

SCIENTISTS AND ENGINEERS IN TAIWAN: 1990

by

David Zaslow

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

IPC Staff Paper
No. 92

April 1998

SCIENTISTS AND ENGINEERS IN TAIWAN: 1990

by

David Zaslow

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

April 1998

This report is based on activities supported by the National Science Foundation under Agreement No. SRS-9528607. Any opinions, findings, and conclusions or recommendations expressed herein are those of the author and do not necessarily reflect the views of the National Science Foundation.

EXECUTIVE SUMMARY

The typical member of the group “Scientists and Engineers” (S/E)¹ in Taiwan is a male, college graduate in his late 20's to early 30's, employed by the private sector in manufacturing. Exceptions exist to this characterization, since females, who comprise one-eighth of scientists and engineers, are more likely to work in services. Changes in Taiwan's economy highlight the role of scientists and engineers. The former agrarian economy has given way to one focussed increasingly on technologically advanced production. Taiwan is a leading producer of computers, and is attempting to expand its aircraft, biotechnology, and precision instrument industries. Much of this development is due to assistance from Taiwan's authorities, in the form of research and development (R&D) funding. Since Taiwan lacks abundant natural resources (for instance, importing nearly all consumed fossil fuel), human capital investment has played a prominent role in Taiwan's economic success. In particular, the highly educated scientist and engineer population has been vital to Taiwan's economic growth.

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

PREFACE

The International Programs Center conducts economic and demographic studies, some of which are issued as Staff Papers. A complete list is included at the end of this report. The use of data not generated by the U.S. Bureau of the Census precludes performing the same statistical reviews the Bureau does on its own data.

We are grateful to Lois Darmohray and Beverly Mathis of the International Programs Center for secretarial support. Any shortcomings in the report are the responsibility of the author.

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; e-mail: dzaslow@ccmail.census.gov.

CONTENTS

	Page
EXECUTIVE SUMMARY	iii
PREFACE	iv
INTRODUCTION	1
Figure 1. Scientists and Engineers per 1,000 Members of the Economically Active Population: 1990	2
Figure 2. Scientists and Engineers by Specialty and Sex: 1990	5
Figure 3. Distribution of Scientists and Engineers by Specialty and Sex: 1990 ...	5
Figure 4. Percent Distribution of Male and Female Scientists and Engineers by Age: 1990	7
Figure 5. Scientists and Engineers by Age Group: 1990	7
Figure 6. Scientists and Engineers by Sector of the Economy: 1990	8
Figure 7. Scientists and Engineers by Industry: 1990	10
Figure 8. Distribution of Scientists and Engineers Within Industry Groups: 1990	11
Figure 9. Distribution of Scientists and Engineers in Manufacturing, by Industry: 1990	14
Figure 10. Research & Development by Sector of Performance, 1994	15
Figure 11. Share of Gross Domestic Product Used for R&D	15
Figure 12. Scientists and Engineers in Services, by Industry: 1990	16
Figure 13. Scientists and Engineers by Educational Attainment: 1990	18

TABLES

Table	
TW-1(90) Scientists and Engineers by Age and Sex, for Taiwan: 1990	21
TW-2(90) Scientists and Engineers by Employment Status and Sex, for Taiwan: 1990	24
TW-3(90) Scientists and Engineers by Industry and Sex, for Taiwan: 1990	27
TW-4(90) Scientists and Engineers by Manufacturing Industry and Sex, for Taiwan: 1990	30
TW-5(90) Scientists and Engineers by Service Industry and Sex, for Taiwan: 1990	33
TW-6(90) Scientists and Engineers by Educational Attainment and Sex, for Taiwan: 1990	36
Bibliography	39

INTRODUCTION

This report summarizes occupational and educational statistics on scientists and engineers² in Taiwan, based on data from the 1990 census. Scientists and engineers are a small share of Taiwan's working-age population, compared with other countries in this series.³ In 1990, Taiwan had approximately seven scientists and engineers per 1,000 members of its economically active population (Figure 1).^{4 5} Scientists and engineers' education levels far exceed those of the overall employed labor force, and have helped Taiwan make the transition from a technological imitator to innovator.

