SCIENTISTS AND ENGINEERS IN THE PHILIPPINES: 1990

by

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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 Philippines' National Statistics Office for providing data from the 1990 Population 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. We cannot assure the accuracy of the information in this report since outside data area not subjected to the same statistical reviews the Bureau performs on its own data.

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INTRODUCTION

This report presents statistics on scientists and engineers in the Philippines based upon the 1990 population census. Scientists and engineers are a small share of the Philippines' working-age population compared with other countries in this series.[3] In 1990, the Philippines had approximately four S/E per 1,000 members of its economically active population (Figure 1).[4] This low level is due, in part, to the limited support for research, as well as to the large share of scientists and engineers who do not return to the Philippines after studying abroad. Many government officials and academicians in the Philippines view this shortage of scientists and engineers as a barrier to economic growth, and have proposed a number of measures to redress this problem.

Appendix tables provide detailed information upon which the graphic presentation is based. Users wishing to compare data in this report with those of other countries should consult the list of IPC Staff Papers in the back of this report. The most recently published report of this series is "Scientists and Engineers in Taiwan: 1990."

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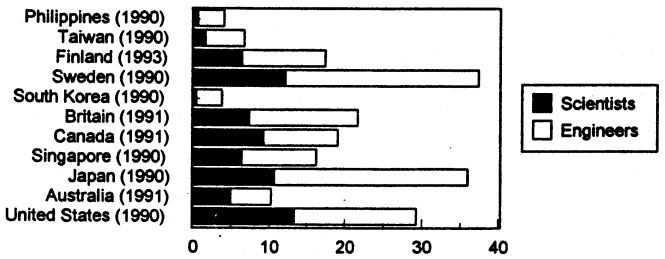
[3]The distribution curve of scientists and engineers' share of these countries economically active population is normally distributed. In a random sample of countries at all levels of development, this would suggest that the data set is representative of countries outside the sample. However, most countries in our sample either are developed countries, or like the Philippines, are striving to advance their living standards. Therefore, any assessments drawn in this report, at best, relate to countries in these levels of economic development.

[4]Generally, this refers to the entire population in the working ages, although definitions may vary across countries.

Figure 1. Scientists and Engineers per 1,000 Members of the Economically Active Population*



Per 1,000 in the Economically Active Population

* Working age pop. Differences in ages bet. countries may distort comparisons.
Source: Table PHIL-1(90); Philippine Department of Labor and Employment 1992, p. 12; Zaslow, 1997e, p. 2.

Males occupy most scientist and engineer positions.

Eighty-three percent of scientists and engineers are male (Table PHIL-1(90)). This contrasts sharply with the gender composition of the Philippines' labor force and economically active population, of which males comprised 63 and 50 percent, respectively in 1990 (Philippine Department of Labor and Employment, 1992, p. 12). In each country in this series, males are a higher proportion of S/E than the overall economically active population (Zaslow, 1997e, p. 3). When arranged from low to high, the Philippines have the second largest gap (after Japan) between males' share of S/E and their respective share of the economically active population.

Males' preponderance among science and engineering occupations seems likely to continue, and the slow increase in females' participation in the labor force suggests that any change in the gender distribution of S/E will be gradual. Between 1980 and 1990, females' labor force participation rate rose from approximately 42 to 47 percent (Philippine Department of Labor and Employment, 1992, pp. 11, 12).

Scientists and engineers are concentrated among a few employment categories.

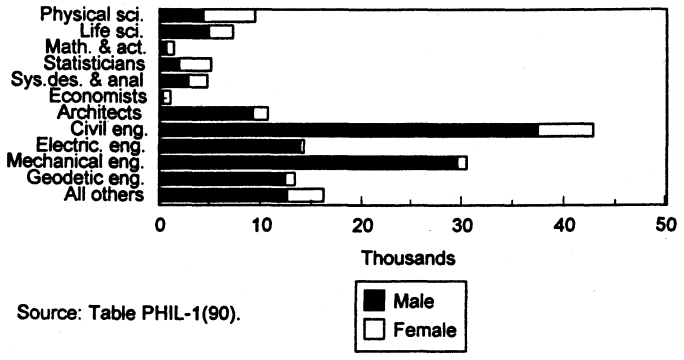
Within the employment category "Scientists and Engineers,"[5] those specializing in the five leading categories (civil engineering, mechanical engineering, electrical engineering, geodetic engineering and related professions, and architecture) are most numerous. These fields, regardless of gender, comprise 71 percent of all S/E (Table PHIL-1(90)). Males account for 92 percent of the 112,036 S/E in these fields. Among males, there are also substantial numbers of chemists and agronomists and related scientists. Among females, civil engineers, chemists, and statisticians are most common.

The overall distribution of scientists and engineers is dispersed more for males than females.[6] While males account for most employment across the different occupations, their majorities are greatest in engineering (Figure 2). Overall, males account for 53 percent of scientists but 90 percent of engineers (Table PHIL-1(90)). Therefore, when considered as shares of each gender, males are skewed towards the engineering professions, while females are skewed towards the science occupations (Figure 3).

[5]See Table PHIL-1(90) for a list of occupations that constitute the category, "scientists and engineers."

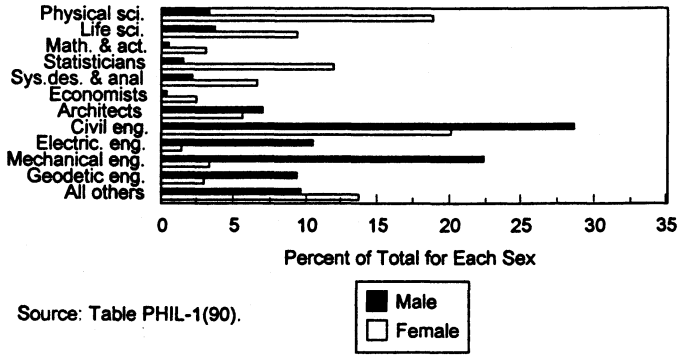
[6]The standard deviation of the occupational categories' distribution for males is 7.6 percent, compared to 5.5 percent for females.

Figure 2. Scientists and Engineers by Specialty and Sex: 1990



Source: Table PHIL-1(90).

Figure 3. Distribution of Scientists and Engineers by Specialty and Sex: 1990



Source: Table PHIL-1(90).

Scientists and engineers are comparatively young.

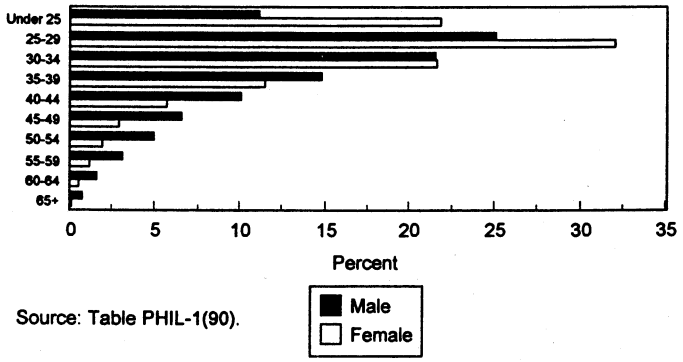
Scientists and engineers in the Philippines are younger than S/E in most other countries in this series. This also is true in relation to the Philippines' labor force. The Philippines has the fourth largest share of younger ages among S/E (after Singapore, South Korea, and Taiwan), with 61 percent of S/E being below age 35 (Table PHIL-1(90)). By contrast, 49 percent of the labor force is below age 35 (Philippine Department of Labor and Employment, 1992, p. 13).[7] The female share of the youngest S/E (under age 25) is far higher than the male (29 versus 11 percent, respectively) (Table PHIL-1(90); and Figure 4). Measured by 5-year age cohorts, the S/E population has a more peaked distribution than does the labor force.[8] Nearly all scientist and engineer occupations have at least half their members under age 35 (Figure 5).

The cost/efficiency implications of having a comparatively young scientist and engineer workforce are mixed. Younger workers can be paid less than older workers and they benefit from education in the latest technological developments, but they lack the specific, job-related knowledge that may characterize more experienced workers. Of the countries in this series, two groups seem to exist in terms of shares of their S/E under age 35. Four of the western Pacific Rim countries (Singapore, South Korea, Taiwan and the Philippines) have high shares of S/E under age 35 (over 60 percent), while the remainder have shares of 50 percent or less. Of the countries whose S/E workforces are concentrated most among the younger ages, growth in GDP per capita between 1981 and 1990 varied greatly (Figure 6).

[7]Measured in 5-year age cohorts, the skew for S/E and the labor force is .83 and .30, respectively.

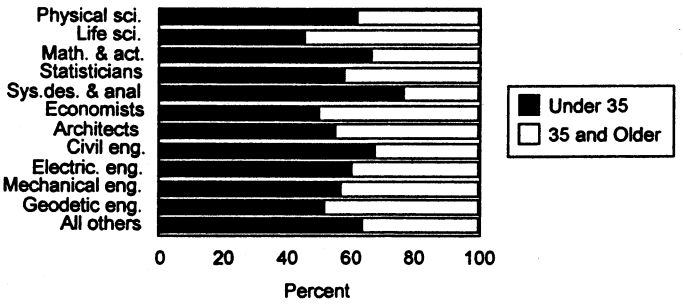
[8]The measure of kurtosis (relative peakedness or flatness of a distribution, compared to a normal, bell-shaped distribution) of the S/E population, by 5-year age cohort is -.35 for S/E, compared to -.70 for the labor force.

