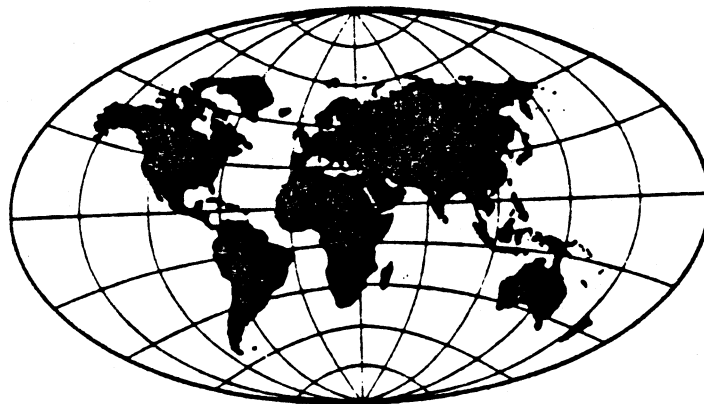


SCIENTISTS AND ENGINEERS IN GREAT BRITAIN: 1991

by

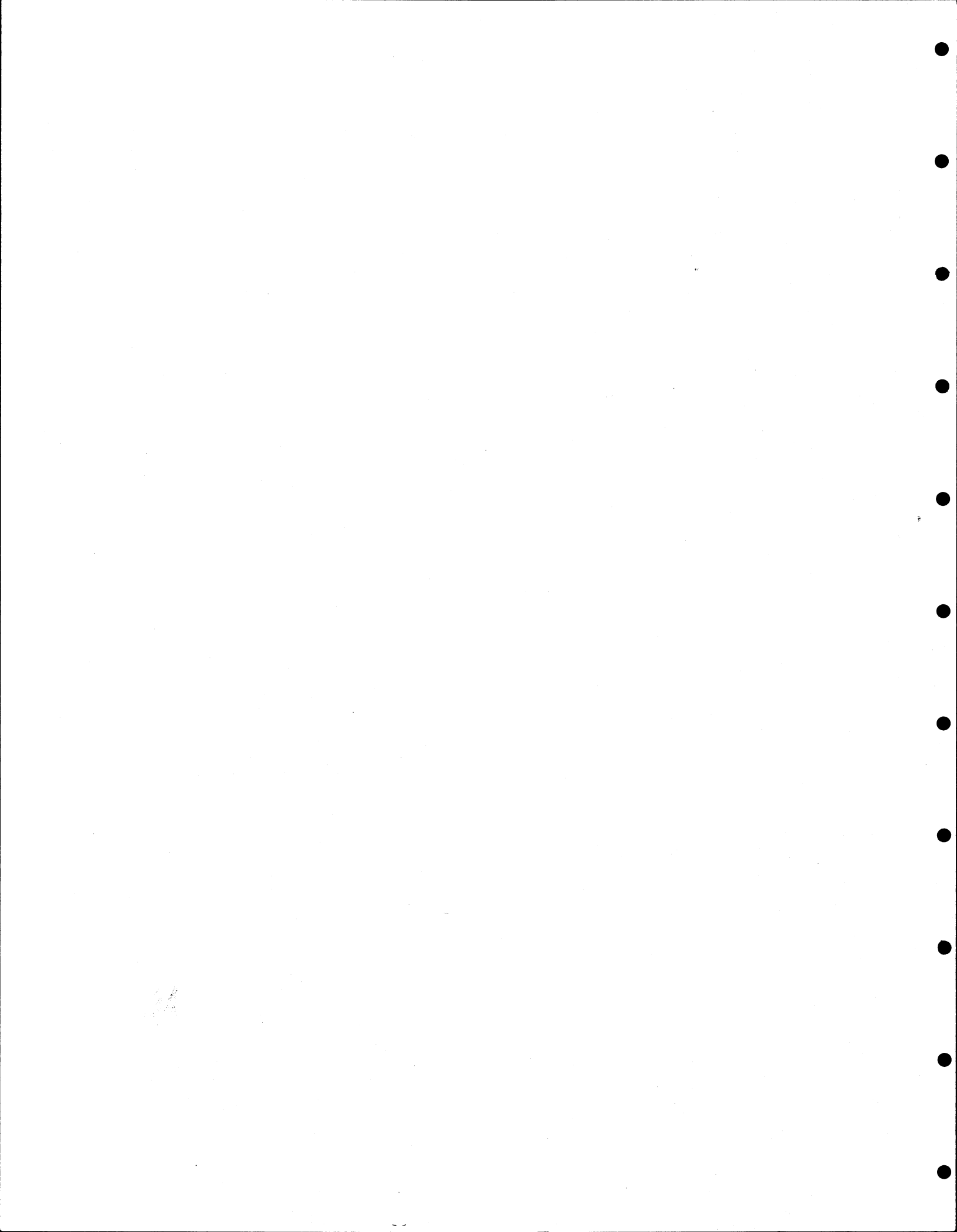
David Zaslow



**International Programs Center
Population Division
U.S. Bureau of the Census
Washington, D.C. 20233-8860**

**IPC Staff Paper
No. 85**

January 1997



EXECUTIVE SUMMARY

The typical member of the group "Scientists and Engineers" (S/E)¹ in Great Britain² is a male college graduate (baccalaureate) in his late 30's, who works in manufacturing, or to a lesser extent, a service sector of the economy. There are exceptions to this characterization, since females, who comprise one-ninth of scientists and engineers, are far more likely to be employed in services than manufacturing, and are more likely to progress on to earn a masters or doctoral degree. Female scientists and engineers are also considerably younger than their male colleagues, suggesting that females may account for an increasing share of scientists and engineers in the future. Increasing this source of new scientists and engineers will be required to offset forecasted shortages of skilled S/E.

¹ Data in these reports refer to non-academic scientists and engineers.

² Data in this report refer to Great Britain, which differs from the United Kingdom in that Great Britain excludes data from Northern Ireland.

PREFACE

The International Programs Center conducts demographic and economic studies, some of which are issued as Staff Papers. A complete list is included at the end of this report.

We are grateful to the British Office of National Statistics, for its assistance in providing data from the 1991 census, upon which the tables and charts in this report are based. Within the International Programs Center, thanks are due to Lois Darmohray and Beverly Mathis for secretarial support. The use of data not generated by the U.S. Bureau of the Census precludes performing the same statistical reviews the Bureau performs on its own data.

Comments and questions regarding this study should be addressed to David Zaslow, Eurasia Branch, International Programs Center, U.S. Bureau of the Census, Washington, D.C. 20233-8860; telephone (301) 457-1362.

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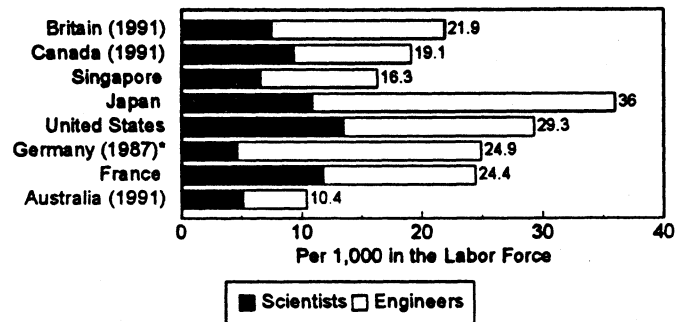
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INTRODUCTION

This report presents statistics on scientists and engineers (S/E) in Great Britain, based on the 1991 census. It begins with a graphic comparison among countries, including the United States. It is followed by sections describing new data for Great Britain. Data tables provide detailed information upon which the graphic presentation is based. Users who wish to compare more closely data presented in this report with those of other countries should consult the list of IPC/CIR Staff Papers in the back of this report. The most recently published report of this series is "Scientists and Engineers in Canada: 1991."

Great Britain lies in the mid range among countries reported on in this series in terms of number of scientists and engineers, relative to its labor force. In 1991, Great Britain had approximately 22 scientists and engineers, per 1,000 members of its labor force (Table GB-1(91) and *1991 Census Qualified Manpower Great Britain*, 1994, pp. 29, 30). Yet British science and engineering may be facing serious problems beyond the issue of sheer numbers. According to numerous reports, many British scientists and engineers perceive a lack of respect for their professions, reflected in pay scales and a lack of public esteem. As a result, the ranks of scientists and engineers are thinning out and many S/E are working abroad for higher compensation, while others have exited the fields entirely. The decline in prestige of science and engineering also is reflected in S/E's minimal representation among corporate leaders in their fields (Sampson, 1991, pp. 33, 34). Under these circumstances, Britain's technological dynamism could be at risk.

Figure 1. Scientists and Engineers per 1,000 Members of the Labor Force, for Selected Countries: 1990



* West Germany
Source: Zaslów, 1996 (Canada), p. 2; 1991 Census
Qual. Manpower GB, pp. 29, 30.

The scientist and engineering occupations are largely populated by males.

The vast majority of scientists and engineers (89 percent) are male (Table GB-1(91)). This contrasts sharply with the sex breakdown of the British labor force, of which males comprise a much smaller majority, 57 percent (*1991 Census Qualified Manpower Great Britain*, 1994, pp. 29, 30). In each of the countries that have been reviewed in recent reports of this series (Australia and Canada (1991), and Japan and Singapore (1990)), males are far more heavily represented among scientists and engineers than the overall labor force (*International Data Base*; Zaslow, 1995, pp. 17, 18; Zaslow, 1996 (Japan), pp. 15, 16; Zaslow, 1996 (Singapore), pp. 16, 17, and Zaslow, 1996 (Canada), pp. 20, 21).

Females' share of scientist and engineer employment most likely would be even smaller than is implied by the employment breakdown by sex listed above, if measured in full-time equivalencies. In 1991, among employees (who represent 79 percent of the labor force), 34 percent of females and just 3 percent of males worked part-time³ (*1991 Census Qualified Manpower Great Britain*, 1994, pp. 29, 30). Although no data are available on full- and part-time work in science and engineering, based on the national data, it is likely that a higher share of females than males work part-time.

Although males presumably will continue to dominate science and engineering, data on new entrants to these fields suggest that the gap will diminish. One fifth (20 percent) of scientists and engineers below age 25 are female, compared to 11 percent of all S/E (Table GB-1(91)). In addition, in 1989, 10 percent of female graduates began careers in science or engineering, compared to 30 percent of males. In particular, women are becoming increasingly engaged in chemical engineering, where females' share of graduating students rose from 8 to 26 percent between 1980 and 1989 (Hammond and Holton, 1993, p. 81). However, females continue to comprise only a negligible share of chemical engineers (less than one percent) (Table GB-1(91)).

Taking account of the gender composition of the overall labor force and the scientist and engineer population, Great Britain most resembles the distributions seen in Australia and Canada. It was noted above that 57 percent of the British labor force and 89 percent of its scientists and engineers were male, while in Australia, the corresponding shares were 58 and 81 percent, and in Canada, the corresponding shares were 55 and 81 percent, respectively (Zaslow, 1995, pp. 17, 18; and Zaslow, 1996 (Canada), pp. 20, 21). These similarities may be based, in a general sense, on a common cultural and educational heritage. The gap is greater between males' share of Japan's national labor force and its scientist and engineer workforce, at 49 and 93 percent, respectively (Zaslow, 1996 (Japan), pp. 15, 16). In

³ Official data do not define what is meant by the expression "part-time," in terms of hours worked. That determination is made by the census respondent.

Singapore, males' share of both national and S/E labor force are lower than in Great Britain (51 and 75 percent, respectively) (Zaslow, 1996 (Singapore), pp. 16, 17).

Scientists and engineers are widely dispersed among the employment categories.

Within the employment category "Scientists and Engineers,"⁴ those with specialization in natural science are most numerous. Nearly 80,000 males and 33,000 females, or 20 percent of the overall employment category, work in this field (Table GB-1(91)). Among female scientists and engineers, the largest share (51 percent) is natural scientists (Figure 3), with social science a distant second. Of the 12 science and engineering categories, 6 have employment of between 50,000 and 70,000 S/E (Figure 2). All of these 6 categories are among the engineering professions.

