists and engineers, combined, employed about six times as many scientists as engineers; among nonprofit organizations, the ratio of employed scientists to engineers was about two to one. Other employers, who accounted for about one-quarter of the employed S/E labor force, hired about 20 percent more engineers than scientists (tables 2 and 3).

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