Figure 4. Scientists and Engineers by Age and Sex: 1990



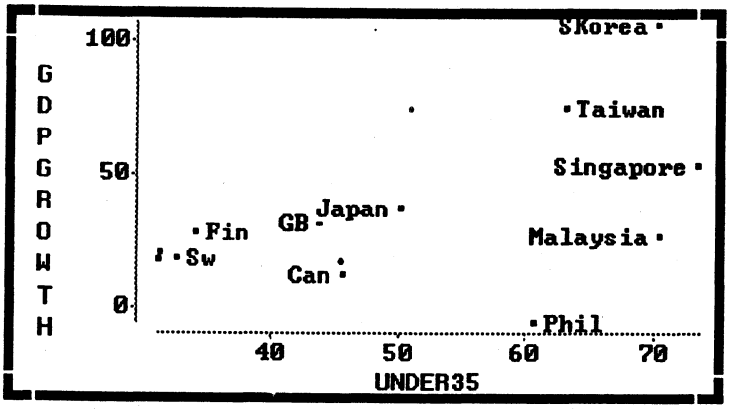
Source: Table PHIL-1(90).

Figure 5. Scientists and Engineers by Age Group: 1990



Source: Table PHIL-1(90).

Figure 6. Percent of S/E Under Age 35 and Real GDP Growth In Percent (1981-90)



Observations for France and FRG (1987) are near that for Sweden.
Observation for Australia near that of Canada.
Source: Penn World Tables and Table PHIL-1(90)

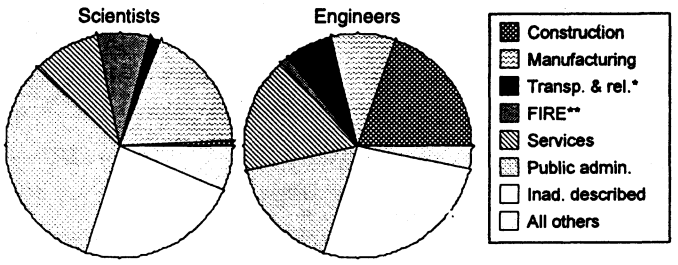
Scientists and engineers are concentrated among a few industries.

Four industry groups (public administration, services, construction, and inadequately described) each employ at least 15 percent of S/E, while 2 other industry groups employ substantial, albeit smaller shares of S/E (Table PHIL-3(90); and Figure 7).[9] This pattern is unusual, as S/E in other countries are concentrated in manufacturing and services. Further, the Philippines is unique among the countries in this series as public administration is the largest sector, let alone a large sector, in terms of employment of S/E.

The Philippines has the lowest share of scientists and engineers in manufacturing in this series (11 percent). This occurs, in part, because the manufacturing sector is insufficiently developed to support the national government's goal of improving living standards by expanding the country's science and technology (S&T) base (Philippine Department of Science and Technology, 1997a, p. 1). Scientists and engineers in other western Pacific Rim countries in this series (South Korea and Taiwan) are concentrated far more heavily in manufacturing (44 and 43 percent, respectively) than are those in the Philippines (Zaslow, 1997c, p. 11; Zaslow, 1997e, p. 9). Initial analysis of data shows that South Korea and Taiwan have higher shares of GDP originating in manufacturing than does the Philippines (Korea, 1996, pp. 490, 491; Taiwan Council, 1996, p. 38; and Philippine National Statistical Coordination Board, 1992, pp. 3-28, 29). Another feature of Philippine manufacturing's slow development is its high dependence upon foreign companies for technological development (Philippine Department of Science and Technology, 1997e, p. 1). This dependence will remain high until the local S/E base reaches critical mass and generates indigenous technological growth.

[9] Two measures which quantify concentration are the Herfindahl-Hirschman Index (H Index) (the concentration of market shares held by particular suppliers) and the coefficient of variation (the standard deviation divided by the mean). The H Indexes for the combined total of scientists and engineers is .17 (there is no threshold for significant concentration). The coefficient of variation is .88.

Figure 7. Scientists and Engineers by Industry: 1990

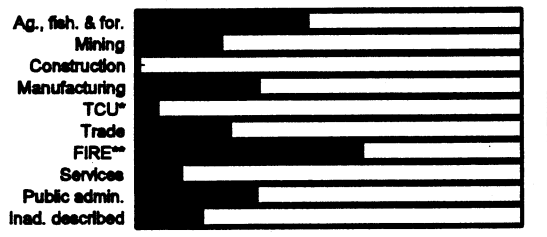


* Transport, communications, and public utilities
** Finance, insurance, and real estate
Source: Table PHIL-3(90).

Engineers outnumber scientists in nearly every economic sector.

With engineers accounting for 81 percent of all S/E, most industries employ more engineers than scientists (Figure 8). Since scientists and engineers study different disciplines and develop different skills, hiring practices probably reflect a matching process based on technical considerations. Construction has the most pronounced preference, with engineers comprising over 99 percent of S/E. By contrast, finance, insurance, and real estate is the only sector in which scientists outnumber engineers (Table PHIL-3(90)). In 1990, nearly half (47 percent) of Philippine S/E were either civil or mechanical engineers. These positions are related to the country's efforts to expand its physical infrastructure, such as highways, energy production and transmission, and communications (particularly in rural areas) (Library of Congress, 1997b, p. 1). In particular, opportunities for scientists and engineers may be most promising in the communications sector, which has become increasingly vibrant in the 1990s due to the deregulation of the telephone industry (Tiglao, 1994, p. 52).

Figure 8. Distribution of Scientists and Engineers Within Industry Groups: 1990



* Transport, communications, and public utilities
** Finance, insurance, and real estate
Source: Table PHIL-3(90).

S/E in the Philippines face many obstacles to improving their country's economy.

Sixty-seven percent of scientists and engineers in manufacturing work in just three sub-sectors (Table PHIL-4(90); and Figure 9). These sub-sectors (food, beverages & tobacco; chemical related products; and transport equipment) each employ similar shares of scientists and engineers (between 21 and 24 percent), while the average share of employment for the other sectors is just 4 percent (Table PHIL-4(90)).[10] Manufacturing's three leading employers of S/E generated 61 percent of manufacturing value added in 1989 (Philippine National Statistical Office, 1995, pp. 567-573).

The Philippine economy has grown neither as fast, nor reached levels of economic activity as high as in other countries in the region (Figure 10), due in part to shortcomings of the country's manufacturing sector.[11] Much of the country's manufacturing sector suffers from low labor productivity. In 1990, small- to medium-sized firms employed 80 percent of all manufacturing workers, producing just 25 percent of manufacturing value added (Library of Congress, 1997e, p. 1).

Goals set by the Philippine Department of Science and Technology highlight the country's technological shortcomings. For the country to be considered a newly industrialized country (NIC),[12] it must:

1) Modernize production sectors through massive technology transfer from domestic and foreign sources;
2) Upgrade research and development (R&D) capability through intensified activities in high priority sectors; and
3) Develop S&T infrastructure, including institution building, manpower development, and development of an S&T culture (Philippine Department of Science and Technology, 1997d, p. 1).

To attract foreign technology and investment, the Philippines tried to remove obstacles stemming from the Marcos period (1965-1986). The government enacted legislation in 1987 and 1991 to spur foreign investment. These laws included guarantees regarding repatriation of profits, as well as tax abatement (Evans, 1993, p. 35). Despite continuing electric power

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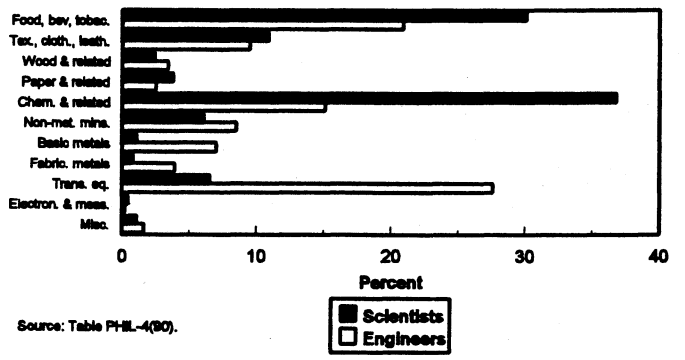
[10]Since there are so many categories with few scientists and engineers, the H Indexes for S/E in manufacturing were .25 and .17, respectively. The coefficients of variation were 1.38 and .96.

[11]The real GDP per worker in the Philippines in 1990 ($4,784) lagged far behind levels reached in Singapore ($24,369), Japan ($22,624), and Taiwan ($18,409). The GDP per worker in Indonesia ($5,024) closely approximated levels in the Philippines (Penn World Tables, 1997).

[12]The attainment of status as a newly industrialized country was a goal set by President Fidel Ramos, upon taking office in 1992 (Asian Institute of Technology, 1997, p. 2).

Figure 9. Distribution of Scientists and Engineers in Manufacturing, by Industry: 1990



shortages [13] and low investment in infrastructure (even though this has been addressed, in terms of allocations of foreign aid), the country is gaining investment from foreign technology firms. In the early 1990s, foreign investment facilitated production of semiconductors, computer hard drives, and related equipment (Wilson, 1996, p. 12; and *Comline Daily News Electronics*, 1997, p. 1).[14] Also, increased investment in the chemical industry is likely to raise productivity (Wood, 1995, p. 37). More generally, the economy and investor confidence were bolstered in the early 1990s by banking reforms which reportedly have reduced the domestic impact of the 1997 regional economic downturn (Richburg, 1998, p. A25).

While the above measures to encourage investment are important, the Philippines' moderate labor costs (relative to regional competitors), high education levels among S/E and the high literacy levels in the country's economic center of Metro Manila seem at least as likely to

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[13] Energy shortages, manifested by brownouts in Metro Manila and in 33 provinces on the Luzon power grid lasting 4 hours per day in 1990, have hampered economic development. Large sums were spent on a nuclear reactor, built on a seismic fault, which the Aquino government would not certify for production (Library of Congress, 1997b, p. 1).