Surprisingly, Great Britain is more similar to two Asian countries studied in recent reports of this series, Japan and Singapore, than to two Commonwealth countries, Canada and Australia, in its distribution of scientists and engineers. Great Britain and the two Asian countries all heavily favor employment of engineers, while Canada and Australia have comparable numbers of scientists and engineers (Table GB-1(91) and Zaslów, 1996 (Canada), p. 4).

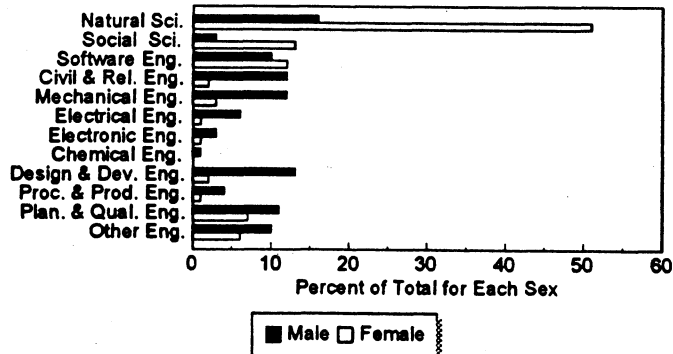
⁴ See Table GB-1(91) for a list of occupations that constitute the category, "scientists and engineers."

Figure 2. Scientists and Engineers by Specialty and Sex, for Great Britain: 1991



Source: Table GB-1(91).

Figure 3. Distribution of Scientists and Engineers by Specialty and Sex, for Great Britain: 1991



Source: Table GB-1(91).

British science and engineering reportedly suffers from a lack of prestige, complicating efforts to attract the most qualified candidates.

By numerous accounts, science and engineering work suffers in Great Britain because these fields are accorded little respect by society at large, and consequently, fail to attract the most promising students. Classical academic studies, rather than technical education, continue to be more highly regarded, particularly among the country's most capable students. The quality of the country's research capacity is further diminished by the loss of many skilled scientists, who opt to work abroad, in order to receive higher pay and have access to superior research facilities (Klinger, 1986, p. 52). This situation that has created shortages of scientists in key export sectors, and reportedly factors into Great Britain's inability to keep pace with its competitors in world trade (Barnett, 1991, p. 71; Sampson, 1991, p. 33; and Lethbridge and Davies, 1995, pp. 453).

The low stature of British engineers is reflected in their minimal representation among corporate leaders of British engineering companies. In Great Britain (as of 1991), just 10 percent of directors of these companies reportedly were engineers, compared with over 60 percent in Germany. This reflects engineering's lack of prestige as a career, and also suggests that companies may sacrifice engineering considerations in the name of short-term financial considerations. However, just as non-technical leaders of engineering firms may lack direct knowledge of engineering considerations, engineers apparently contribute to their minimal representation among directors, as few British engineers reportedly broaden their skills to gain the ability to understand non-technical areas of expertise, such as finance, that are required to advance to upper management (Sampson, 1991, p. 34).

Perhaps recognizing the lack of focus in Great Britain's scientific and engineering community, the national government has attempted to bring the country's industrial and academic communities together to work on projects of joint interest, offering matching funds for selected projects (Freemantle, 1995, pp.16, 17). For fiscal 1996-97, the British Department of Trade and Industry has a budget of £359 million to be used in support of science, engineering, and technology (SET). The work is performed by government, industry, and academia, for the development of new, technologically-advanced products (*Forward Look of Government Funding*, 1996, p. 29; and Nosek and Shepard, 1995, p. 11). Since the sums involved are small, the hope is that a critical mass will be reached by bringing together companies with mutual interests in technological development, and facilitating their cooperation (Kenward, 1993, p. 21).

Another problem facing Great Britain is that funds for advanced work are comparatively limited. British industry reportedly trailed other leading industrial countries in investment in research and development (R&D). In the late 1980's, British industrial spending on R&D equaled 1.6 percent of output, compared to 2.1 percent in Japan and 2.2 percent in

West Germany (Crafts, 1996, p. 178).⁵ One reason why many British firms lack sufficient resources for large-scale research and development is their comparatively small shares of world markets, which diminishes economic returns on R&D (Caulkin, 1991, p. 36). In addition, the comparatively small size of many British firms may constrain their ability to be innovative (which includes making use of spillovers from other firms' advances), due to shortages of financial resources that are frequently more available to larger firms (Swan and Newell, 1995, p. 868).⁶ Another possible reason for the dearth of resources for R&D may be that British companies reportedly are under greater pressure than firms in other countries to pay dividends to stockholders, in order to withstand the comparatively frequent hostile corporate takeovers in Great Britain (Crafts, 1996, p. 175).⁷ For instance, in their respective electronics industries, British companies devote far more than their Japanese counterparts to dividends than to R&D (Figure 4). In 1992, British electronics firms paid £900 million in dividends, but spent just £680 million for R&D, while Japanese electronics firms paid the equivalent of £1.2 billion in dividends, while spending £13 billion on R&D (Kenward, 1993, p. 23).⁸

It appears that the nature in which British firms obtain financing constrains them from adopting longer time horizons for evaluating R&D's affect on profitability. Britain's productivity reportedly has been impaired due to this lack of a connection (such as in Germany and Japan) between sources of financing (banks) and industry since before World War II (Eichengreen, 1996, p. 214). In Germany and Japan, many institutional investors (such as banks) have affiliations with the operation of the firms that suggest a partnership role. Firms in these countries can be more innovative to the extent that they can devote greater funds to the development of products which may mature at later dates. Partnership also may provide the discipline required to force companies to focus on core businesses (Healey, 1994, p. 39; and Corfe, 1993, p. 41).⁹

⁵ British R&D data may somewhat understate actual spending, as the British do not require publicly-owned firms to reveal R&D expenditures (Patel and Pavitt, 1987, p. 81).

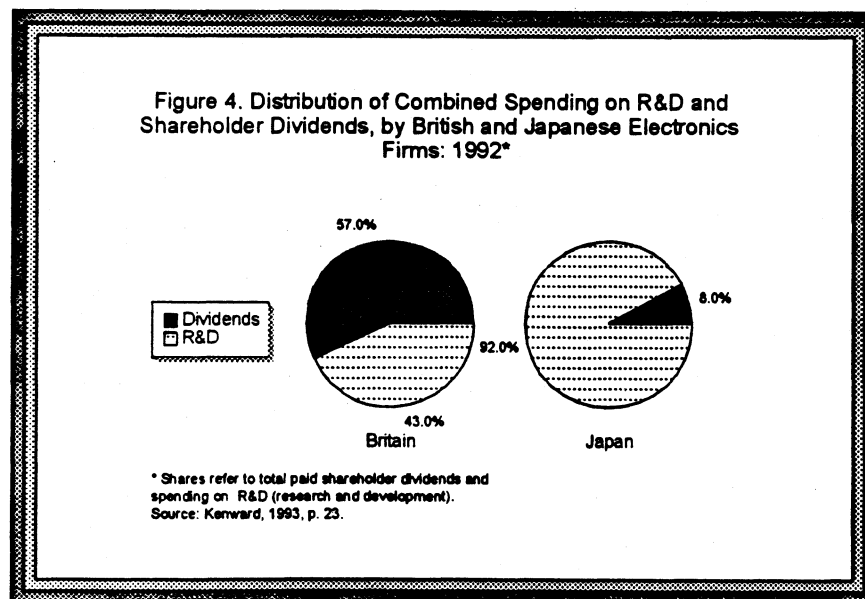
⁶ The chemicals and pharmaceuticals industries reportedly are the exceptions to the broader trend of British industries not keeping pace with foreign companies in R&D spending (Porter, 1990, p. 44).

⁷ The share of profits devoted to R&D has been perceived to be an indicator of management's commitment to technological change (Patel and Pavitt, 1987, p. 73).

⁸ This disparity in R&D funding almost certainly contributes to the disparity in U.S. patents (a frequently cited barometer of technological development) by country. In 1991, Japanese firms and individuals receiving over 21,000 U.S. patents, compared with 2,800 for Great Britain (Kenward, 1993, p. 23). This comparative disparity is far greater than Japan's advantage in scientists and engineers, relative to each country's labor force (Figure 1), or Japan's advantage in per capita gross domestic product (GDP) (*The World Factbook 1995*, pp. 216, 440).

⁹ Innovation is encouraged by having a business strategy, that is linked to a technology strategy which does not require short-term payback (Swan and Newell, 1995, p. 864).

Still another reason mentioned for shortages of funding for research and development (for civilian industry) is that much of Britain's R&D spending, particularly by the government, was devoted to military applications during the Cold War (Kaldor, et. al., 1986, p. 34).¹⁰ In 1987, half of British government R&D spending reportedly was for defense-related projects, compared with 12 percent in former West Germany, 5 percent in Japan, and 34 percent in France (Porter, 1990, p. 44). While this focus presumably has been relaxed with the end of the Cold War,¹¹ Great Britain lost ground to countries with a smaller financial commitment to defense. Using data for the United Kingdom, the country's share of world-wide exports of technology-intensive products fell from 10.8 percent in 1980 to 8.7 percent in 1987 (National Science Foundation, 1991, p. 125). Great Britain's heavy commitment to defense R&D also drained the country's limited supply of highly qualified S/E, reducing manpower available for research in the civilian sphere (Kaldor, et. al., 1986, p. 45).



¹⁰ There are reportedly no data disaggregating S/E between the military and civilian sectors of the economy (Kaldor, et.al., 1986, p. 39).

¹¹ Britain's share of defense spending, as a percent of gross domestic product, declined from 5.2 percent, on average, from 1980 to 1984, to 3.1 percent in 1995 (Atkinson and Graham, 1996, p. 15).

Like the British labor force in general, scientists and engineers are comparatively young.

Nearly half (44 percent) of scientists and engineers are below age 35 (Table GB-1(91)). Measured by 5-year age groups, the largest number of scientists and engineers in Great Britain is between 25 and 29. The number of scientists and engineers then declines for each cohort. The median age of scientists and engineers in Britain is 37. The British age distribution of scientists and engineers closely resembles Australia's and Canada's: 45 percent and 46 percent of their respective S/E are less than age 35 (Zaslow, 1996 (Canada), p. 8). The share of scientists and engineers below age 35 is slightly higher in Japan (50 percent) (Zaslow, 1996 (Japan), p. 15), but is considerably higher in Singapore (74 percent) (Zaslow, 1996 (Singapore), p. 16).

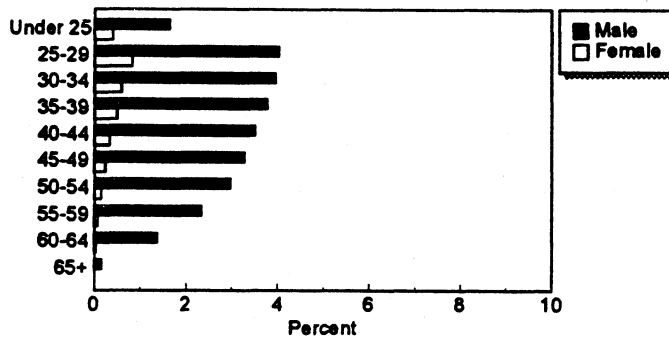
At 44 percent, scientists and engineers are nearly identically concentrated among the younger age groups as is the country's overall economically active population. In 1991, 42 percent of Great Britain's labor force was below age 35 (*1991 Census Qualified Manpower Great Britain*, 1994, pp. 85, 87).

The ages of those in the S/E occupation fields vary significantly by sex. Based on median age, male scientists and engineers are 7 years older than their female counterparts (38 and 31 years of age, respectively) (Table GB-1(91)). Male scientists and engineers who are under age 35 comprise 41 percent of all male S/E, compared to 63 percent for females (Table GB-1(91)). As in other countries studied in this series, this most likely reflects the expanding role of women in the work place. The percentage of females in Great Britain (age 18 and older) who are in the labor force, increased from 46 to 50 percent between 1981 and 1991 (*Census 1981 Qualified Manpower Great Britain*, 1984, p. 15; *1991 Census Qualified Manpower Great Britain*, 1994, p. 30).