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/CIR Staff Papers in the back of this report. The most recently published report of this series is "Scientists and Engineers in Finland: 1993."

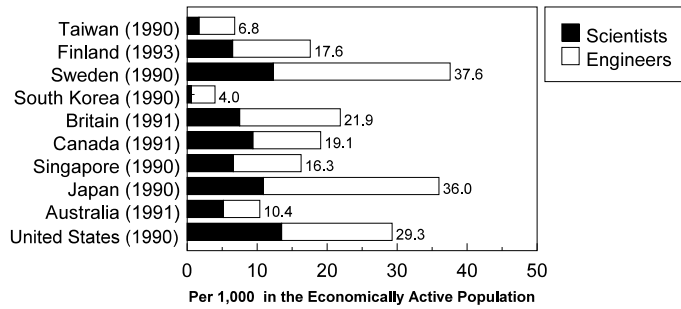
²All data in the reports of this series refer to nonacademic scientists and engineers.

³Taiwan was recognized as independent by 30 countries, as of May 1997.

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

⁵This level, the second lowest among countries in this series, is due in part to the large share of scientists and engineers who do not return to Taiwan after study abroad.

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



* Working age pop. Differences in ages between countries may distort comparisons.
Source: Table TW-1(90); Taiwan Coun. for Econ. Pl. & Dev; Zaslow, 1997a, p. 2.

Primarily, males occupy the scientist and engineers' occupations.

Most scientists and engineers (87 percent) are male (Table TW-1(90)). This contrasts sharply with the gender composition of Taiwan's labor force and economically active population, of which males comprised 66 and 50 percent, respectively in 1990 (Taiwan Census Office, 1992, p. 155). In each jurisdiction in this series,⁶ males are a higher proportion of scientists and engineers than the overall economically active population (Zaslow, 1997a, p. 3). When arranged from low to high, Taiwan has the second largest disparity (after Japan) between males' share of S/E and the economically active population.

Males' preponderance among science and engineering occupations seems likely to continue, although less than in the past. Females' share of scientists and engineers in 1990 (13 percent) is more than double the 1980 level of 5 percent (Jamison, 1991, pp. 14, 16). In terms of growth rates, the overall number of S/E tripled, the number of male S/E increased 2.8 fold, while the number of female S/E rose 7.5 fold (Jamison, 1991, pp. 14-16; and Table TW-1(90)). Females' growing representation in the sciences and engineering is consistent with trends in the overall economy, as employment among females grew more rapidly than among males during the 1980s (3.6 versus 0.3 percent, respectively) (Taiwan Census Office, 1992, p. 158). Due to this faster growth, females' share of total employment rose from 27 to 33 percent between 1980 and 1990 (Taiwan Census Office, 1982, p. 470; and Taiwan Census Office, 1992, pp. 728, 729). Since females' share of S/E rose faster than their share of employment, it appears that more of the newly employed females are becoming scientists and engineers. Considering their increasing numbers, as expected, female S/E are concentrated at the younger ages, as females' share of S/E under age 30 exceeds their share of all ages (21 versus 13 percent, respectively) (Table TW-1(90)).

⁶These are Australia, Britain, Canada, Finland, Japan, Singapore, South Korea and Sweden.

Scientists and engineers are concentrated among a few employment categories.

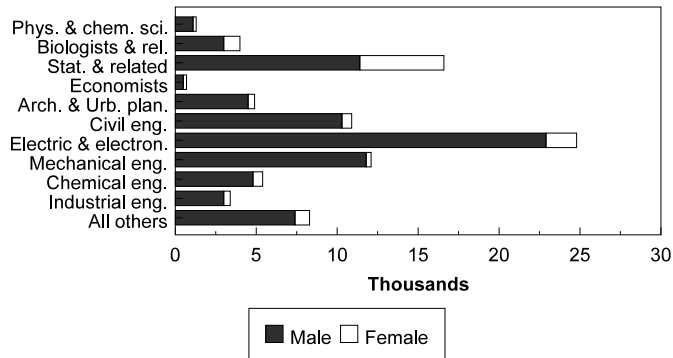
Within the employment category “Scientists and Engineers,”⁷ those specializing in the electrical and electronic engineering; statistics, mathematics, and systems analysis; mechanical engineering; and civil engineering are most numerous. Males account for 88 percent of the 64,320 S/E in these fields. These same fields, regardless of gender, employ 70 percent of all S/E (Table TW-1(90)). Among males, there are also substantial numbers of chemical engineers, architects, industrial engineers, and biologists. Among females, statisticians, mathematicians, systems analysts and related technicians, electrical and electronic engineers, and biologists (and related) are most common.