[14] A recent example is a $400 million semiconductor plant to be built in Calamba, 30 miles south of Manila, starting in November 1997 for completion in the first quarter of 1999 for the Dutch firm, Philips Electronics N.V. (*The New York Times*, 1997, p. D22).

spur investment (Library of Congress, 1997a, p. 1). In turn, opportunities for scientists and engineers may improve as the economy becomes increasingly open to foreign trade, particularly if increased foreign trade spurs high technology industries and related research, as has happened in other countries in the region, such as Singapore and South Korea. The measure of "openness" (the value of exports and imports, divided by GDP in current international prices) rose from 45.8 to 62.7 (Penn World Tables, 1997) between 1985 (the last full year of President Marcos' rule) and 1992.[15]

One byproduct of an increasingly open society is the emigration of many current and future S/E. The Philippines is vulnerable to "brain drain" due to limited domestic employment prospects and low salaries for those who do find work. At the same time, the use of the English language makes such skills particularly transferrable to other countries. To counter this outflow, the "Balik Scientist" program was launched to entice Filipino emigres and scientists of Filipino descent to return and remain. However, this program has had negligible success, with only five scientists serving for the limited term of the program (1 year or less) as of early 1995 (Philippine Department of Science and Technology, 1997b, p. 1).

The Philippines have not devoted substantial sums to R&D. The Philippines' share of GDP used for R&D is the smallest of any country in this series (Figure 11). There has been an ongoing debate in the Philippines about strategies to compensate for the country's technological and economic shortcomings. Some advocate the "leapfrog" strategy, whereby a country does not seek to replicate the traditional progression from an economy based on agriculture, to manufacturing, to services.[16] Others, including leaders of the country's S&T ministry, question this strategy, asserting that the Philippines lack the required physical and human capital. Further, countries such as Singapore and Taiwan, which have successfully adopted the leapfrog strategy, faced fewer competitors than exist at present (Philippine Department of Science and Technology, 1997g, p. 1). Finally, the Philippines could be hampered if the Far East economy plunges into recession, following the region's dramatic fluctuations in currency and stock exchanges that began in the last half of 1997 (*The Washington Post*, 1997, p. A1).

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[15]"Openness" probably has more meaning when considered as time series data for a single country, rather than in cross-national comparisons, as factors such as the size of the domestic market and exchange rate fluctuations, affect the role of foreign trade. Also, "openness" combines exports and imports, which may mask restrictions to free trade. In the Philippines, the economy reportedly has become more open due to foreign exchange deregulation, foreign investment and banking liberalization, and tariff and market barrier reduction (U.S. Department of State, 1994, p. 7). Tariff reduction began in 1981, although domestic producers of several key commodities, such as rice, sugar, fruits, and a variety of luxury consumer goods continue to be protected by a 50 percent tariff, while import of goods produced "in sufficient quantity" are banned entirely (Asian Institute of Technology, 1997, p. 4).

[16]The four main steps in a "leapfrog" strategy are to create an educated workforce that can absorb new technology, import advanced technology by encouraging foreign investment, invest in information technology, and not to waste resources on untenable domestic industries (Philippine Department of Science and Technology, 1997c, p. 1).

To compensate for limited R&D spending, the Philippines has established science and technology parks. There are currently three such parks intended to improve interaction between technology firms (Philippine Department of Science and Technology, 1997i, p. 1). However, no information has been provided (even in a database focusing on S&T developments in the Philippines)[17] to indicate that product development has improved due to the clustering of firms.[18]

Many Philippine officials assert that more funding is needed to educate S/E. Just 11 percent of the $15.6 billion in international developmental aid received between 1986 and 1994 was used for social development projects, which include but are not limited to education and health. Most was spent on physical infrastructure. While the country's telecommunications and transport systems need improvement, officials engaged in fostering technological development argue for a more even distribution of developmental resources (Philippine Department of Science and Technology, 1997i, p. 1). Redirecting funds from investment in telecommunications and transport to expanding higher educational opportunities has been recommended, since few S/E have advanced degrees. Some recommend the creation of a S&T university, such as in Hong Kong, to increase the number of S/E graduates (Philippine Department of Science and Technology, 1997f, p. 1).

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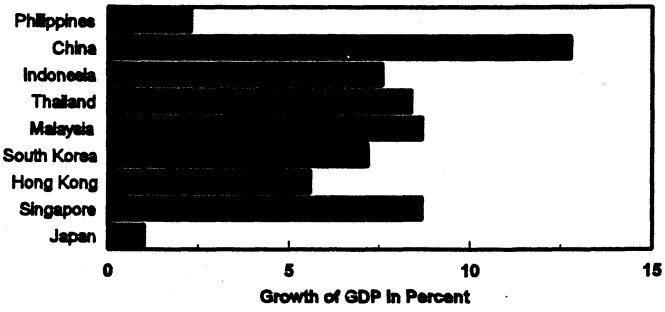
[17]The World Wide Web address for the database is http://www.stii.dost.gov.ph .

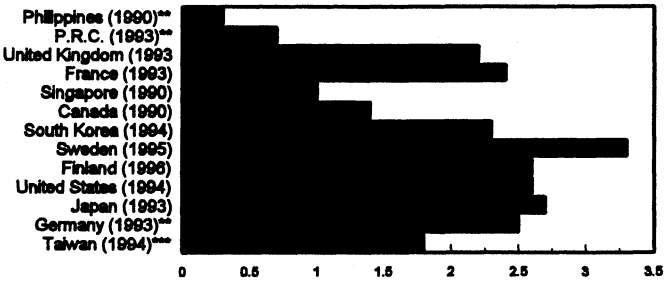
[18]Numerous attempts were made to model the effects of research and development on changes in GDP per capita. The best combination of explanatory variables (in terms of statistical explanatory power) were shares of R&D in GDP, land, growth in capital stock per worker between 1981 and 1990, and labor force growth between 1980 and 1990--yielding an adjusted coefficient of determination (adjusted R-squared) of .44, with no apparent diagnostic problems. However, growth of capital stock seems to be the only explanatory variable that is statistically significant, and the model would be improved by substituting change in R&D's share of GDP for the R&D share in GDP.

Figure 10. Economic Growth Rates in Pacific Rim Countries: 1990-1995



Source: "World Development Report 1997," 1997, pp. 234, 235.

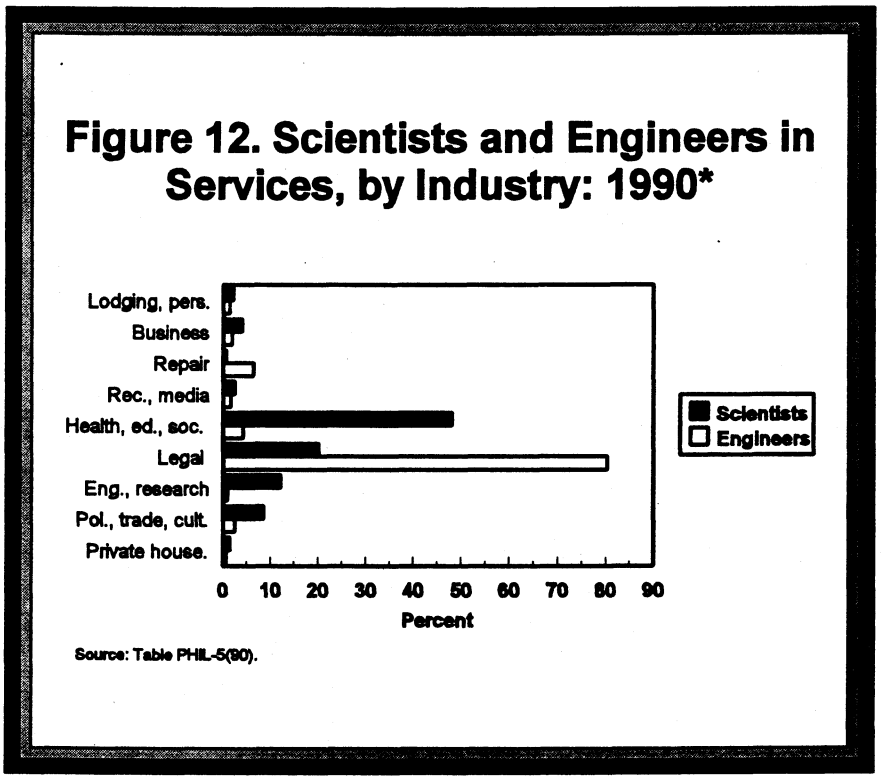
Figure 11. Share of Gross Domestic Product Used for R&D*



* Research and Development; ** Estimate; *** Excl. defense R&D
Source: Phil. Dept. of S&T, 1995, p. 1; Zaslow, 1997a, p. 14.

Service industry S/E are concentrated in legal services.

Seventy-three percent of service industry scientists and engineers provide what are broadly defined as legal services (Table PHIL-5(90); and Figure 12).[19] [20] Smaller shares of S/E work in health, education and social services, and repair services. Sex selection/role modeling seems to materially affect the service sector employing a scientist or engineer. Males are concentrated far more in the broadly defined legal services than are females (as a percentage for each sex), while females outnumber males in engineering and research (Table PHIL-5(90)).



[19] The H Indexes for scientists and engineers are .30 and .65, respectively. Their respective coefficients of variation are 1.15 and 2.34. The substantially larger coefficient for engineers reflects the concentration of 80 percent of engineers in legal services.

[20] The S/E listed in legal services also include those engaged in engineering, architectural and technical services, as well as accounting, auditing, bookkeeping, land surveying, geological and prospecting services, and market research services. Despite the category title, "engineering and research" does not include S/E engaged in engineering.