A comparison of education and employment data for Great Britain suggests that there is potential for females to increase their share of the scientist and engineer workforce.¹² Overall, females comprise 37 percent of those with a bachelors or higher degree, but account for just 11 percent of scientists and engineers (*1991 Census Qualified Manpower Great Britain*, 1994, pp. 85, 87; and Table GB-1(91)). As shown in Figure 5, women are hardly represented in the older S/E groups, and have only begun to be seen in the young working age groups.

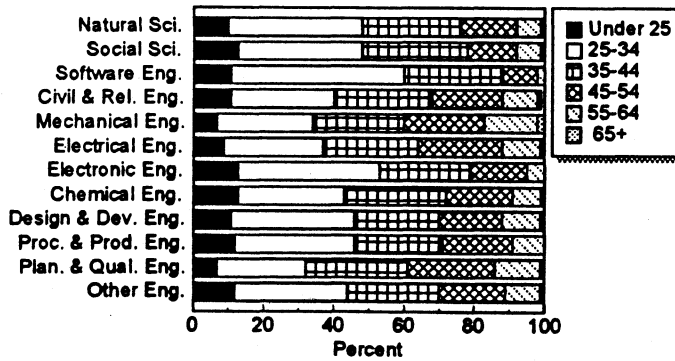
¹² Analysis of this issue would be improved with the use of age-specific data on educational attainment for scientists and engineers, which does not exist.

Figure 5. Scientists and Engineers Share of Total Population in Each Age Group, for Great Britain: 1991



Source: Table GB-1(91); 1991 Census Qualified Manpower Great Britain, Vol. 1, p. 19.

Figure 6. Scientists and Engineers by Age Group, for Great Britain: 1991



Source: Table GB-1(91).

The manufacturing and services industries dominate employment of scientists and engineers.

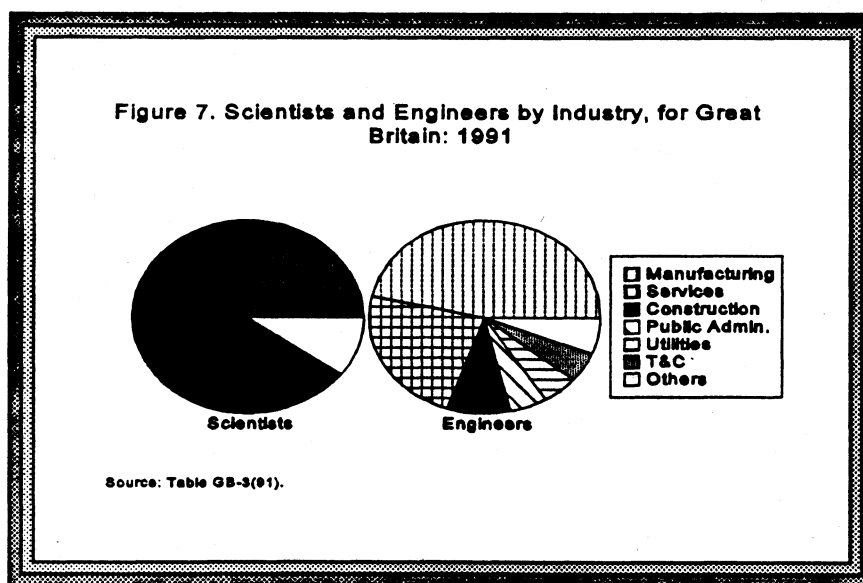
The manufacturing and services industries employ 72 percent of scientists and engineers, or more specifically, 77 percent of scientists and 69 percent of engineers (Table GB-3(91)). Scientists and engineers are more concentrated in these sectors than is the country's overall employed population,¹³ where 49 percent are engaged in manufacturing, services, as well as mining (*1991 Census Qualified Manpower Great Britain*, 1994, p. 109). Engineers comprise the vast majority of S/E in manufacturing, while scientists have a slight numerical advantage, relative to engineers, in the services sector (Table GB-3(91)). The share of Great Britain's S/E engaged in manufacturing and services is nearly identical to that of Singapore (Zaslow, 1996 (Singapore), p. 19; and closely mirrors that found in the United States and Japan (70 and 68 percent, respectively) (National Science Board, 1993, p. 326; and Zaslow, 1996 (Japan), p. 21).

Although there is a high concentration of scientists and engineers (considered a key element of efforts to improve technology and productivity), in manufacturing, labor productivity (for all manufacturing workers) reportedly trails that of many of Great Britain's economic competitors. The U.S., Germany, France, and Japan all have higher labor productivity in manufacturing than does Great Britain. This is probably due to the former countries' greater investment in physical capital, workforce skills and research and development (O'Mahony, 1994, p. 85).

¹³ To compare the distribution of scientists and engineers with that of the country's overall employed population, we must include employment in mining, since this is combined with manufacturing in British statistics.

Most industries exhibit a preference for either scientists or engineers.

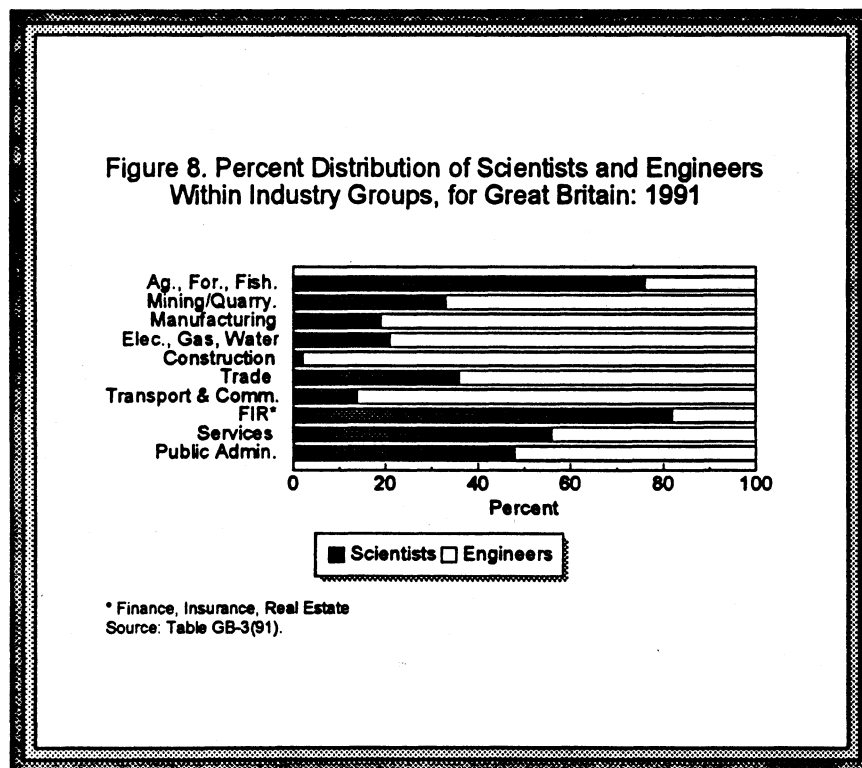
Most industries exhibit a hiring preference for either scientists or engineers (Figure 8). Since scientists and engineers study different disciplines, and develop different skills, these hiring patterns probably reflect a matching process based on technological considerations. The agriculture,¹⁴ finance, insurance and real estate, and services sectors favor scientists. Conversely, the mining and quarrying, manufacturing, electric, water, and gas, construction, trade, and transport and communication sectors are skewed towards employment of engineers. Only the public administration sector has approximately equal numbers of scientists and engineers. In international perspective, British patterns most closely resemble Canada's (Zaslow, 1996 (Canada), p. 12). The distribution of scientists and engineers in Great Britain is somewhat less similar to those of Australia, Japan, and Singapore (Zaslow, 1995, p. 10; and Zaslow, 1996 (Canada), p. 12).



¹⁴ Agriculture includes the agriculture, forestry and fishing sectors.

The "other" metal products¹⁵, electric and electronic products and chemicals and plastics sectors are the largest employers of scientists and engineers in manufacturing.

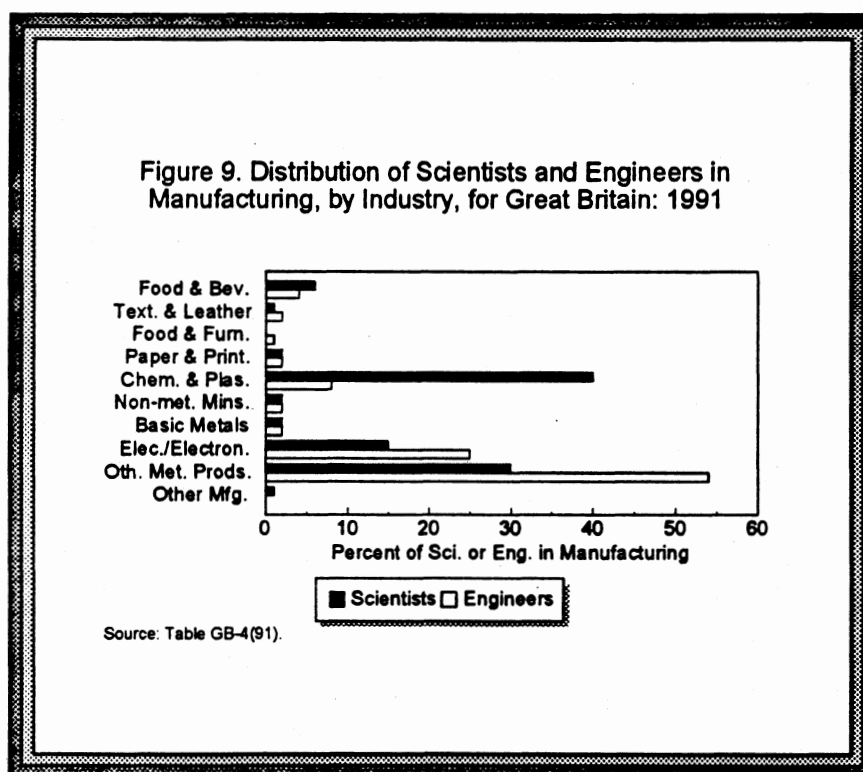
Employment of scientists and engineers in manufacturing is concentrated within a few industries. Approximately seven-eighths (87 percent) of scientists and engineers engaged in manufacturing work related to the "other" metal products; electric, electronic products; and chemicals and plastics products (Table GB-4(91)). In particular, the leading employer of S/E among manufacturers is the other metal products sector. It employs 91,570 engineers and 11,430 scientists (Table GB-4(91)), accounting for 54 percent of the former and 30 percent of the latter (Figure 9). These industries include some in which Britain reportedly has a significant share of world trade. These include electrical generation equipment, chemicals and pharmaceuticals (Porter, 1990, p. 43).



¹⁵ Other metal products include goods produced in foundries, mechanical engineering products (including equipment to process agricultural products, textiles, food, mining equipment, and data processing machinery, among others).

Nearly all scientists and engineers in the services sector work in business and social community services.