The overall distribution of scientists and engineers is more concentrated for males than females.⁸ While males account for most employment across the different S/E occupations, their majorities are greatest in engineering (Figure 2). Overall, females account for 29 percent of scientists, but just 7 percent of engineers (Table TW-1(90) and Figure 3).

⁷See Table TW-1(90) for a list of occupations that constitute the category “Scientists and Engineers.”

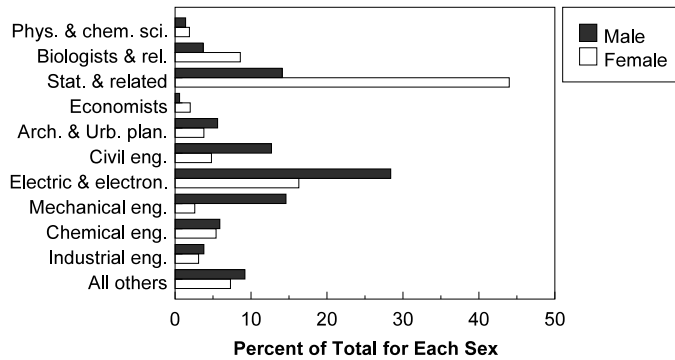
⁸The standard deviation of the occupational categories’ distribution for males is 8.0 percent, compared to 11.7 percent for females.

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



Source: Table TW-1(90).

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



Source: Table TW-1(90).