Most scientists and engineers are college educated but lack advanced degrees.

Scientists and engineers in the Philippines are highly educated. Eighty-one percent of scientists and 83 percent of engineers graduated from college, nearly all with a bachelors' degree (Table PHIL-6(90); and Figure 13). The share of S/E with a 4-year bachelors' degree (82 percent) is the highest among the countries in this series, followed by Singapore's 68 percent (Zaslow, 1996c, p. 25).[21] Females are more likely to graduate from college than males, 87 to 82 percent, respectively. Among less educated S/E, most have attended, but not graduated from college (Table PHIL-6(90)). Scientists and engineers' educational levels far exceed those of the overall Philippine labor force, 12 percent of which graduated from college (Philippine Department of Labor and Employment, 1992, p. 18).[22]

Nevertheless, leading science and technology officials assert that there is insufficient advanced human capital S/E to spur economic development. While data for doctorates among scientists and engineers are not reported in the census, the Philippines had just 948 Ph.D.'s in all disciplines in 1995 (Philippine Department of Science and Technology, 1997f, p. 1). Among S/E, just six-tenths of 1 percent held either a masters or doctorate in 1990 (Table PHIL-6(90)). This near absence of Ph.D.'s is considered by Philippine S&T officials to be an important difference between their own, and developed countries' stock of human capital (Philippine Department of Science and Technology, 1997f, p. 1).[23] However, for the countries in this series, data indicate that no such relationship exists between shares of S/E with graduate degrees (above the bachelors level) and levels of GDP per capita in 1990 (particularly since the Philippines has the highest share of S/E with graduate degrees of all countries in this series and the lowest GDP per capita).

In addition, the presence of doctorates in the sciences and engineering is not highly correlated to rates of economic development, at least for the United States and Japan in recent years. For instance, the number of new S/E doctorates was nearly unchanged from the mid-1970s to the early 1990s in Japan (at well below U.S. per-capita levels). By contrast, the number of S/E doctorates in the U.S. rose more dramatically, but the U.S. economy grew slower than that of Japan for most of that period (National Science Board, 1996, p. 2-21; and World Bank, 1997, p. 235). Nevertheless, Japanese and South Korean officials recently have expanded graduate study in the belief that increased graduate study by S/E will increase their countries' role in developing advanced technology (National Science Board, 1996, pp. 2-20, 21).

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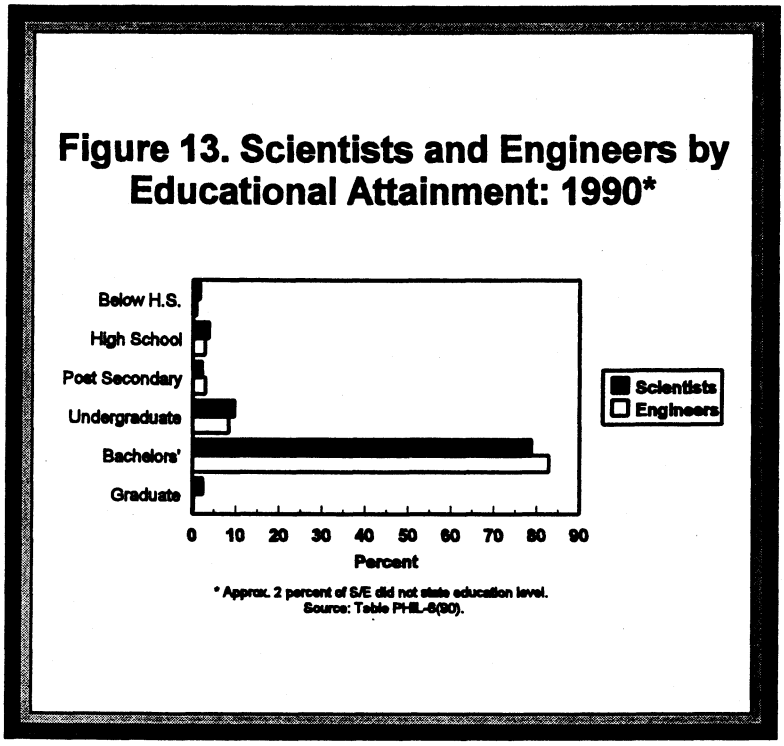
[21]International comparisons should take note that the Philippine elementary and secondary school system only encompasses 10 years of schooling, compared to 12 years in the United States and many other countries (Philippine Department of Science and Technology, 1997b, p. 1).

[22]In 1990, there were 2,071 colleges and universities in the Philippines (Philippine National Statistical Coordination Board, 1992, pp. 10-4, 5).

[23]No discussion has been revealed regarding the perceived impact of masters' level S&E on economic development.



The Philippines' high level of S/E with a bachelors' degree has not generated a corresponding degree of economic growth, in part, because the country lacks the facilities to take advantage of highly educated workers (Rosenzweig, 1996, p. 22; and Philippine Department of Science and Technology, 1997j, p. 1). Many highly educated individuals cannot find work commensurate with their qualifications (Library of Congress, 1997a, p. 2). Many work abroad, often in menial positions, but earn far more than those in similar jobs in the Philippines (Wingrove, 1994, p. 4).[24] This diminishes the contribution of well-educated Filipinos in general, and scientists and engineers in particular, to the domestic economy.[25]

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[24]For instance, in FY 1988-1990, over 26,000 "professionals," many in the health fields, emigrated to the United States, in addition to individuals who changed their visa status while already in the United States. Also, there are over 30,000 Filipinos, including college graduates, working in menial jobs in Hong Kong (Kanjanapan, 1995, pp. 12, 16; and Wingrove, 1994, p. 4). And in regards to international comparisons of labor costs, the general manager of Intel Philippines (admittedly not an impartial observer) estimated that engineers' salaries are less than one-third of what a comparably skilled engineer would earn in the United States, and half that of an engineer in Malaysia (Wilson, 1996, p. 13). The relatively lower wages than Malaysia is significant, as four Asian countries that are said to have low wages in technological assembly work are Indonesia, Malaysia, the Philippines, and Thailand (DeSilver, 1996, p. 2).

[25]Further evidence against the purported connection between higher education (at least among S/E in the countries in this series) and economic development is suggested by a model relating shares of S/E with a bachelors or higher degree (and other explanatory variables), and growth in GDP per capita. The regression of GDP per capita (1990) on the share of S/E with a bachelors or higher degree, land, growth in capital stock per worker between 1981 and 1990, growth of the labor force between 1980 and 1990, and growth in investment's share of GDP between 1981 and 1990

Similar to graduate study, vocational education is less important in the Philippines than in other countries in this series. Less than 3 percent of scientists and engineers in the Philippines report post-secondary education (which would include vocational school and junior college) as their highest level of education (Table PHIL-6(90)). Many Filipinos reportedly disdain vocational training, associating it with manual labor. This may be due to a belief that many students lack basic skills, as indicated by studies showing that many students have deficient reading, math and language ability. Yet by the late 1980s, vocational training was slated for expansion (Library of Congress, 1997a, p. 1).[26]

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produces an inverse relationship between shares of S/E with a bachelors or higher degree, and growth in GDP per capita. However, any suggestion of causality between educational levels in general and economic growth on a broader scale than the countries in this series would require a model that incorporates a random mix of many more countries from a broader range of economic levels and includes more refined measures of education, both for scientists and engineers and the overall labor forces. In addition, the suggestion that an inverse relationship exists between S/E levels of advanced human capital and GDP growth rates should be tempered by the fact that the signs of coefficients can be distorted by the scale of data, the interaction of various explanatory variables, and unusually large or small values, although these factors do not seem to be present in this data set.

[26]However, no press accounts have been found to indicate that vocational education has expanded.

Conclusions

The Philippines' concentration of scientists and engineers in its economically active population lies at the low end of the countries in this series. The Philippines' scientists and engineers are concentrated among the younger age groups to a greater extent than is the Philippines' economically active population. Males predominate among scientists and engineers, accounting for 83 percent of S/E. In this respect, the Philippines' sex distribution matches Sweden's. The Philippines' scientist and engineer sex distribution contrasts sharply with its economically active population, which is split evenly between males and females. Female scientists and engineers are concentrated more heavily in the younger age groups than are males, and are more likely to be engaged in the sciences than engineering. Nevertheless, initial analysis of data on S/E and indicators of economic development indicate that growth in capital stock per worker affects economic development far more than any demographic characteristic of scientists and engineers. However, future analysis may suggest an indirect connection between growth of S/E and capital stock, with growth of S/E being induced by growth in capital stock. At present, the cumulative data on scientists and engineers do not include sufficient time series data for this analysis.