Virtually all (97 percent) service sector scientists and engineers are employed in the provision of business and social community services. Most of the remaining scientists and engineers are engaged in recreational, cultural services (Table GB-5(91)). Among the employment categories, scientists are more evenly distributed between the two leading employers of S/E than are engineers, 81 percent of whom are engaged in business services (Figure 10). The remaining two service sectors (recreational, cultural services, and personal services) employ negligible shares of scientists and engineers. Sex selection/role modeling appears to determine the general service sector groups in which a scientist or engineer is likely to work. Males are concentrated in the business services, while females are far more likely to work in social, community services. Among male S/E in the service sector, nearly two-thirds



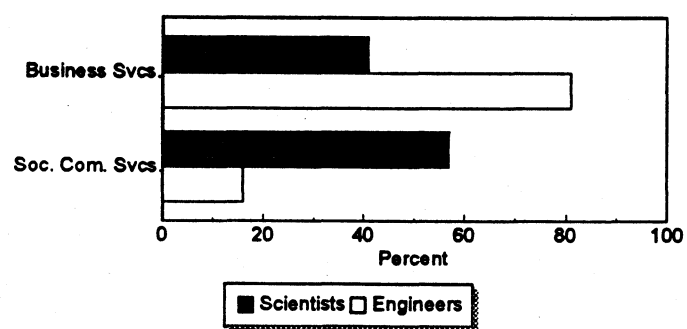
(65 percent) are in business services, while more than two-thirds (69 percent) of female S/E in the service sector are in social, community services.

The pattern of employment among British scientists and engineers in the service industries is similar to that found in Australia and Canada. Scientists are primarily employed

in the provision of social and related services,¹⁶ while engineers are concentrated among business services (Table GB-8(91); and Zaslow, 1996 (Canada), p. 14). In Japan and Singapore (two other countries recently described in this series), both scientists and engineers are heavily skewed towards employment in business services (Zaslow, 1996 (Japan), p. 27; and Zaslow, 1996 (Singapore), p. 22). This may reflect a more extensive system for the provision of social and related services in Great Britain, Australia, and Canada.

¹⁶ Biological scientists and biochemists are the largest group of scientists among social, community services, while psychologists account for a small share of scientists in this service category (Table GB-5(91)).

Figure 10. Scientists and Engineers in Services, by Industry, for Great Britain: 1991*

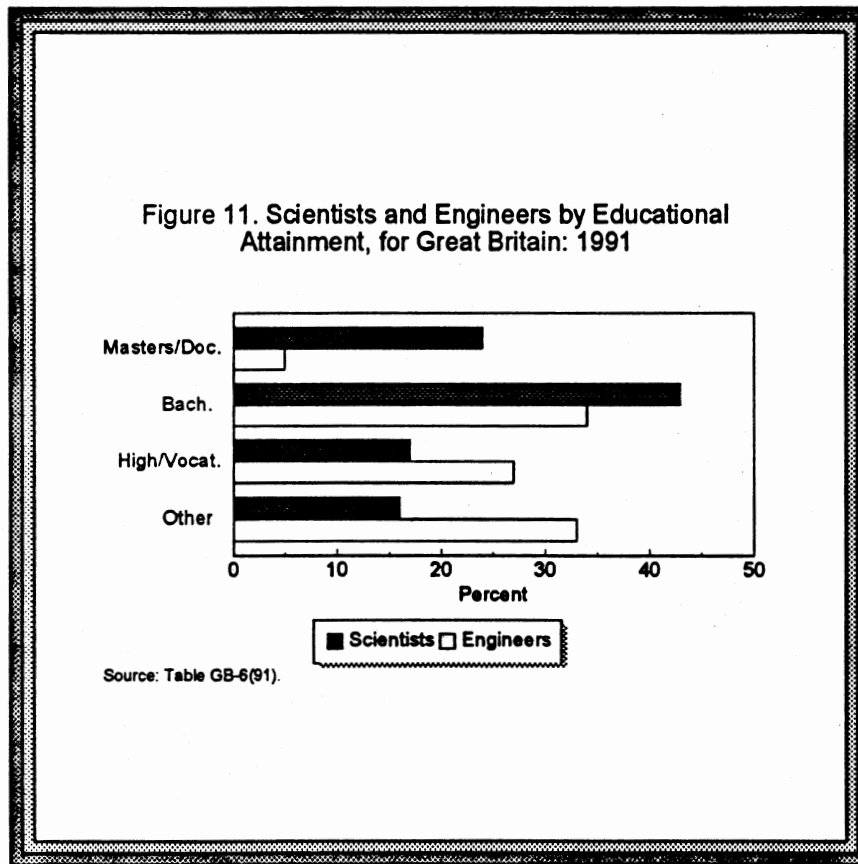


* Recreational, Cultural & Personal Services are a small percent of services, and are not shown.
Source: Table GB-5(91).

About half of all scientists and engineers have earned a college degree.

Almost one-half (49 percent) of scientists and engineers have earned a college degree. Of those who have degrees, most (76 percent) reported a bachelors (or equivalent) degree as their highest level of educational attainment, while the remainder had earned masters or doctoral degrees (Table GB-6(91)). Although the majority of both scientists and engineers with degrees report a bachelors or equivalent as their highest level of education, scientists are far more likely to complete post-graduate education than engineers (Figure 11). For those without a college degree, less than half (47 percent) have either a high school or vocational degree. A far higher share of engineers than scientists have less than a high school or vocational degree (33 percent versus 16 percent) (Table GB-6(91)).

Cross-nationally, similar shares of scientists and engineers report that their formal education did not include at least a bachelors degree. In Japan, a nearly identical share (52 percent) did not earn at least a bachelors degree (Zaslow, 1996 (Japan), p. 30), while in Australia, vocational schools (grouped in British data with high schools) play a greater role in the training of engineers than scientists (Zaslow, 1995, p. 32).



Educational attainment among scientists and engineers far exceeds that of the overall British adult population.

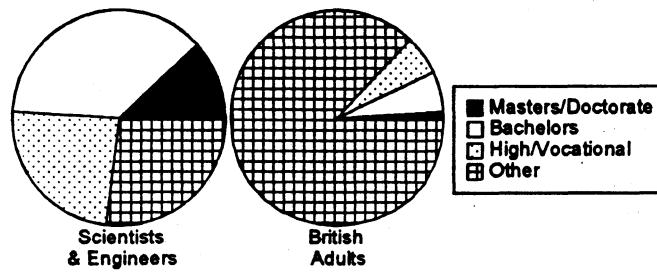
As previously indicated, 49 percent of scientists have earned a college degree (Table GB- 6(91)). By contrast, in 1991, just 7 percent of all Britons aged 18 and older had earned a bachelor's degree or higher (*1991 Census Qualified Manpower Great Britain*, 1994, p. 19; and Figure 12). College completion rates among S/E and the total adult population are considerably below those for Canada, where in 1991, 62 percent of scientists and engineers, and 11 percent of the general adult population¹⁷ had earned a college degree (Zaslow, 1996 (Canada), p.17).

While it is unclear where or how scientists and engineers supplement the skills learned during formal education, in-house courses assist a wide variety of Britons who did not obtain adequate skills during their formal education or who require familiarity with new technology. Job-related training became increasingly common in the 1980's. The share of all employees (not only scientists and engineers) who received job-related training rose from 8.2 percent in 1984 to 15.4 percent in 1990 (Crafts, 1996, p. 178), with British scientists and engineers placing greater value on these courses than do S/E in Japan (McCormick, 1995, p. 204). Nevertheless, many observers have faulted British industry for insufficient attention to worker training, compared with the country's leading economic competitors (O'Mahony, 1994, p. 85). British industry reportedly spent less than 1 percent of revenues on training, compared to 2 percent for former West Germany and 3 percent in Japan (Porter, 1990, p. 44). This shortage is compounded by the fact that the leading political parties (the Conservatives and Labour) apparently have not advocated major government-funded training programs to supplement industry-funded training for those who already are employed.¹⁸ Instead, the political parties have only advocated penalties for firms that fail to meet voluntary training targets ("Competitiveness," 1994, p. 65).

¹⁷ The adult population in Canada is defined as those aged 15 and older. The inclusion of 15-17 year olds would reduce the rates of Canadian "adults" who have earned college degrees.

¹⁸ Youth training programs, such as those to train craftsmen, have been established by the government (Prais, 1988, p. 82).

Figure 12. Comparison of Educational Levels of Scientists and Engineers, and the General Adult Population, for Great Britain: 1991*



* For Ages 18 and Older
 Source: Table GB-6(91); and 1991 Census Qualified Manpower Great Britain, 1994.

Most scientists and engineers trained in fields related to their current employment.

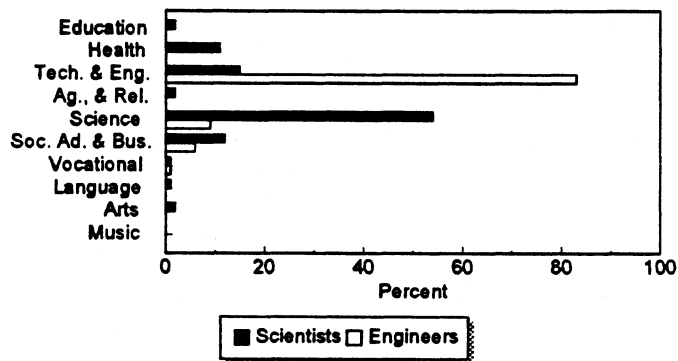
Although it is not always possible to link an academic discipline with an occupational field, most scientists and engineers studied in fields that relate directly to their occupational requirements (Table GB-7(91)). In 1991, 66 percent of scientists had studied in science-related fields, while 83 percent of engineers had studied in academic fields relating to their employment.¹⁹ This pattern is especially evident for the fields labeled science and technology and engineering (Figure 13). It is also worth noting that the high correspondence between education and employment is present in the data for S/E in Australia and Canada (Zaslow, 1996 (Canada), p. 16).

However, data on bachelor's degrees in science and engineering in 1991 suggests that in the future, fewer S/E will have studied in fields for which they were trained. Although most S/E are in engineering (Tables GB-1 through 7), there is a nearly even split between degrees for sciences and engineering (55-45 percent in favor of the sciences in 1991) (*1991 Census Qualified Manpower Great Britain*, 1994, p. 126).²⁰ This could mean that longstanding concerns in Britain about shortages of college educated engineers will continue (Prais, 1988, p. 79), and/or that many graduates who studied the sciences will be forced to take positions in engineering, despite a lack of formal training for these positions. This latter problem would be particularly acute for Britain, considering that engineering curricula reportedly are deficient in the training of many skills required for a career in engineering (Prais, 1988, p. 79).

¹⁹ The disciplines defined as being science-related are: health, medicine and dentistry, and science (inc. math and applied sciences). The engineering-related category is technology and engineering.

²⁰ By contrast in 1989, 77 percent of science and engineering degrees in the United States were earned in the sciences (*National Science Board*, 1991, p. 236).

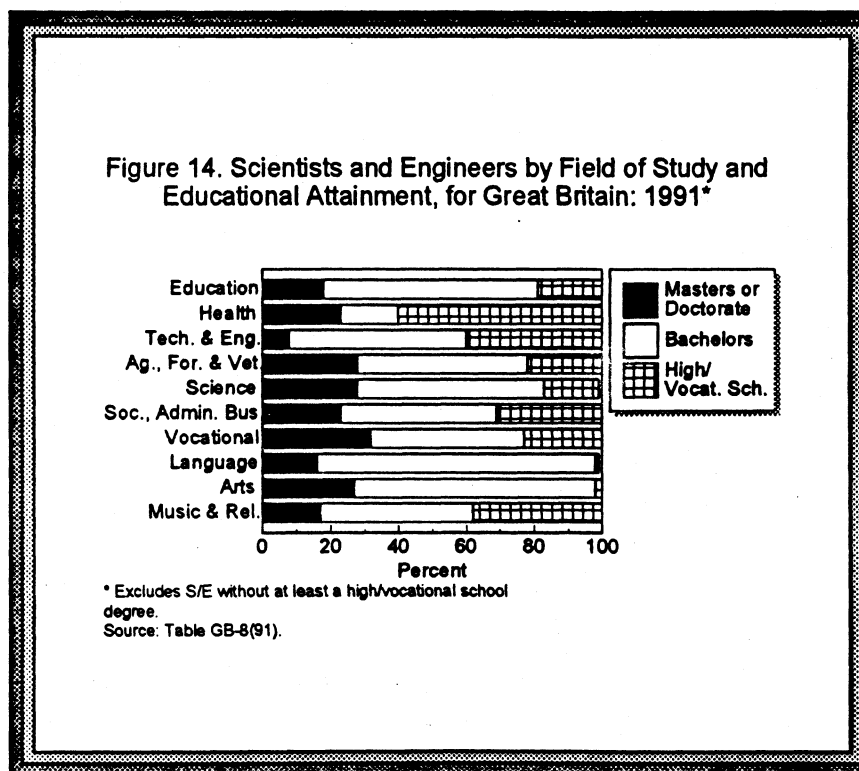
Figure 13. Scientists and Engineers by Major Fields of Study, for Great Britain: 1991



Source: Table GB-7(91).