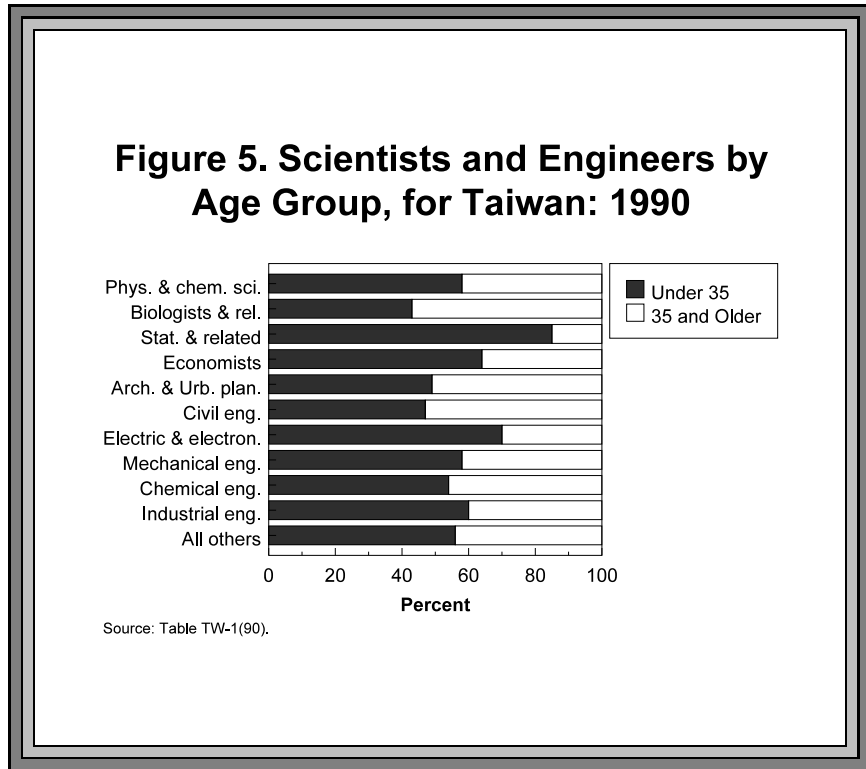
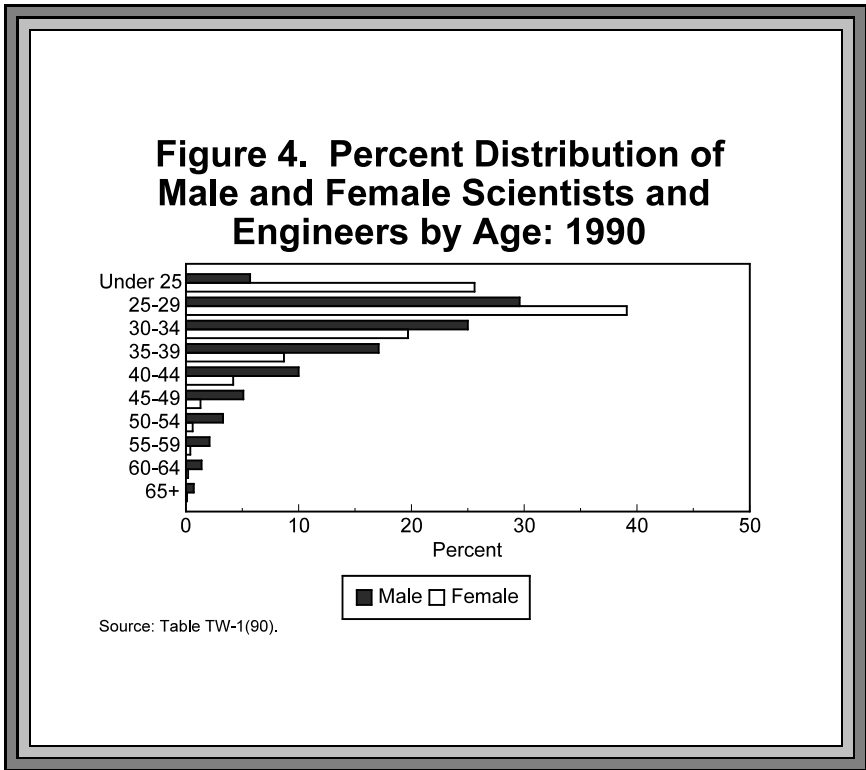
Scientists and engineers' age distribution is skewed toward the younger ages.

Scientists and engineers in Taiwan are younger as a group than S/E in most other countries in this series. Taiwan has the third largest share of S/E among the younger ages (after Singapore and South Korea), with 63 percent of S/E being below age 35 (Table TW-1(90)). The female share of the youngest S/E (under age 25) is far higher than the male (39 versus 6 percent) (Table TW-1(90); and Figure 4). Statisticians, mathematicians, systems analysts and related technicians have the highest share under age 35 (85 percent) (Figure 5).

The distributions between younger and older workers are dissimilar for the employed labor force and scientists and engineers. In 1990, 49 percent of the employed labor force was below age 35, compared to 63 percent of S/E (Taiwan Census Office, 1992, pp. 782, 783; and Table TW-1(90)).⁹ Measured by 5-year age cohorts, the S/E population features a far more peaked distribution than the employed labor force.¹⁰