Tables

PHIL-1(90)

Table 1. Scientists and Engineers, by Age Group and Sex, for the Philippines: 1990

Both Sexes

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	Median Age
SCIENTISTS AND ENGINEERS	158,092	20,537	41,650	34,124	22,605	14,818	9,407	7,050	4,498	2,369	1,034	33
SCIENTISTS	29,691	4,268	6,847	6,521	4,379	2,783	1,960	1,430	993	361	149	33
Physical Scientists	9,569	1,390	2,424	2,150	1,309	733	609	449	306	109	90	32
Physicists and Astronomers	463	152	51	60	81	10	31	19	20	20	19	32
Meteorologists	414	10	72	92	51	55	40	23	50	21	0	38
Chemists	7,595	1,172	2,021	1,666	1,039	619	395	358	205	50	70	32
Geologists and Geophysicists	1,097	56	280	332	138	49	143	49	31	18	1	33
Life Scientists	7,445	551	1,067	1,773	1,434	870	660	517	444	100	29	36
Biologists, Botanists, Zoologists and Related Scientists	779	165	90	181	132	41	74	29	67	0	0	34
Bacteriologists, Pharmacologists and Related Scientists	603	94	103	130	142	49	10	20	34	21	0	34
Agronomists and Related Scientists	6,063	292	874	1,462	1,160	780	576	468	343	79	29	37
Mathematicians and Actuaries	1,606	260	419	390	231	140	35	71	30	20	10	32
Statisticians	5,272	768	1,231	1,062	625	657	435	270	134	90	0	33
System Designers and Analysts	4,642	1,143	1,490	938	545	271	124	63	48	0	20	29
Economists	1,157	156	216	208	235	112	97	60	31	42	0	35
ENGINEERS	128,401	16,269	34,803	27,603	18,226	12,035	7,447	5,620	3,505	2,008	885	32
Architects	10,795	1,456	2,632	1,906	1,615	1,205	806	505	339	236	95	33
Civil Engineers	43,067	5,508	14,059	9,617	4,915	3,544	1,972	1,585	1,006	605	256	31
Electrical Engineers	14,279	2,000	3,781	2,873	2,607	1,363	805	462	273	42	73	32
Electronic and Telecommunication Eng.	3,700	911	1,377	525	359	173	152	112	61	30	0	28
Mechanical Engineers	30,546	3,220	6,901	7,283	5,010	3,210	1,920	1,321	863	564	254	34
Chemical Engineers	3,758	434	897	787	677	433	241	112	104	31	42	34
Mining Engineers, Metallurgists and Related Professionals	1,454	72	346	359	271	111	153	74	30	19	19	34
Geodetic Engineers and Related Profes.	13,349	1,336	3,002	2,605	1,903	1,374	987	997	684	368	93	35
Industrial Engineers	2,592	586	850	552	146	203	91	113	10	41	0	29
Other Engineers and Related Profes.	4,861	746	958	1,096	723	419	320	339	135	72	53	33

PHIL-1(90)

Table 1. Scientists and Engineers, by Age Group and Sex, for the Philippines: 1990--Continued

Male

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	Median Age
SCIENTISTS AND ENGINEERS	131,526	14,680	33,091	28,362	19,557	13,304	8,637	6,511	4,177	2,213	994	33
SCIENTISTS	15,679	1,819	3,011	3,241	2,325	1,667	1,465	1,035	773	234	109	35
Physical Scientists	4,533	446	960	959	544	453	456	321	245	80	69	35
Physicists and Astronomers	269	71	30	20	60	10	20	19	10	10	19	36
Meteorologists	274	0	43	40	11	46	40	23	50	21	0	45
Chemists	3,014	340	647	607	345	348	253	230	164	31	49	34
Geologists and Geophysicists	976	35	240	292	128	49	143	49	21	18	1	34
Life Scientists	4,922	297	627	1,034	898	591	576	423	366	81	29	38
Biologists, Botanists, Zoologists and Related Scientists	504	102	19	122	100	10	64	20	67	0	0	35
Bacteriologists, Pharmacologists and Related Scientists	349	42	42	68	122	20	10	20	15	10	0	36
Agronomists and Related Scientists	4,069	153	566	844	676	561	502	383	284	71	29	39
Mathematicians and Actuaries	784	122	184	246	108	68	15	21	10	10	0	32
Statisticians	2,083	198	301	369	279	340	275	187	93	41	0	38
System Designers and Analysts	2,870	672	868	579	373	175	102	52	38	0	11	29
Economists	487	84	71	54	123	40	41	31	21	22	0	36
ENGINEERS	115,847	12,861	30,080	25,121	17,232	11,637	7,172	5,476	3,404	1,979	885	33
Architects	9,318	1,079	2,070	1,675	1,472	1,142	755	485	319	226	95	35
Civil Engineers	37,689	4,123	11,718	8,574	4,610	3,393	1,910	1,552	967	586	256	32
Electrical Engineers	13,897	1,861	3,648	2,833	2,557	1,363	795	452	273	42	73	33
Electronic and Telecommunication Eng.	3,256	669	1,214	496	349	173	152	112	61	30	0	29
Mechanical Engineers	29,655	3,036	6,628	7,030	4,940	3,178	1,860	1,302	863	564	254	34
Chemical Engineers	2,351	135	485	427	478	381	199	101	72	31	42	36
Mining Engineers, Metallurgists and Related Professionals	1,373	62	307	338	260	111	153	74	30	19	19	35
Geodetic Engineers and Related Profes.	12,559	1,186	2,693	2,434	1,843	1,324	978	966	674	368	93	35
Industrial Engineers	1,719	251	499	418	123	192	82	103	10	41	0	31
Other Engineers and Related Profes.	4,030	459	818	896	600	380	288	329	135	72	53	34

PHIL-1(90)

Table 1. Scientists and Engineers, by Age Group and Sex, for the Philippines: 1990--Continued

Female

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+	Median Age
SCIENTISTS AND ENGINEERS	26,566	5,857	8,559	5,762	3,048	1,514	770	539	321	156	40	29
SCIENTISTS	14,012	2,449	3,836	3,280	2,054	1,116	495	395	220	127	40	31
Physical Scientists	5,036	944	1,464	1,191	765	280	153	128	61	29	21	31
Physicists and Astronomers	194	81	21	40	21	0	11	0	10	10	0	29
Meteorologists	140	10	29	52	40	9	0	0	0	0	0	33
Chemists	4,581	832	1,374	1,059	694	271	142	128	41	19	21	30
Geologists and Geophysicists	121	21	40	40	10	0	0	0	10	0	0	30
Life Scientists	2,523	254	440	739	536	279	84	94	78	19	0	34
Biologists, Botanists, Zoologists and Related Scientists	275	63	71	59	32	31	10	9	0	0	0	30
Bacteriologists, Pharmacologists and Related Scientists	254	52	61	62	20	29	0	0	19	11	0	31
Agronomists and Related Scientists	1,994	139	308	618	484	219	74	85	59	8	0	34
Mathematicians and Actuaries	822	138	235	144	123	72	20	50	20	10	10	31
Statisticians	3,189	570	930	693	346	317	160	83	41	49	0	31
System Designers and Analysts	1,772	471	622	359	172	96	22	11	10	0	9	28
Economists	670	72	145	154	112	72	56	29	10	20	0	34
ENGINEERS	12,554	3,408	4,723	2,482	994	398	275	144	101	29	0	28
Architects	1,477	377	562	231	143	63	51	20	20	10	0	28
Civil Engineers	5,378	1,385	2,341	1,043	305	151	62	33	39	19	0	28
Electrical Engineers	382	139	133	40	50	0	10	10	0	0	0	27
Electronic and Telecommunication Eng.	444	242	163	29	10	0	0	0	0	0	0	23
Mechanical Engineers	891	184	273	253	70	32	60	19	0	0	0	30
Chemical Engineers	1,407	299	412	360	199	52	42	11	32	0	0	30
Mining Engineers, Metallurgists and Related Professionals	81	10	39	21	11	0	0	0	0	0	0	29
Geodetic Engineers and Related Profes.	790	150	309	171	60	50	9	31	10	0	0	29
Industrial Engineers	873	335	351	134	23	11	9	10	0	0	0	26
Other Engineers and Related Profes.	831	287	140	200	123	39	32	10	0	0	0	30

Source:
Data derived from special tabulation, performed by the Philippine National Statistics Office, from the 1990 Population Census

PHIL-3(90)

Table 3. Scientists and Engineers, by Industry Group and Sex, for the Philippines: 1990

Both Sexes

Occupation	Total	Agriculture, Fishery and Forestry	Mining	Construc-tion	Manufac-turing	Transport, Communica-tions and Public Utilities	Trade	Finance, Insurance, and Real Estate	Services	Public Adminis-tration	Inadequately described
SCIENTISTS AND ENGINEERS	158,092	2,344	2,545	25,328	17,342	9,395	1,485	3,869	24,280	30,702	40,802
SCIENTISTS	29,691	1,039	559	172	5,492	511	359	2,264	2,823	9,561	6,911
Physical Scientists	9,569	112	427	30	4,347	30	122	81	953	964	2,503
Physicists and Astronomers	463	0	20	0	10	0	0	0	112	52	269
Meteorologists	414	0	0	0	19	9	0	11	20	260	95
Chemists	7,595	101	166	20	4,247	21	122	70	659	389	1,800
Geologists and Geophysicists	1,097	11	241	10	71	0	0	0	162	263	339
Life Scientists	7,445	787	10	0	215	22	72	91	876	4,232	1,140
Biologists, Botanists, Zoologists and Related Scientists	779	70	10	0	62	12	11	10	222	208	174
Bacteriologists, Pharmacologists and Related Scientists	603	59	0	0	72	0	21	0	208	120	123
Agronomists and Related Scientists	6,063	658	0	0	81	10	40	81	446	3,904	843
Mathematicians and Actuaries	1,606	65	33	22	111	52	10	330	172	426	385
Statisticians	5,272	65	58	20	196	72	72	499	304	2,996	990
System Designers and Analysts	4,642	10	31	90	612	324	72	1,098	390	513	1,502
Economists	1,157	0	0	10	11	11	11	165	128	430	391
ENGINEERS	128,401	1,305	1,986	25,156	11,850	8,884	1,126	1,605	21,457	21,141	33,891
Architects	10,795	92	0	3,717	162	60	82	93	3,474	642	2,473
Civil Engineers	43,067	219	191	15,485	1,190	284	168	438	4,618	11,590	8,884
Electrical Engineers	14,279	64	110	2,325	1,916	627	182	200	2,067	911	5,877
Electronic and Telecommunication Eng.	3,700	0	10	122	701	665	72	119	799	135	1,077
Mechanical Engineers	30,546	421	472	2,007	4,555	6,747	326	395	4,099	2,876	8,648
Chemical Engineers	3,758	21	79	89	1,414	21	102	30	494	280	1,228
Mining Engineers, Metallurgists and Related Professionals	1,454	0	715	40	83	51	0	0	114	53	398
Geodetic Engineers and Related Profes.	13,349	435	300	725	280	184	10	163	4,541	4,044	2,667
Industrial Engineers	2,592	10	80	222	861	81	62	51	439	111	675
Other Engineers and Related Profes.	4,861	43	29	424	688	164	122	116	812	499	1,964