Languages and the arts²¹ are the fields of study in which the highest shares of scientists and engineers have at least a bachelors degree.²²

Among those scientists and engineers having completed at least a high school or vocational education, nearly all who studied languages and the arts have completed at least a bachelor's degree (99 and 98 percent, respectively) (Figure 14). However, these fields account for an extremely small share of British scientists and engineers (Table GB-8(91)). The health, medicine, and dentistry field of study features the highest share of scientists and engineers who lack at least a college degree. This may suggest that many self-described scientists and engineers who studied in this field may be performing support activities. Among British scientists and engineers who have completed at least a high school or vocational degree, the most frequently reported fields of study are technology and engineering, and science (including mathematics and applied sciences) (Table GB-8(91)). College graduation rates are considerably lower for these fields, as 60 percent of S/E who studied technology and engineering and 84 percent who studied science earned a college degree.



²¹ Figure 14 includes data on all academic subject areas reported in the census. A small share of British scientists and engineers reportedly studied "non-technical" subjects. Therefore, these subject areas are included to account for all British S/E, some of whom may have gained technical skills on-the-job.

²² References to Table GB-8(91) exclude S/E without a high school or vocational degree.

Conclusions

Great Britain's concentration of scientists and engineers in its workforce lies roughly in the middle of the range of industrialized countries studied in recent reports of this series. Great Britain's scientists and engineers age structure is similar to that of the country's overall labor force, and S/E are more concentrated in manufacturing and services than is the country's employed labor force. In addition, 49 percent of Great Britain's scientists and engineers have earned a college degree, compared to just 7 percent of the country's adult population. Males predominate among scientists and engineers, accounting for 89 percent. In this respect, Great Britain's sex distribution most resembles Japan's (where males accounted for 93 percent of S/E). Great Britain's scientist and engineer sex distribution contrasts sharply with that of its overall labor force. The latter split is 57-43, male to female. Female scientists and engineers are far more concentrated in the younger age groups than are males, and are more heavily concentrated in the sciences.

Beyond the demographic issues, there has been considerable concern expressed by British observers of the country's efforts to advance its technological frontier in light of support being given to Great Britain's scientists and engineers. Insufficient training and monetary compensation, and a seeming lack of regard for the contributions of scientists and engineers threatens to deplete the country's supply of qualified scientists and engineers, a key component of efforts to improve productivity and technology.

Tables²³

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²³ Tables are numbered so as to be consistent with those of tables in previous reports in the scientists and engineers series (see list at end of this report). Any breaks in sequential order are due to a lack of data.

GB-1(91)

Table 1. Scientists and Engineers by Age and Sex, for Great Britain: 1991*

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	Both Sexes	
												Median Age	
TOTAL SCIENTISTS & ENGINEERS	561,710	56,490	101,980	88,240	76,200	75,790	58,520	46,200	33,600	18,900	5,790		37
SCIENTISTS	191,210	20,660	42,050	35,950	29,490	24,050	16,580	10,560	7,310	3,230	1,330		34
Natural Scientists	111,730	11,640	22,630	19,980	17,050	13,810	10,850	7,470	5,170	2,270	860		35
Chemists	25,430	2,720	4,930	4,040	3,390	2,960	3,140	2,040	1,380	650	180		36
Biological scientists and biochemists	38,360	3,890	7,610	7,010	6,540	4,920	3,430	2,170	1,550	810	430		35
Physicists, geologists and meteorologists	14,040	1,460	2,790	2,800	2,280	1,770	1,060	860	680	250	90		34
Other natural scientists	33,900	3,570	7,300	6,130	4,840	4,160	3,220	2,400	1,560	560	160		34
Social Scientists	22,800	3,020	4,390	3,500	3,490	3,320	1,930	1,320	940	570	320		34
Actuaries, economists and statisticians	13,640	2,560	3,240	2,090	1,730	1,510	910	570	610	260	160		31
Psychologists	6,790	350	830	950	1,320	1,410	860	550	220	210	90		39
Other social scientists	2,370	110	320	460	440	400	160	200	110	100	70		38
Software engineers	56,680	6,000	15,030	12,470	8,950	6,920	3,800	1,770	1,200	390	150		32
ENGINEERS	370,500	35,830	59,930	52,290	46,710	51,740	41,940	35,640	26,290	15,670	4,460		38
Civil, structural, municipal, mining	59,930	6,850	8,980	8,680	8,340	8,470	6,520	5,250	3,670	2,350	820		38
Mechanical engineers	61,520	4,040	8,560	8,110	6,990	9,110	7,220	7,060	5,450	3,520	1,460		41
Electrical engineers	29,650	2,570	4,200	4,030	3,610	4,520	4,010	3,090	2,150	1,170	300		40
Electronic engineers	16,550	2,090	3,490	3,090	2,330	1,920	1,550	1,060	610	330	80		34
Chemical engineers	4,040	520	810	410	600	580	400	350	180	140	50		37
Design and development engineers	66,390	7,380	12,710	10,210	8,020	8,090	6,200	5,860	4,370	2,930	620		36
Process and production engineers	19,800	2,310	3,840	2,820	2,370	2,500	2,030	1,890	1,200	680	160		37
Planning and quality control engineers	58,480	3,830	7,490	7,360	7,560	9,230	7,990	6,750	5,110	2,690	470		41
Other engineers nec	54,140	6,240	9,850	7,580	6,890	7,320	6,020	4,330	3,550	1,860	500		37

GB-1(91)

Table 1. Scientists and Engineers by Age and Sex, for Great Britain: 1991--Continued*

Occupation	Total	Male										Median Age
		Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	
TOTAL SCIENTISTS & ENGINEERS	497,770	45,300	84,300	76,590	67,340	69,230	54,530	44,000	32,440	18,470	5,570	38
SCIENTISTS	142,360	13,410	28,950	26,590	22,030	18,710	13,390	8,860	6,380	2,850	1,190	35
Natural Scientists	79,070	6,450	13,830	13,650	12,160	10,480	8,780	6,310	4,580	2,040	790	37
Chemists	21,250	1,780	3,490	3,370	3,000	2,670	2,930	1,890	1,330	620	170	38
Biological scientists and biochemists	21,850	1,530	3,640	3,850	3,700	3,060	2,200	1,580	1,210	670	410	37
Physicists, geologists and meteorologists	12,260	1,140	2,300	2,380	2,000	1,670	1,000	790	650	250	80	35
Other natural scientists	23,710	2,000	4,400	4,050	3,460	3,080	2,650	2,050	1,390	500	130	36
Social Scientists	14,190	1,770	2,570	2,190	2,160	2,090	1,230	850	650	430	250	35
Actuaries, economists and statisticians	10,000	1,690	2,130	1,530	1,280	1,210	770	500	510	240	140	33
Psychologists	2,800	50	230	340	630	680	360	260	80	110	60	40
Other social scientists	1,390	30	210	320	250	200	100	90	60	80	50	37
Software engineers	49,100	5,190	12,550	10,750	7,710	6,140	3,380	1,700	1,150	380	150	33
ENGINEERS	355,410	31,890	55,350	50,000	45,310	50,520	41,140	35,140	26,060	15,620	4,380	39
Civil, structural, municipal, mining	58,660	6,360	8,570	8,550	8,240	8,400	6,490	5,240	3,660	2,350	800	38
Mechanical engineers	59,860	3,710	8,120	7,720	6,840	8,960	7,080	7,040	5,430	3,510	1,450	42
Electrical engineers	29,180	2,430	4,060	3,960	3,580	4,480	4,000	3,080	2,130	1,160	300	40
Electronic engineers	16,110	1,940	3,320	3,070	2,290	1,900	1,520	1,050	610	330	80	34
Chemical engineers	3,760	430	690	400	550	570	400	350	180	140	50	38
Design and development engineers	64,840	6,970	12,210	10,010	7,840	7,990	6,160	5,790	4,330	2,920	620	37
Process and production engineers	19,130	2,130	3,650	2,720	2,300	2,450	1,980	1,880	1,180	680	160	37
Planning and quality control engineers	53,710	2,920	6,260	6,560	6,970	8,720	7,610	6,480	5,040	2,680	470	42
Other engineers nec	50,160	5,000	8,470	7,010	6,700	7,050	5,900	4,230	3,500	1,850	450	38

GB-1(91)

Table 1. Scientists and Engineers by Age and Sex, for Great Britain: 1991--Continued*

Occupations	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	Female
												Median Age
TOTAL SCIENTISTS & ENGINEERS	63,940	11,190	17,680	11,650	8,860	6,560	3,990	2,200	1,160	430	220	31
SCIENTISTS	48,850	7,250	13,100	9,360	7,460	5,340	3,190	1,700	930	380	140	32
Natural Scientists	32,660	5,190	8,800	6,330	4,890	3,330	2,070	1,160	590	230	70	31
Chemists	4,180	940	1,440	670	390	290	210	150	50	30	10	28
Biological scientists and biochemists	16,510	2,360	3,970	3,160	2,840	1,860	1,230	590	340	140	20	32
Physicists, geologists and meteorologists	1,780	320	490	420	280	100	60	70	30	0	10	30
Other natural scientists	10,190	1,570	2,900	2,080	1,380	1,080	570	350	170	60	30	31
Social Scientists	8,610	1,250	1,820	1,310	1,330	1,230	700	470	290	140	70	34
Actuaries, economists and statisticians	3,640	870	1,110	560	450	300	140	70	100	20	20	28
Psychologists	3,990	300	600	610	690	730	500	290	140	100	30	38
Other social scientists	980	80	110	140	190	200	60	110	50	20	20	39
Software engineers	7,580	810	2,480	1,720	1,240	780	420	70	50	10	0	31
ENGINEERS	15,090	3,940	4,580	2,290	1,400	1,220	800	500	230	50	80	28
Civil, structural, municipal, mining	1,270	490	410	130	100	70	30	10	10	0	20	26
Mechanical engineers	1,660	330	440	390	150	150	140	20	20	10	10	30
Electrical engineers	470	140	140	70	30	40	10	10	20	10	0	27
Electronic engineers	440	150	170	20	40	20	30	10	0	0	0	27
Chemical engineers	280	90	120	10	50	10	0	0	0	0	0	26
Design and development engineers	1,550	410	500	200	180	100	40	70	40	10	0	28
Process and production engineers	670	180	190	100	70	50	50	10	20	0	0	27
Planning and quality control engineers	4,770	910	1,230	800	590	510	380	270	70	10	0	31
Other engineers nec	3,980	1,240	1,380	570	190	270	120	100	50	10	50	27

* Excludes data from Northern Ireland.