PHIL-3(90)

Table 3. Scientists and Engineers, by Industry Group and Sex, for the Philippines: 1990--Continued

Male

Occupation	Total	Agriculture, Fishery and Forestry	Mining	Construc-tion	Manufac-turing	Transport, Communica-tions and Public Utilities	Trade	Finance, Insurance, and Real Estate	Services	Public Adminis-tration	Inadequately described
SCIENTISTS AND ENGINEERS	131,526	2,039	2,353	23,283	12,890	8,915	1,185	2,714	20,867	22,814	34,466
SCIENTISTS	15,679	785	464	151	2,484	272	183	1,253	1,490	4,865	3,732
Physical Scientists	4,533	63	341	30	1,767	21	59	31	498	504	1,219
Physicists and Astronomers	269	0	10	0	0	0	0	0	70	31	158
Meteorologists	274	0	0	0	0	0	0	11	0	178	85
Chemists	3,014	52	100	20	1,706	21	59	20	276	72	688
Geologists and Geophysicists	976	11	231	10	61	0	0	0	152	223	288
Life Scientists	4,922	644	10	0	153	22	51	72	499	2,609	862
Biologists, Botanists, Zoologists and Related Scientists	504	61	10	0	41	12	11	10	101	134	124
Bacteriologists, Pharmacologists and Related Scientists	349	48	0	0	41	0	10	0	115	59	76
Agronomists and Related Scientists	4,069	535	0	0	71	10	30	62	283	2,416	662
Mathematicians and Actuaries	784	45	33	11	71	11	0	135	58	245	175
Statisticians	2,083	33	49	20	80	10	31	222	124	1,138	376
System Designers and Analysts	2,870	0	31	90	413	208	42	721	248	212	905
Economists	487	0	0	0	0	0	0	72	63	157	195
ENGINEERS	115,847	1,254	1,889	23,132	10,406	8,643	1,002	1,461	19,377	17,949	30,734
Architects	9,318	82	0	3,276	141	51	82	93	2,969	529	2,095
Civil Engineers	37,689	219	182	14,141	1,099	274	148	387	3,937	9,573	7,729
Electrical Engineers	13,897	64	110	2,255	1,838	617	171	170	2,016	880	5,776
Electronic and Telecommunication Eng.	3,256	0	10	113	568	553	51	119	738	126	978
Mechanical Engineers	29,655	411	472	1,977	4,466	6,678	316	374	4,005	2,565	8,391
Chemical Engineers	2,351	10	52	70	898	0	61	30	301	142	787
Mining Engineers, Metallurgists and Related Professionals	1,373	0	675	40	74	51	0	0	103	53	377
Geodetic Engineers and Related Profes.	12,559	425	300	706	251	184	10	153	4,355	3,674	2,501
Industrial Engineers	1,719	0	59	160	538	71	62	30	305	72	422
Other Engineers and Related Profes.	4,030	43	29	394	533	164	101	105	648	335	1,678

PHIL-3(90)

Table 3. Scientists and Engineers, by Industry Group and Sex, for the Philippines: 1990--Continued

Female

Occupation	Total	Agriculture, Fishery and Forestry	Mining	Construc-tion	Manufac-turing	Transport, Communica-tions and Public Utilities	Trade	Finance, Insurance, and Real Estate	Services	Public Adminis-tration	Inadequately described
SCIENTISTS AND ENGINEERS	26,566	305	192	2,045	4,452	480	300	1,155	3,413	7,888	6,336
SCIENTISTS	14,012	254	95	21	3,008	239	176	1,011	1,333	4,696	3,179
Physical Scientists	5,036	49	86	0	2,580	9	63	50	455	460	1,284
Physicists and Astronomers	194	0	10	0	10	0	0	0	42	21	111
Meteorologists	140	0	0	0	19	9	0	0	20	82	10
Chemists	4,581	49	66	0	2,541	0	63	50	383	317	1,112
Geologists and Geophysicists	121	0	10	0	10	0	0	0	10	40	51
Life Scientists	2,523	143	0	0	62	0	21	19	377	1,623	278
Biologists, Botanists, Zoologists and Related Scientists	275	9	0	0	21	0	0	0	121	74	50
Bacteriologists, Pharmacologists and Related Scientists	254	11	0	0	31	0	11	0	93	61	47
Agronomists and Related Scientists	1,994	123	0	0	10	0	10	19	163	1,488	181
Mathematicians and Actuaries	822	20	0	11	40	41	10	195	114	181	210
Statisticians	3,189	32	9	0	116	62	41	277	180	1,858	614
System Designers and Analysts	1,772	10	0	0	199	116	30	377	142	301	597
Economists	670	0	0	10	11	11	11	93	65	273	196
ENGINEERS	12,554	51	97	2,024	1,444	241	124	144	2,080	3,192	3,157
Architects	1,477	10	0	441	21	9	0	0	505	113	378
Civil Engineers	5,378	0	9	1,344	91	10	20	51	681	2,017	1,155
Electrical Engineers	382	0	0	70	78	10	11	30	51	31	101
Electronic and Telecommunication Eng.	444	0	0	9	133	112	21	0	61	9	99
Mechanical Engineers	891	10	0	30	89	69	10	21	94	311	257
Chemical Engineers	1,407	11	27	19	516	21	41	0	193	138	441
Mining Engineers, Metallurgists and Related Professionals	81	0	40	0	9	0	0	0	11	0	21
Geodetic Engineers and Related Profes.	790	10	0	19	29	0	0	10	186	370	166
Industrial Engineers	873	10	21	62	323	10	0	21	134	39	253
Other Engineers and Related Profes.	831	0	0	30	155	0	21	11	164	164	286

Source:
Data derived from special tabulation, performed by the Philippine National Statistics Office, from the 1990 Population Census.

PHIL-4(90)

Table 4. Scientists and Engineers, by Manufacturing Industry and Sex, for the Philippines: 1990

Both Sexes

Occupation	Total	Food, Beverages & Tobacco	Textiles, Clothing & Footwear	Wood & Wood Products	Paper Products & Printing	Chemical Related Products	Non-metal Mineral Products	Basic Metal Products	Fabricated Metal Products	Transport Equipment	Electronic & Measuring Equipment	Miscellaneous Manufacturing
SCIENTISTS AND ENGINEERS	17,342	4,125	1,720	527	503	3,810	1,345	886	504	3,629	39	254
SCIENTISTS	5,492	1,654	600	130	208	2,020	334	62	44	359	20	61
Physical Scientists	4,347	1,391	505	71	91	1,801	272	20	33	102	10	51
Physicists and Astronomers	10	0	10	0	0	0	0	0	0	0	0	0
Meteorologists	19	10	0	0	0	9	0	0	0	0	0	0
Chemists	4,247	1,381	495	71	91	1,752	250	20	33	102	10	42
Geologists and Geophysicists	71	0	0	0	0	40	22	0	0	0	0	9
Life Scientists	215	81	0	20	11	62	10	0	0	31	0	0
Biologists, Botanists, Zoologists and Related Scientists	62	20	0	10	11	0	0	0	0	21	0	0
Bacteriologists, Pharmacologists and Related Scientists	72	10	0	0	0	42	10	0	0	10	0	0
Agronomists and Related Scientists	81	51	0	10	0	20	0	0	0	0	0	0
Mathematicians and Actuaries	111	31	10	0	20	20	0	20	0	0	0	10
Statisticians	196	69	0	10	11	22	21	11	0	42	10	0
System Designers and Analysts	612	82	85	29	75	115	31	11	11	173	0	0
Economists	11	0	0	0	0	0	0	0	0	11	0	0
ENGINEERS	11,850	2,471	1,120	397	295	1,790	1,011	824	460	3,270	19	193
Architects	162	31	10	30	0	0	10	10	21	50	0	0
Civil Engineers	1,190	207	31	61	51	154	182	151	136	207	0	10
Electrical Engineers	1,916	351	167	40	32	236	111	331	69	540	9	30
Electronic and Telecommunication Eng.	701	10	10	10	0	11	0	20	0	620	0	20
Mechanical Engineers	4,555	1,211	348	145	60	583	381	244	183	1,370	0	30
Chemical Engineers	1,414	326	170	43	40	603	131	40	10	51	0	0
Mining Engineers, Metallurgists and Related Professionals	83	21	0	0	0	22	12	28	0	0	0	0
Geodetic Engineers and Related Profes.	280	0	0	38	61	69	30	0	0	20	0	62
Industrial Engineers	861	144	304	20	20	41	85	0	31	196	10	10
Other Engineers and Related Profes.	688	170	80	10	31	71	69	0	10	216	0	31

PHIL-4(90)

Table 4. Scientists and Engineers, by Manufacturing Industry and Sex, for the Philippines: 1990--Continued