Source:

Special tabulation based upon the 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

GB-3(91)

Table 3. Scientists and Engineers by Industry and Sex, for Great Britain: 1991*

Occupation	Total	Agriculture Forestry & Fish.	Mining & Quarrying	Manufacturing	Electric Gas & Water	Construc- tion	Wholesale & Retail Trade	Transport & Commun.	Fin. & Insur.	Services	Public Admin.	Both Sexes	
												Inadeq. Defined	
TOTAL SCIENTISTS & ENGINEERS	561,710	1,470	11,470	207,500	24,520	35,260	16,460	22,980	8,410	195,750	33,290	4,600	
SCIENTISTS	191,210	1,120	3,740	38,470	5,040	590	5,870	3,200	6,930	108,910	15,880	1,460	
Natural Scientists	111,730	1,110	3,230	22,750	3,670	370	2,720	670	540	64,730	10,940	1,000	
Chemists	25,430	60	570	13,920	1,230	90	700	140	10	7,550	1,040	120	
Biological scientists and biochemists	38,360	880	10	2,600	410	40	1,250	30	20	30,300	2,520	300	
Physicists, geologists and meteorologists	14,040	20	2,460	1,060	520	200	340	40	10	7,180	1,830	380	
Other natural scientists	33,900	150	190	5,170	1,510	40	430	460	500	19,700	5,550	200	
Social Scientists	22,800	10	130	860	230	50	290	350	3,910	12,850	3,890	230	
Actuaries, economists and statisticians	13,640	10	130	830	220	40	280	300	3,880	6,090	1,700	160	
Psychologists	6,790	0	0	20	0	0	10	40	30	4,720	1,950	20	
Other social scientists	2,370	0	0	10	10	10	0	10	0	2,040	240	50	
Software engineers	56,680	0	380	14,860	1,140	170	2,860	2,180	2,480	31,330	1,050	230	
ENGINEERS	370,500	350	7,730	169,030	19,480	34,670	10,590	19,780	1,480	86,840	17,410	3,140	
Civil, structural, municipal, mining	59,930	50	2,410	2,200	2,640	22,720	310	1,680	50	22,180	5,140	550	
Mechanical engineers	61,520	140	1,890	22,070	3,220	2,020	1,700	3,650	600	19,810	5,290	1,130	
Electrical engineers	29,650	0	510	7,770	5,890	1,830	790	4,940	240	5,350	2,020	310	
Electronic engineers	16,550	10	100	8,000	160	50	1,080	1,010	50	4,810	1,180	100	
Chemical engineers	4,040	0	430	1,760	290	80	110	10	0	1,220	40	100	
Design and development engineers	66,390	20	490	40,730	1,630	2,540	1,040	2,110	140	16,630	770	290	
Process and production engineers	19,800	10	500	16,210	370	280	320	470	10	1,370	160	100	
Planning and quality control engineers	58,480	20	660	42,100	1,860	2,220	2,330	3,350	160	4,890	650	240	
Other engineers nec	54,140	100	740	28,190	3,420	2,930	2,910	2,560	230	10,580	2,160	320	

GB-3(91)

Table 3. Scientists and Engineers by Industry and Sex, for Great Britain: 1991--Continued*

Occupation	Total	Agriculture Forestry & Fish.	Mining & Quarrying	Manufacturing	Electric Gas & Water	Construction	Wholesale & Retail Trade	Transport & Commun.	Fin. & Insur.	Services	Public Admin.	Male	
												Inadeq. Defined	
TOTAL SCIENTISTS & ENGINEERS	497,770	1,220	10,870	193,340	23,080	34,500	14,050	21,880	6,620	159,440	28,440	4,330	
SCIENTISTS	142,360	900	3,330	32,120	3,990	520	4,510	2,680	5,240	76,340	11,470	1,260	
Natural Scientists	79,070	890	2,850	18,050	2,910	330	2,050	580	350	41,830	8,380	850	
Chemists	21,250	50	490	11,840	970	80	590	120	10	6,160	820	120	
Biological scientists and biochemists	21,850	720	10	1,520	250	30	910	30	20	16,190	1,960	210	
Physicists, geologists and meteorologists	12,260	20	2,170	920	410	180	310	40	10	6,240	1,610	350	
Other natural scientists	23,710	100	180	3,770	1,280	40	240	390	310	13,240	3,990	170	
Social Scientists	14,190	10	130	570	150	30	140	230	3,070	7,410	2,270	180	
Actuaries, economists and statisticians	10,000	10	130	560	140	30	130	200	3,050	4,390	1,240	120	
Psychologists	2,800	0	0	0	0	0	10	30	20	1,830	890	20	
Other social scientists	1,390	0	0	10	10	0	0	0	0	1,190	140	40	
Software engineers	49,100	0	350	13,500	930	160	2,320	1,870	1,820	27,100	820	230	
ENGINEERS	355,410	320	7,540	161,220	19,090	33,980	9,540	19,200	1,380	83,100	16,970	3,070	
Civil, structural, municipal, mining	58,660	50	2,400	2,170	2,580	22,280	300	1,660	50	21,530	5,090	550	
Mechanical engineers	59,860	140	1,890	21,420	3,200	1,990	1,660	3,600	590	19,030	5,220	1,120	
Electrical engineers	29,180	0	510	7,610	5,820	1,820	780	4,860	230	5,250	1,990	310	
Electronic engineers	16,110	10	90	7,810	160	50	1,030	980	50	4,670	1,160	100	
Chemical engineers	3,760	0	400	1,670	250	70	110	10	0	1,120	40	90	
Design and development engineers	64,840	20	480	39,860	1,610	2,480	1,010	2,050	130	16,170	760	270	
Process and production engineers	19,130	10	460	15,720	370	260	310	450	10	1,280	160	100	
Planning and quality control engineers	53,710	20	610	38,690	1,830	2,140	1,940	3,120	130	4,380	610	240	
Other engineers nec	50,160	70	700	26,270	3,270	2,890	2,400	2,470	190	9,670	1,940	290	

GB-3(91)

Table 3. Scientists and Engineers by Industry and Sex, for Great Britain: 1991--Continued*

Occupation	Total	Female										
		Agriculture Forestry & Fish.	Mining & Quarrying	Manufac- turing	Electric Gas & Water	Construc- tion	Wholesale & Retail Trade	Transport & Commun.	Fin. & Insur.	Services	Public Admin.	Inadeq. Defined
TOTAL SCIENTISTS & ENGINEERS	63,940	250	600	14,160	1,440	760	2,410	1,100	1,790	36,310	4,850	270
SCIENTISTS	48,850	220	410	6,350	1,050	70	1,360	520	1,690	32,570	4,410	200
Natural Scientists	32,660	220	380	4,700	760	40	670	90	190	22,900	2,560	150
Chemists	4,180	10	80	2,080	260	10	110	20	0	1,390	220	0
Biological scientists and biochemists	16,510	160	0	1,080	160	10	340	0	0	14,110	560	90
Physicists, geologists and meteorologists	1,780	0	290	140	110	20	30	0	0	940	220	30
Other natural scientists	10,190	50	10	1,400	230	0	190	70	190	6,460	1,560	30
Social Scientists	8,610	0	0	290	80	20	150	120	840	5,440	1,620	50
Actuaries, economists and statisticians	3,640	0	0	270	80	10	150	100	830	1,700	460	40
Psychologists	3,990	0	0	20	0	0	0	10	10	2,890	1,060	0
Other social scientists	980	0	0	0	0	10	0	10	0	850	100	10
Software engineers	7,580	0	30	1,360	210	10	540	310	660	4,230	230	0
ENGINEERS	15,090	30	190	7,810	390	690	1,050	580	100	3,740	440	70
Civil, structural, municipal, mining	1,270	0	10	30	60	440	10	20	0	650	50	0
Mechanical engineers	1,660	0	0	650	20	30	40	50	10	780	70	10
Electrical engineers	470	0	0	160	70	10	10	80	10	100	30	0
Electronic engineers	440	0	10	190	0	0	50	30	0	140	20	0
Chemical engineers	280	0	30	90	40	10	0	0	0	100	0	10
Design and development engineers	1,550	0	10	870	20	60	30	60	10	460	10	20
Process and production engineers	670	0	40	490	0	20	10	20	0	90	0	0
Planning and quality control engineers	4,770	0	50	3,410	30	80	390	230	30	510	40	0
Other engineers nec	3,980	30	40	1,920	150	40	510	90	40	910	220	30

* Excludes data from Northern Ireland.

Source:

Special tabulation based upon the 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

GB-4(91)

Table 4. Scientists and Engineers by Manufacturing Industry and Sex, for Great Britain: 1991*

Occupation	Total	Both Sexes									
		Food & Beverages	Textiles & Leather	Wood & Furn.	Paper & Printing	Chemicals & Plastics	Non-metal Minerals	Basic Metals	Electric, Electronic Products	Other Metal Products	Other Manufacturing
TOTAL SCIENTISTS & ENGINEERS	207,500	8,810	2,870	1,560	3,790	29,870	3,630	4,810	47,840	103,000	1,320
SCIENTISTS	38,470	2,200	270	120	860	15,560	620	950	5,930	11,430	530
Natural Scientists	22,750	1,900	190	80	460	14,640	550	700	950	2,770	510
Chemists	13,920	870	160	30	350	9,640	320	360	450	1,280	460
Biological scientists and biochemists	2,600	680	0	0	20	1,700	30	10	30	120	10
Physicists, geologists and meteorologists	1,060	0	0	0	10	120	60	40	200	610	20
Other natural scientists	5,170	350	30	50	80	3,180	140	290	270	760	20
Social Scientists	860	80	10	0	70	350	10	50	40	250	0
Actuaries, economists and statisticians	830	80	10	0	70	350	10	50	40	220	0
Psychologists	20	0	0	0	0	0	0	0	0	20	0
Other social scientists	10	0	0	0	0	0	0	0	0	10	0
Software engineers	14,860	220	70	40	330	570	60	200	4,940	8,410	20
ENGINEERS	169,030	6,610	2,600	1,440	2,930	14,310	3,010	3,860	41,910	91,570	790
Civil, structural, municipal, mining	2,200	10	20	20	10	170	90	30	110	1,720	20
Mechanical engineers	22,070	550	240	110	460	1,060	270	370	3,550	15,370	90
Electrical engineers	7,770	230	20	20	120	450	60	220	3,400	3,240	10
Electronic engineers	8,000	50	0	20	80	100	20	40	4,790	2,890	10
Chemical engineers	1,760	20	20	20	20	1,080	40	20	40	500	0
Design and development engineers	40,730	190	180	270	270	1,540	550	600	13,240	23,740	150
Process and production engineers	16,210	340	120	180	250	1,380	340	300	3,900	9,300	100
Planning and quality control engineers	42,100	2,540	1,380	620	1,330	4,800	770	1,060	8,700	20,650	250
Other engineers nec	28,190	2,680	620	180	390	3,730	870	1,220	4,180	14,160	160

Table 4. Scientists and Engineers by Manufacturing Industry and Sex, for Great Britain: 1991--Continued*

Occupation	Total	Male									
		Food & Beverages	Textiles & Leather	Wood & Furn.	Paper & Printing	Chemicals & Plastics	Non-metal Minerals	Basic Metals	Electric, Electronic Products	Other Metal Products	Other Manufacturing
TOTAL SCIENTISTS & ENGINEERS	193,340	6,930	2,200	1,500	3,350	25,050	3,390	4,580	45,840	99,360	1,140
SCIENTISTS	32,120	1,530	230	110	690	12,000	560	860	5,400	10,350	390
Natural Scientists	18,050	1,350	170	70	370	11,310	500	640	840	2,430	370
Chemists	11,840	690	140	30	310	8,170	320	310	410	1,110	350
Biological scientists and biochemists	1,520	430	0	0	20	950	0	0	30	90	0
Physicists, geologists and meteorologists	920	0	0	0	10	90	60	40	160	560	0
Other natural scientists	3,770	230	30	40	30	2,100	120	290	240	670	20
Social Scientists	570	40	10	0	50	240	10	30	30	160	0
Actuaries, economists and statisticians	560	40	10	0	50	240	10	30	30	150	0
Psychologists	0	0	0	0	0	0	0	0	0	0	0
Other social scientists	10	0	0	0	0	0	0	0	0	10	0
Software engineers	13,500	140	50	40	270	450	50	190	4,530	7,760	20
ENGINEERS	161,220	5,400	1,970	1,390	2,660	13,050	2,830	3,720	40,440	89,010	750
Civil, structural, municipal, mining	2,170	0	20	20	10	170	90	30	110	1,700	20
Mechanical engineers	21,420	550	210	100	460	1,050	270	350	3,460	14,880	90
Electrical engineers	7,610	230	20	20	120	450	60	220	3,300	3,180	10
Electronic engineers	7,810	50	0	20	80	100	10	40	4,660	2,840	10
Chemical engineers	1,670	20	20	20	20	1,030	40	20	30	470	0
Design and development engineers	39,860	180	180	260	270	1,500	540	600	12,940	23,240	150
Process and production engineers	15,720	320	110	180	230	1,270	340	280	3,760	9,130	100
Planning and quality control engineers	38,690	1,980	1,030	590	1,100	4,120	700	1,000	8,150	19,790	230
Other engineers nec	26,270	2,070	380	180	370	3,360	780	1,180	4,030	13,780	140

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Table 4. Scientists and Engineers by Manufacturing Industry and Sex, for Great Britain: 1991--Continued*

Occupation	Total	Food & Beverages	Textiles & Leather	Wood & Furn.	Paper & Printing	Chemicals & Plastics	Non-metal Minerals	Basic Metals	Electric, Electronic Products	Other Metal Products	Female	
											Other Metal Products	Other Manufacturing
TOTAL SCIENTISTS & ENGINEERS	14,160	1,880	670	60	440	4,820	240	230	2,000	3,640	180	
SCIENTISTS	6,350	670	40	10	170	3,560	60	90	530	1,080	140	
Natural Scientists	4,700	550	20	10	90	3,330	50	60	110	340	140	
Chemists	2,080	180	20	0	40	1,470	0	50	40	170	110	
Biological scientists and biochemists	1,080	250	0	0	0	750	30	10	0	30	10	
Physicists, geologists and meteorologists	140	0	0	0	0	30	0	0	40	50	20	
Other natural scientists	1,400	120	0	10	50	1,080	20	0	30	90	0	
Social Scientists	290	40	0	0	20	110	0	20	10	90	0	
Actuaries, economists and statisticians	270	40	0	0	20	110	0	20	10	70	0	
Psychologists	20	0	0	0	0	0	0	0	0	20	0	
Other social scientists	0	0	0	0	0	0	0	0	0	0	0	
Software engineers	1,360	80	20	0	60	120	10	10	410	650	0	
ENGINEERS	7,810	1,210	630	50	270	1,260	180	140	1,470	2,560	40	
Civil, structural, municipal, mining	30	10	0	0	0	0	0	0	0	20	0	
Mechanical engineers	650	0	30	10	0	10	0	20	90	490	0	
Electrical engineers	160	0	0	0	0	0	0	0	100	60	0	
Electronic engineers	190	0	0	0	0	0	10	0	130	50	0	
Chemical engineers	90	0	0	0	0	50	0	0	10	30	0	
Design and development engineers	870	10	0	10	0	40	10	0	300	500	0	
Process and production engineers	490	20	10	0	20	110	0	20	140	170	0	
Planning and quality control engineers	3,410	560	350	30	230	680	70	60	550	860	20	
Other engineers nec	1,920	610	240	0	20	370	90	40	150	380	20	

* Excludes data from Northern Ireland.

Source:

Special tabulation based upon the 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

GB-5(91)

Table 5. Scientists and Engineers by Service Industry and Sex, for Great Britain: 1991*

Both
Sexes

Occupation	Total	Business Services	Social, Community Services	Recreational, Cultural Services	Personal Services
TOTAL SCIENTISTS & ENGINEERS	195,750	114,480	75,820	4,630	820
SCIENTISTS	108,910	44,370	61,890	1,930	720
Natural Scientists	64,730	8,940	54,620	1,120	50
Chemists	7,550	1,840	5,690	20	0
Biological scientists and biochemists	30,300	2,030	27,600	640	30
Physicists, geologists and meteorologists	7,180	2,520	4,580	80	0
Other natural scientists	19,700	2,550	16,750	380	20
Social Scientists	12,850	5,600	5,980	600	670
Actuaries, economists and statisticians	6,090	4,720	1,340	30	0
Psychologists	4,720	410	4,260	10	40
Other social scientists	2,040	470	380	560	630
Software engineers	31,330	29,830	1,290	210	0
ENGINEERS	86,840	70,110	13,930	2,700	100
Civil, structural, municipal, mining	22,180	20,270	1,800	100	10
Mechanical engineers	19,810	15,960	3,540	290	20
Electrical engineers	5,350	3,650	1,230	450	20
Electronic engineers	4,810	2,220	1,380	1,200	10
Chemical engineers	1,220	840	380	0	0
Design and development engineers	16,630	14,740	1,740	150	0
Process and production engineers	1,370	1,100	190	70	10
Planning and quality control engineers	4,890	3,890	900	80	20
Other engineers nec	10,580	7,440	2,770	360	10

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Table 5. Scientists and Engineers by Service Industry and Sex, for Great Britain: 1991--Continued* Male

Occupation	Total	Business Services	Social, Community Services	Recreational, Cultural Services	Personal Services
TOTAL SCIENTISTS & ENGINEERS	159,440	104,320	50,710	3,940	470
SCIENTISTS	76,340	36,660	37,930	1,360	390
Natural Scientists	41,830	6,750	34,230	810	40
Chemists	6,160	1,590	4,550	20	0
Biological scientists and biochemists	16,190	1,450	14,210	500	30
Physicists, geologists and meteorologists	6,240	2,240	3,920	80	0
Other natural scientists	13,240	1,470	11,550	210	10
Social Scientists	7,410	4,120	2,600	340	350
Actuaries, economists and statisticians	4,390	3,620	760	10	0
Psychologists	1,830	210	1,620	0	0
Other social scientists	1,190	290	220	330	350
Software engineers	27,100	25,790	1,100	210	0
ENGINEERS	83,100	67,660	12,780	2,580	80
Civil, structural, municipal, mining	21,530	19,650	1,770	100	10
Mechanical engineers	19,030	15,460	3,280	270	20
Electrical engineers	5,250	3,600	1,190	440	20
Electronic engineers	4,670	2,170	1,340	1,150	10
Chemical engineers	1,120	790	330	0	0
Design and development engineers	16,170	14,330	1,700	140	0
Process and production engineers	1,280	1,040	170	60	10
Planning and quality control engineers	4,380	3,740	570	70	0
Other engineers nec	9,670	6,880	2,430	350	10

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Table 5. Scientists and Engineers by Service Industry and Sex, for Great Britain: 1991--Continued* Female

Occupation	Total	Business Services	Social, Community Services	Recreational, Cultural Services	Personal Services
TOTAL SCIENTISTS & ENGINEERS	36,310	10,160	25,110	690	350
SCIENTISTS	32,570	7,710	23,960	570	330
Natural Scientists	22,900	2,190	20,390	310	10
Chemists	1,390	250	1,140	0	0
Biological scientists and biochemists	14,110	580	13,390	140	0
Physicists, geologists and meteorologists	940	280	660	0	0
Other natural scientists	6,460	1,080	5,200	170	10
Social Scientists	5,440	1,480	3,380	260	320
Actuarial, economists and statisticians	1,700	1,100	580	20	0
Psychologists	2,890	200	2,640	10	40
Other social scientists	850	180	160	230	280
Software engineers	4,230	4,040	190	0	0
ENGINEERS	3,740	2,450	1,150	120	20
Civil, structural, municipal, mining	650	620	30	0	0
Mechanical engineers	780	500	260	20	0
Electrical engineers	100	50	40	10	0
Electronic engineers	140	50	40	50	0
Chemical engineers	100	50	50	0	0
Design and development engineers	460	410	40	10	0
Process and production engineers	90	60	20	10	0
Planning and quality control engineers	510	150	330	10	20
Other engineers nec	910	560	340	10	0

* Excludes data from Northern Ireland.

Source:

Special tabulation based upon the 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

GB-6(91)

Table 6. Scientists and Engineers by Educational Attainment and Sex,
for Great Britain: 1991*Both
Sexes

Occupation	Total	Masters or Doctorate	Bachelors Degree	High School or Vocational Degree	Other
TOTAL SCIENTISTS & ENGINEERS	561,710	65,040	209,720	134,960	151,990
SCIENTISTS	191,210	45,310	82,420	33,190	30,290
Natural Scientists	111,730	32,170	40,740	23,320	15,500
Chemists	25,430	5,830	9,390	5,440	4,770
Biological scientists and biochemists	38,360	8,140	11,970	13,080	5,170
Physicists, geologists and meteorologists	14,040	6,040	5,860	770	1,370
Other natural scientists	33,900	12,160	13,520	4,030	4,190
Social Scientists	22,800	7,280	11,030	820	3,670
Actuaries, economists and statisticians	13,640	2,490	7,310	700	3,140
Psychologists	6,790	4,110	2,570	30	80
Other social scientists	2,370	680	1,150	90	450
Software engineers	56,680	5,860	30,650	9,050	11,120
ENGINEERS	370,500	19,730	127,300	101,770	121,700
Civil, structural, municipal, mining	59,930	3,420	30,610	9,720	16,180
Mechanical engineers	61,520	4,670	24,440	19,160	13,250
Electrical engineers	29,650	1,230	9,590	12,160	6,670
Electronic engineers	16,550	1,250	7,200	5,820	2,280
Chemical engineers	4,040	680	2,230	310	820
Design and development engineers	66,390	3,150	21,500	21,120	20,620
Process and production engineers	19,800	720	4,110	5,340	9,630
Planning and quality control engineers	58,480	1,580	10,710	14,110	32,080
Other engineers nec	54,140	3,030	16,910	14,030	20,170

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Table 6. Scientists and Engineers by Educational Attainment and Sex,
for Great Britain: 1991--Continued*

Occupation	Total	Male			
		Masters or Doctorate	Bachelors Degree	High School or Vocational Degree	Other
TOTAL SCIENTISTS & ENGINEERS	497,770	53,470	183,600	122,050	138,650
SCIENTISTS	142,360	34,800	62,220	22,810	22,530
Natural Scientists	79,070	25,670	28,440	14,150	10,810
Chemists	21,250	5,180	7,620	4,500	3,950
Biological scientists and biochemists	21,850	5,830	6,770	6,130	3,120
Physicists, geologists and meteorologists	12,260	5,410	4,970	680	1,200
Other natural scientists	23,710	9,250	9,080	2,840	2,540
Social Scientists	14,190	4,040	7,190	590	2,370
Actuaries, economists and statisticians	10,000	1,870	5,580	530	2,020
Psychologists	2,800	1,790	950	10	50
Other social scientists	1,390	380	660	50	300
Software engineers	49,100	5,090	26,590	8,070	9,350
ENGINEERS	355,410	18,670	121,380	99,240	116,120
Civil, structural, municipal, mining	58,660	3,260	29,940	9,630	15,830
Mechanical engineers	59,860	4,460	23,600	18,920	12,880
Electrical engineers	29,180	1,190	9,370	12,060	6,560
Electronic engineers	16,110	1,230	6,980	5,690	2,210
Chemical engineers	3,760	630	2,040	290	800
Design and development engineers	64,840	3,070	20,860	20,750	20,160
Process and production engineers	19,130	650	3,810	5,280	9,390
Planning and quality control engineers	53,710	1,380	9,650	13,300	29,380
Other engineers nec	50,160	2,800	15,130	13,320	18,910

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Table 6. Scientists and Engineers by Educational Attainment and Sex,
for Great Britain: 1991--Continued*

Occupation	Total	Female			
		Masters or Doctorate	Bachelors Degree	High School or Vocational Degree	Other
TOTAL SCIENTISTS & ENGINEERS	63,940	11,570	26,120	12,910	13,340
SCIENTISTS	48,850	10,510	20,200	10,380	7,760
Natural Scientists	32,660	6,500	12,300	9,170	4,690
Chemists	4,180	650	1,770	940	820
Biological scientists and biochemists	16,510	2,310	5,200	6,950	2,050
Physicists, geologists and meteorologists	1,780	630	890	90	170
Other natural scientists	10,190	2,910	4,440	1,190	1,650
Social Scientists	8,610	3,240	3,840	230	1,300
Actuaries, economists and statisticians	3,640	620	1,730	170	1,120
Psychologists	3,990	2,320	1,620	20	30
Other social scientists	980	300	490	40	150
Software engineers	7,580	770	4,060	980	1,770
ENGINEERS	15,090	1,060	5,920	2,530	5,580
Civil, structural, municipal, mining	1,270	160	670	90	350
Mechanical engineers	1,660	210	840	240	370
Electrical engineers	470	40	220	100	110
Electronic engineers	440	20	220	130	70
Chemical engineers	280	50	190	20	20
Design and development engineers	1,550	80	640	370	460
Process and production engineers	670	70	300	60	240
Planning and quality control engineers	4,770	200	1,060	810	2,700
Other engineers nec	3,980	230	1,780	710	1,260

* Excludes data from Northern Ireland.