Male

Occupation	Total	Food, Beverages & Tobacco	Textiles, Clothing & Footwear	Wood & Wood Products	Paper Products & Printing	Chemical Related Products	Non-metal Mineral Products	Basic Metal Products	Fabricated Metal Products	Transport Equipment	Electronic & Measuring Equipment	Miscellaneous Manufacturing
SCIENTISTS AND ENGINEERS	12,890	2,948	1,090	464	348	2,365	1,105	801	452	3,096	20	201
SCIENTISTS	2,484	775	200	110	104	813	173	52	44	185	10	18
Physical Scientists	1,767	582	126	61	31	701	153	10	33	52	0	18
Physicists and Astronomers	0	0	0	0	0	0	0	0	0	0	0	0
Meteorologists	0	0	0	0	0	0	0	0	0	0	0	0
Chemists	1,706	582	126	61	31	671	131	10	33	52	0	9
Geologists and Geophysicists	61	0	0	0	0	30	22	0	0	0	0	9
Life Scientists	153	51	0	20	11	41	10	0	0	20	0	0
Biologists, Botanists, Zoologists and Related Scientists	41	10	0	10	11	0	0	0	0	10	0	0
Bacteriologists, Pharmacologists and Related Scientists	41	0	0	0	0	21	10	0	0	10	0	0
Agronomists and Related Scientists	71	41	0	10	0	20	0	0	0	0	0	0
Mathematicians and Actuaries	71	21	0	0	20	10	0	20	0	0	0	0
Statisticians	80	49	0	0	0	0	10	11	0	0	10	0
System Designers and Analysts	413	72	74	29	42	61	0	11	11	113	0	0
Economists	0	0	0	0	0	0	0	0	0	0	0	0
ENGINEERS	10,406	2,173	890	354	244	1,552	932	749	408	2,911	10	183
Architects	141	31	10	30	0	0	10	10	10	40	0	0
Civil Engineers	1,099	187	20	51	51	154	182	111	136	197	0	10
Electrical Engineers	1,838	329	167	40	32	225	102	325	69	519	0	30
Electronic and Telecommunication Eng.	568	10	10	10	0	11	0	20	0	487	0	20
Mechanical Engineers	4,466	1,183	337	145	60	573	371	233	183	1,351	0	30
Chemical Engineers	898	203	109	10	9	406	110	31	0	20	0	0
Mining Engineers, Metallurgists and Related Professionals	74	21	0	0	0	22	12	19	0	0	0	0
Geodetic Engineers and Related Profes.	251	0	0	38	51	69	11	0	0	20	0	62
Industrial Engineers	538	113	177	20	20	21	75	0	0	102	10	0
Other Engineers and Related Profes.	533	96	60	10	21	71	59	0	10	175	0	31

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Table 4. Scientists and Engineers, by Manufacturing Industry and Sex, for the Philippines: 1990--Continued

Female

Occupation	Total	Food, Beverages & Tobacco	Textiles, Clothing & Footwear	Wood & Wood Products	Paper Products & Printing	Chemical Related Products	Non-metal Mineral Products	Basic Metal Products	Fabricated Metal Products	Transport Equipment	Electronic & Measuring Equipment	Miscellaneous Manufacturing
SCIENTISTS AND ENGINEERS	4,452	1,177	630	63	155	1,445	240	85	52	533	19	53
SCIENTISTS	3,008	879	400	20	104	1,207	161	10	0	174	10	43
Physical Scientists	2,580	809	379	10	60	1,100	119	10	0	50	10	33
Physicists and Astronomers	10	0	10	0	0	0	0	0	0	0	0	0
Meteorologists	19	10	0	0	0	9	0	0	0	0	0	0
Chemists	2,541	799	369	10	60	1,081	119	10	0	50	10	33
Geologists and Geophysicists	10	0	0	0	0	10	0	0	0	0	0	0
Life Scientists	62	30	0	0	0	21	0	0	0	11	0	0
Biologists, Botanists, Zoologists and Related Scientists	21	10	0	0	0	0	0	0	0	11	0	0
Bacteriologists, Pharmacologists and Related Scientists	31	10	0	0	0	21	0	0	0	0	0	0
Agronomists and Related Scientists	10	10	0	0	0	0	0	0	0	0	0	0
Mathematicians and Actuaries	40	10	10	0	0	10	0	0	0	0	0	10
Statisticians	116	20	0	10	11	22	11	0	0	42	0	0
System Designers and Analysts	199	10	11	0	33	54	31	0	0	60	0	0
Economists	11	0	0	0	0	0	0	0	0	11	0	0
ENGINEERS	1,444	298	230	43	51	238	79	75	52	359	9	10
Architects	21	0	0	0	0	0	0	0	11	10	0	0
Civil Engineers	91	20	11	10	0	0	0	40	0	10	0	0
Electrical Engineers	78	22	0	0	0	11	9	6	0	21	9	0
Electronic and Telecommunication Eng.	133	0	0	0	0	0	0	0	0	133	0	0
Mechanical Engineers	89	28	11	0	0	10	10	11	0	19	0	0
Chemical Engineers	516	123	61	33	31	197	21	9	10	31	0	0
Mining Engineers, Metallurgists and Related Professionals	9	0	0	0	0	0	0	9	0	0	0	0
Geodetic Engineers and Related Profes.	29	0	0	0	10	0	19	0	0	0	0	0
Industrial Engineers	323	31	127	0	0	20	10	0	31	94	0	10
Other Engineers and Related Profes.	155	74	20	0	10	0	10	0	0	41	0	0

Source:
Data derived from special tabulation, performed by the Philippine National Statistics Office, from the 1990 Population Census.

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Table 5. Scientists and Engineers, by Service Industry and Sex, for the Philippines: 1990

Both Sexes

Occupation	Total	Lodging & Personal Services	Business Services	Repair Services	Recreation & Media Services	Health, Education & Social Services	Legal Services	Engineering & Research	Political, Trade & Cultural Organs.	Private Household Services
SCIENTISTS AND ENGINEERS	24,280	373	517	1,417	422	2,257	17,803	546	785	160
SCIENTISTS	2,823	62	113	21	71	1,360	569	344	243	40
Physical Scientists	953	41	62	10	20	450	280	48	42	0
Physicists and Astronomers	112	0	11	10	10	71	0	0	10	0
Meteorologists	20	0	0	0	0	10	0	10	0	0
Chemists	659	30	40	0	10	359	161	38	21	0
Geologists and Geophysicists	162	11	11	0	0	10	119	0	11	0
Life Scientists	876	0	21	11	0	530	51	185	78	0
Biologists, Botanists, Zoologists and Related Scientists	222	0	0	0	0	164	10	0	48	0
Bacteriologists, Pharmacologists and Related Scientists	208	0	0	0	0	186	0	22	0	0
Agronomists and Related Scientists	446	0	21	11	0	180	41	163	30	0
Mathematicians and Actuaries	172	0	10	0	0	84	19	41	9	9
Statisticians	304	0	20	0	20	163	40	50	10	1
System Designers and Analysts	390	21	0	0	31	113	123	0	72	30
Economists	128	0	0	0	0	20	56	20	32	0
ENGINEERS	21,457	311	404	1,396	351	897	17,234	202	542	120
Architects	3,474	32	86	0	10	129	3,134	30	33	20
Civil Engineers	4,618	61	119	31	52	297	3,925	20	73	40
Electrical Engineers	2,067	75	20	449	31	10	1,342	20	120	0
Electronic and Telecommunication Eng.	799	21	0	247	136	20	305	0	50	20
Mechanical Engineers	4,099	81	72	607	40	199	2,856	38	176	30
Chemical Engineers	494	0	0	10	0	94	360	10	20	0
Mining Engineers, Metallurgists and Related Professionals	114	0	0	0	0	0	104	0	0	10
Geodetic Engineers and Related Profes.	4,541	0	43	10	51	57	4,276	63	41	0
Industrial Engineers	439	10	11	42	0	9	357	0	10	0
Other Engineers and Related Profes.	812	31	53	0	31	82	575	21	19	0

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Table 5. Scientists and Engineers, by Service Industry and Sex, for the Philippines: 1990--Continued

Male

Occupation	Total	Lodging & Personal Services	Business Services	Repair Services	Recreation & Media Services	Health, Education & Social Services	Legal Services	Engineering & Research	Political, Trade & Cultural Organs.	Private Household Services
SCIENTISTS AND ENGINEERS	20,867	322	385	1,365	361	1,392	16,005	262	665	110
SCIENTISTS	1,490	52	62	21	51	676	351	113	154	10
Physical Scientists	498	31	21	10	20	236	159	0	21	0
Physicists and Astronomers	70	0	0	10	10	40	0	0	10	0
Meteorologists	0	0	0	0	0	0	0	0	0	0
Chemists	276	20	10	0	10	186	50	0	0	0
Geologists and Geophysicists	152	11	11	0	0	10	109	0	11	0
Life Scientists	499	0	21	11	0	294	40	93	40	0
Biologists, Botanists, Zoologists and Related Scientists	101	0	0	0	0	71	10	0	20	0
Bacteriologists, Pharmacologists and Related Scientists	115	0	0	0	0	93	0	22	0	0
Agronomists and Related Scientists	283	0	21	11	0	130	30	71	20	0
Mathematicians and Actuaries	58	0	10	0	0	20	19	0	9	0
Statisticians	124	0	10	0	10	63	20	10	10	1
System Designers and Analysts	248	21	0	0	21	63	82	0	52	9
Economists	63	0	0	0	0	0	31	10	22	0
ENGINEERS	19,377	270	323	1,344	310	716	15,654	149	511	100
Architects	2,969	21	86	0	0	60	2,729	30	33	10
Civil Engineers	3,937	41	71	31	41	268	3,362	20	73	30
Electrical Engineers	2,016	75	20	449	31	10	1,302	20	109	0
Electronic and Telecommunication Eng.	738	21	0	206	136	20	285	0	50	20
Mechanical Engineers	4,005	81	72	596	40	199	2,793	28	166	30
Chemical Engineers	301	0	0	10	0	41	230	10	10	0
Mining Engineers, Metallurgists and Related Professionals	103	0	0	0	0	0	93	0	0	10
Geodetic Engineers and Related Profes.	4,355	0	43	10	41	57	4,133	30	41	0
Industrial Engineers	305	10	11	42	0	9	223	0	10	0
Other Engineers and Related Profes.	648	21	20	0	21	52	504	11	19	0