Source:

Special tabulation based upon the 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

GB-7(91)

Table 7. Scientists and Engineers by Field of Study, for Great Britain: 1991*

Both
Sexes

Occupation	Total	Educational	Health, Medicine and Dentistry	Tech. and Engineering	Agric., Forestry and Vet. Services	Science (inc. Math and App. Sciences)	Social, Admin., and Bus. Studies	Vocational (inc. Archi. and other prof. stud.)	Language (Lit. & Area Stud.)	Arts (other than Lang. and Perf. Arts)	Music, Drama, and Visual Arts	Not Stated
Total**	409,720	4,310	18,830	229,100	4,150	110,620	33,150	2,760	1,480	3,390	1,000	930
SCIENTISTS	160,920	3,140	17,800	23,610	3,810	87,610	19,410	1,350	1,250	2,420	230	290
Natural Scientists	96,230	1,040	17,230	9,250	3,550	58,990	4,150	620	460	660	60	220
Chemists	20,660	110	820	1,640	120	17,540	350	30	0	20	0	30
Biological scientists and biochemists	33,190	360	13,350	750	2,840	14,690	760	60	40	250	10	80
Physicists, geologists and meteorologists	12,670	130	300	1,820	20	10,080	210	20	20	40	10	20
Other natural scientists	29,710	440	2,760	5,040	570	16,680	2,830	510	400	350	40	90
Social Scientists	19,130	1,070	330	410	120	3,890	10,990	450	370	1,410	60	30
Actuaries, Economists and statisticians	10,500	180	160	330	120	3,690	5,240	370	220	130	40	20
Psychologists	6,710	830	160	50	0	80	5,480	10	40	50	0	10
Other social scientists	1,920	60	10	30	0	120	270	70	110	1,230	20	0
Software engineers	45,560	1,030	240	13,950	140	24,730	4,270	280	420	350	110	40
ENGINEERS	248,800	1,170	1,030	205,490	340	23,010	13,740	1,410	230	970	770	640
Civil, structural, municipal, mining	43,750	120	60	41,140	70	970	930	280	0	100	40	40
Mechanical engineers	48,270	220	90	40,230	20	4,740	2,160	350	30	210	90	130
Electrical engineers	22,980	50	0	21,300	10	890	580	40	0	90	0	20
Electronic engineers	14,270	20	20	12,660	0	1,270	190	20	0	30	20	40
Chemical engineers	3,220	20	20	2,600	0	470	100	0	0	0	0	10
Design and development engineers	45,770	270	110	38,950	30	4,620	920	90	30	140	370	240
Process and production engineers	10,170	40	10	8,610	10	720	700	0	0	0	40	40
Planning and quality control engineers	26,400	230	410	14,780	80	4,140	5,960	350	110	220	60	60
Other engineers nec	33,970	200	310	25,220	120	5,190	2,200	280	60	180	150	60

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Table 7. Scientists and Engineers by Field of Study, for Great Britain: 1991--Continued*

Occupation	Total	Education	Health, Medicine and Dentistry	Tech. Engineering	Agric., Forestry and Vet. Services	Science (inc. Math and App. Sciences)	Social, Admin., and Bus. Studies	Vocational (inc. Arch. and other prof. stud.)	Lang.-uage (Lit. & Area Stud.)	Arts (other than Lang. and Perf. Arts)	Music, Drama, and Visual Arts	Not Stated
Total**	359,120	2,620	9,730	222,580	3,350	88,960	25,170	1,950	740	2,460	770	790
SCIENTISTS	119,830	1,690	9,060	22,080	3,060	68,190	12,450	830	590	1,570	150	160
Natural Scientists	68,260	490	8,790	8,370	2,830	44,360	2,420	250	160	440	40	110
Chemists	17,300	60	570	1,510	110	14,700	280	20	0	20	0	30
Biological scientists and biochemists	18,730	150	6,520	550	2,350	8,340	500	40	30	200	10	40
Physicists, geologists and meteorologists	11,060	90	230	1,720	20	8,760	160	10	10	30	10	20
Other natural scientists	21,170	190	1,470	4,590	350	12,560	1,480	180	120	190	20	20
Social Scientists	11,820	440	130	380	110	2,760	6,540	360	190	840	50	20
Actuaries, Economists and statisticians	7,980	110	60	320	110	2,630	4,190	310	100	110	30	10
Psychologists	2,750	310	70	30	0	40	2,210	10	30	40	0	10
Other social scientists	1,090	20	0	30	0	90	140	40	60	690	20	0
Software engineers	39,750	760	140	13,330	120	21,070	3,490	220	240	290	60	30
ENGINEERS	239,290	930	670	200,500	290	20,770	12,720	1,120	150	890	620	630
Civil, structural, municipal, mining	42,830	100	50	40,310	70	960	890	280	0	90	40	40
Mechanical engineers	46,980	190	70	39,530	20	4,380	2,010	340	20	210	80	130
Electrical engineers	22,620	50	0	21,010	10	830	570	40	0	90	0	20
Electronic engineers	13,900	20	20	12,340	0	1,230	190	10	0	30	20	40
Chemical engineers	2,960	20	20	2,390	0	430	90	0	0	0	0	10
Design and development engineers	44,680	210	100	38,290	30	4,370	880	80	20	130	330	240
Process and production engineers	9,740	30	10	8,290	10	630	700	0	0	0	30	40
Planning and quality control engineers	24,330	150	210	14,240	50	3,660	5,400	230	80	190	60	60
Other engineers nec	31,250	160	190	24,100	100	4,280	1,990	140	30	150	60	50

Male

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Table 7. Scientists and Engineers by Field of Study, for Great Britain: 1991--Continued*

Occupation	Total	Educ- ation	Health, Medicine and Dentistry	Tech. and Engin- eer- ing	Agric., Forestry and Vet. Services	Science (inc. Math and App. Sciences)	Social, Admin., and Bus. Studies	Vocational (inc. Archi. and other prof. stud.)	Lang- uage (Lit. & Area Stud.)	Arts (other than Lang. and Perf. Arts)	Music, Drama, and Visual Arts	Not Stated
Total**	50,600	1,690	9,100	6,520	800	21,660	7,980	810	740	930	230	140
SCIENTISTS	41,090	1,450	8,740	1,530	750	19,420	6,960	520	660	850	80	130
Natural Scientists	27,970	550	8,440	880	720	14,630	1,730	370	300	220	20	110
Chemists	3,360	50	250	130	10	2,840	70	10	0	0	0	0
Biological scientists and biochemists	14,460	210	6,830	200	490	6,350	260	20	10	50	0	40
Physicists, geologists and meteorologists	1,610	40	70	100	0	1,320	50	10	10	10	0	0
Other natural scientists	8,540	250	1,290	450	220	4,120	1,350	330	280	160	20	70
Social Scientists	7,310	630	200	30	10	1,130	4,450	90	180	570	10	10
Actuaries, Economists and statisticians	2,520	70	100	10	10	1,060	1,050	60	120	20	10	10
Psychologists	3,960	520	90	20	0	40	3,270	0	10	10	0	0
Other social scientists	830	40	10	0	0	30	130	30	50	540	0	0
Software engineers	5,810	270	100	620	20	3,660	780	60	180	60	50	10
ENGINEERS	9,510	240	360	4,990	50	2,240	1,020	290	80	80	150	10
Civil, structural, municipal, mining	920	20	10	830	0	10	40	0	0	10	0	0
Mechanical engineers	1,290	30	20	700	0	360	150	10	10	0	10	0
Electrical engineers	360	0	0	290	0	60	10	0	0	0	0	0
Electronic engineers	370	0	0	320	0	40	0	10	0	0	0	0
Chemical engineers	260	0	0	210	0	40	10	0	0	0	0	0
Design and development engineers	1,090	60	10	660	0	250	40	10	10	10	40	0
Process and production engineers	430	10	0	320	0	90	0	0	0	0	10	0
Planning and quality control engineers	2,070	80	200	540	30	480	560	120	30	30	0	0
Other engineers nec	2,720	40	120	1,120	20	910	210	140	30	30	90	10

* Excludes data from Northern Ireland.

** Totals refer to scientists and engineers with a High School or Vocational Degree, or higher.

Source:

Special tabulation based upon the 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

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Table 8. Scientists and Engineers by Field of Study and Educational Attainment, for Great Britain: 1991*

Field of Study	Sexes			
	Total	Masters or Doctorate	Bachelors Degree	High School or Vocational Degree
Total	409,720	65,040	209,720	134,960
Education	4,310	780	2,720	810
Health, Medicine and Dentistry	18,830	4,260	3,270	11,300
Technology and Engineering	229,100	17,290	119,860	91,950
Agriculture, Forestry and Veterinary Studies	4,150	1,150	2,080	920
Science (inc. Mathematics and Applied Sciences)	110,620	31,470	61,030	18,120
Social, Administrative and Business Studies	33,150	7,730	15,290	10,130
Vocational (inc. Architecture and Professional Studies)	2,760	880	1,240	640
Language (Literature and Area Studies)	1,480	240	1,220	20
Arts (other than Language and Performing Arts)	3,390	920	2,410	60
Music, Drama and Visual Arts	1,000	170	450	380
Not Stated	930	150	150	630

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Table 8. Scientists and Engineers by Field of Study and Educational Attainment, for Great Britain: 1991--Continued*

Field of Study	Male			
	Total	Masters or Doctorate	Bachelors Degree	High School or Vocational Degree
Total	359,120	53,470	183,600	122,050
Education	2,620	370	1,680	570
Health, Medicine and Dentistry	9,730	2,760	1,810	5,160
Technology and Engineering	222,580	16,230	115,920	90,430
Agriculture, Forestry and Veterinary Studies	3,350	890	1,700	760
Science (inc. Mathematics and Applied Sciences)	88,960	26,650	47,830	14,480
Social, Administrative and Business Studies	25,170	4,840	11,080	9,250
Vocational (inc. Architecture and Professional Studies)	1,950	680	810	460
Language (Literature and Area Studies)	740	140	590	10
Arts (other than Language and Performing Arts)	2,460	640	1,770	50
Music, Drama and Visual Arts	770	150	310	310
Not Stated	790	120	100	570

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Table 8. Scientists and Engineers by Field of Study and Educational Attainment, for Great Britain: 1991--Continued*

Field of Study	Female			
	Total	Masters or Doctorate	Bachelors Degree	High School or Vocational Degree
Total	50,600	11,570	26,120	12,910
Education	1,690	410	1,040	240
Health, Medicine and Dentistry	9,100	1,500	1,460	6,140
Technology and Engineering	6,520	1,060	3,940	1,520
Agriculture, Forestry and Veterinary Studies	800	260	380	160
Science (inc. Mathematics and Applied Sciences)	21,660	4,820	13,200	3,640
Social, Administrative and Business Studies	7,980	2,890	4,210	880
Vocational (inc. Architecture and Professional Studies)	810	200	430	180
Language (Literature and Area Studies)	740	100	630	10
Arts (other than Language and Performing Arts)	930	280	640	10
Music, Drama and Visual Arts	230	20	140	70
Not Stated	140	30	50	60

* Excludes data from Northern Ireland.

Source:

Special tabulation based upon 1991 Population Census (10 percent sample), performed by the British Office of National Statistics.

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