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Table 5. Scientists and Engineers, by Service Industry and Sex, for the Philippines: 1990--Continued

Female

Occupation	Total	Lodging & Personal Services	Business Services	Repair Services	Recreation & Media Services	Health, Education & Social Services	Legal Services	Engineering & Research	Political, Trade & Cultural Organs.	Private Household Services
SCIENTISTS AND ENGINEERS	3,413	51	132	52	61	865	1,798	284	120	50
SCIENTISTS	1,333	10	51	0	20	684	218	231	89	30
Physical Scientists	455	10	41	0	0	214	121	48	21	0
Physicists and Astronomers	42	0	11	0	0	31	0	0	0	0
Meteorologists	20	0	0	0	0	10	0	10	0	0
Chemists	383	10	30	0	0	173	111	38	21	0
Geologists and Geophysicists	10	0	0	0	0	0	10	0	0	0
Life Scientists	377	0	0	0	0	236	11	92	38	0
Biologists, Botanists, Zoologists and Related Scientists	121	0	0	0	0	93	0	0	28	0
Bacteriologists, Pharmacologists and Related Scientists	93	0	0	0	0	93	0	0	0	0
Agronomists and Related Scientists	163	0	0	0	0	50	11	92	10	0
Mathematicians and Actuaries	114	0	0	0	0	64	0	41	0	9
Statisticians	180	0	10	0	10	100	20	40	0	0
System Designers and Analysts	142	0	0	0	10	50	41	0	20	21
Economists	65	0	0	0	0	20	25	10	10	0
ENGINEERS	2,080	41	81	52	41	181	1,580	53	31	20
Architects	505	11	0	0	10	69	405	0	0	10
Civil Engineers	681	20	48	0	11	29	563	0	0	10
Electrical Engineers	51	0	0	0	0	0	40	0	11	0
Electronic and Telecommunication Eng.	61	0	0	41	0	0	20	0	0	0
Mechanical Engineers	94	0	0	11	0	0	63	10	10	0
Chemical Engineers	193	0	0	0	0	53	130	0	10	0
Mining Engineers, Metallurgists and Related Professionals	11	0	0	0	0	0	11	0	0	0
Geodetic Engineers and Related Profes.	186	0	0	0	10	0	143	33	0	0
Industrial Engineers	134	0	0	0	0	0	134	0	0	0
Other Engineers and Related Profes.	164	10	33	0	10	30	71	10	0	0

Source:
Data derived from special tabulation, performed by the Philippine National Statistics Office, from the 1990 Population Census.

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Table 6. Scientists and Engineers, by Educational Attainment and Sex, for the Philippines: 1990

Both Sexes

Occupation	Total	Less than High School	High School	Post Secondary	College Under-Graduate	Bachelors Degree	Graduate Degree	Not Stated
SCIENTISTS AND ENGINEERS	158,092	1,558	4,761	4,397	13,646	129,763	1,014	2,953
SCIENTISTS	29,691	485	1,104	611	2,874	23,361	725	531
Physical Scientists	9,569	287	587	193	1,292	6,908	99	203
Physicists and Astronomers	463	121	41	20	0	174	39	68
Meteorologists	414	10	13	20	112	249	0	10
Chemists	7,595	135	483	122	1,045	5,667	31	112
Geologists and Geophysicists	1,097	21	50	31	135	818	29	13
Life Scientists	7,445	79	211	108	490	6,113	359	85
Biologists, Botanists, Zoologists and Related Scientists	779	19	50	19	52	527	101	11
Bacteriologists, Pharmacologists and Related Scientists	603	10	20	10	65	427	50	21
Agronomists and Related Scientists	6,063	50	141	79	373	5,159	208	53
Mathematicians and Actuaries	1,606	60	91	20	115	1,244	32	44
Statisticians	5,272	40	81	69	437	4,481	91	73
System Designers and Analysts	4,642	19	134	192	458	3,683	82	74
Economists	1,157	0	0	29	82	932	62	52
ENGINEERS	128,401	1,073	3,657	3,786	10,772	106,402	289	2,422
Architects	10,795	163	226	95	998	9,028	31	254
Civil Engineers	43,067	52	359	80	2,215	39,654	59	648
Electrical Engineers	14,279	20	81	204	945	12,773	30	226
Electronic and Telecommunication Eng.	3,700	0	148	180	272	2,942	11	147
Mechanical Engineers	30,546	125	426	2,050	2,181	25,149	81	534
Chemical Engineers	3,758	10	20	10	145	3,434	5	134
Mining Engineers, Metallurgists and Related Professionals	1,454	0	19	11	53	1,299	10	62
Geodetic Engineers and Related Profes.	13,349	619	2,157	966	3,117	6,234	11	245
Industrial Engineers	2,592	0	31	21	174	2,326	20	20
Other Engineers and Related Profes.	4,861	84	190	169	672	3,563	31	152

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Table 6. Scientists and Engineers, by Educational Attainment and Sex, for the Philippines: 1990--Continued

Male

Occupation	Total	Less than High School	High School	Post Secondary	College Under-Graduate	Bachelors Degree	Graduate Degree	Not Stated
SCIENTISTS AND ENGINEERS	131,526	1,348	4,320	3,960	11,863	106,961	667	2,407
SCIENTISTS	15,679	315	857	412	1,778	11,597	413	307
Physical Scientists	4,533	176	401	113	750	2,883	89	121
Physicists and Astronomers	269	61	20	10	0	81	29	68
Meteorologists	274	10	13	10	72	159	0	10
Chemists	3,014	84	318	62	553	1,936	31	30
Geologists and Geophysicists	976	21	50	31	125	707	29	13
Life Scientists	4,922	68	201	88	322	3,990	189	64
Biologists, Botanists, Zoologists and Related Scientists	504	19	50	19	41	323	41	11
Bacteriologists, Pharmacologists and Related Scientists	349	10	20	10	35	223	41	10
Agronomists and Related Scientists	4,069	39	131	59	246	3,444	107	43
Mathematicians and Actuaries	784	31	81	10	75	536	21	30
Statisticians	2,083	40	71	39	288	1,593	42	10
System Designers and Analysts	2,870	0	103	152	323	2,201	50	41
Economists	487	0	0	10	20	394	22	41
ENGINEERS	115,847	1,033	3,463	3,548	10,085	95,364	254	2,100
Architects	9,318	153	215	85	897	7,703	31	234
Civil Engineers	37,689	52	308	80	1,999	34,652	59	539
Electrical Engineers	13,897	10	81	183	894	12,493	20	216
Electronic and Telecommunication Eng.	3,256	0	81	160	242	2,636	11	126
Mechanical Engineers	29,655	115	416	2,029	2,120	24,400	61	514
Chemical Engineers	2,351	10	20	10	104	2,144	0	63
Mining Engineers, Metallurgists and Related Professionals	1,373	0	19	11	53	1,218	10	62
Geodetic Engineers and Related Profes.	12,559	609	2,126	927	2,989	5,672	11	225
Industrial Engineers	1,719	0	31	10	145	1,503	20	10
Other Engineers and Related Profes.	4,030	84	166	53	642	2,943	31	111

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Table 6. Scientists and Engineers, by Educational Attainment and Sex, for the Philippines: 1990--Continued

Female

Occupation	Total	Less than High School	High School	Post Secondary	College Under-Graduate	Bachelors Degree	Graduate Degree	Not Stated
SCIENTISTS AND ENGINEERS	26,566	210	441	437	1,783	22,802	347	546
SCIENTISTS	14,012	170	247	199	1,096	11,764	312	224
Physical Scientists	5,036	111	186	80	542	4,025	10	82
Physicists and Astronomers	194	60	21	10	0	93	10	0
Meteorologists	140	0	0	10	40	90	0	0
Chemists	4,581	51	165	60	492	3,731	0	82
Geologists and Geophysicists	121	0	0	0	10	111	0	0
Life Scientists	2,523	11	10	20	168	2,123	170	21
Biologists, Botanists, Zoologists and Related Scientists	275	0	0	0	11	204	60	0
Bacteriologists, Pharmacologists and Related Scientists	254	0	0	0	30	204	9	11
Agronomists and Related Scientists	1,994	11	10	20	127	1,715	101	10
Mathematicians and Actuaries	822	29	10	10	40	708	11	14
Statisticians	3,189	0	10	30	149	2,888	49	63
System Designers and Analysts	1,772	19	31	40	135	1,482	32	33
Economists	670	0	0	19	62	538	40	11
ENGINEERS	12,554	40	194	238	687	11,038	35	322
Architects	1,477	10	11	10	101	1,325	0	20
Civil Engineers	5,378	0	51	0	216	5,002	0	109
Electrical Engineers	382	10	0	21	51	280	10	10
Electronic and Telecommunication Eng.	444	0	67	20	30	306	0	21
Mechanical Engineers	891	10	10	21	61	749	20	20
Chemical Engineers	1,407	0	0	0	41	1,290	5	71
Mining Engineers, Metallurgists and Related Professionals	81	0	0	0	0	81	0	0
Geodetic Engineers and Related Profes.	790	10	31	39	128	562	0	20
Industrial Engineers	873	0	0	11	29	823	0	10
Other Engineers and Related Profes.	831	0	24	116	30	620	0	41

Source: National Statistics Office, 1990 Census of Population and Housing

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