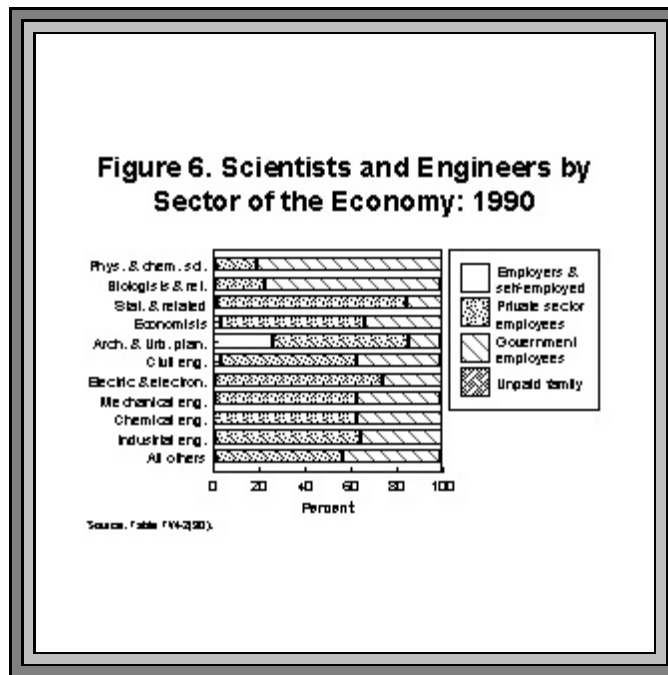
⁹Measured in 5-year age cohorts, the skew for S/E and the employed labor force is 1.16 and .10, respectively.

¹⁰The measure of kurtosis (relative peakedness or flatness of a distribution) of the S/E population, by 5-year age cohort, is .23 (suggesting a relatively peaked distribution). By contrast, the kurtosis of the employed labor force is -1.95, implying a relatively flat distribution. Information to assess the economic impact of the concentration of scientists and engineers among the younger ages is scarce. We do not have data on compensation of scientists and engineers, although presumably pay is lower among younger workers. This is significant as unit labor costs (on a national currency basis) in manufacturing have risen dramatically in Taiwan-- nearly 5-fold since 1970 (Bureau of Labor Statistics, 1997, p. 1).



Nearly all scientists and engineers are employees.

Ninety-eight percent of scientists and 97 percent of engineers are employees, as opposed to entrepreneurs.¹¹ Employees comprise over 99 percent of S/E in several occupational categories, with chemical engineers' 99.7 percent share being the highest. By contrast, architects and urban planners have the lowest share of employees (74 percent) (Table TW-2(90)). As for the public/private sector split, the private sector's share of S/E is smaller than its share of the entire employed labor force (68 versus 88 percent) (Taiwan Census Office, 1992, pp. 924-927).¹² The highest shares of S/E in the private sector were among "other" engineers and specialists; physical/chemical scientists and related specialists; and biological scientists and related specialists' categories, at 83, 80 and 77 percent, respectively (Figure 6). Alternatively, the highest shares of S/E in the public sector were among architects and urban planners; and statisticians, mathematicians, systems analysts and related technicians, at 86 and 85 percent, respectively. Finally, gender affects the employment decision: surprisingly, a higher share of males than females work in the public sector (32 versus 27 percent, respectively) (Table TW-2(90)).



¹¹This is higher than employees' share of the national employed population. In 1990, employees accounted for 64 percent of employed people (Taiwan Census Office, 1992, pp. 924, 926).

¹²The private sector includes all employers, the self-employed (both of these groups may be considered "entrepreneurs"), private sector employees, and unpaid family workers. All public sector scientists and engineers are employees.

Manufacturing and services dominate employment of scientists and engineers.

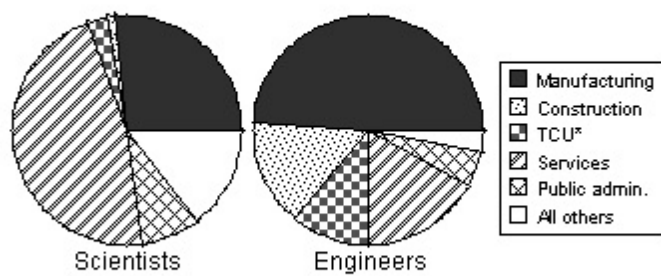
While manufacturing and services employ 74 percent of scientists and 65 percent of engineers (Table TW-3(90) and Figure 7), engineers comprise a substantial majority of S/E in manufacturing but only a slight majority in services. At 67 percent, Taiwan's share of scientists and engineers in these two sectors equals that of Finland, and closely mirrors that found in the United States and Japan (70 and 68 percent, respectively) (Zaslow, 1997a, p. 9; and National Science Board, 1993, p. 326). Both scientists and engineers are dispersed fairly widely among several industrial sectors,¹³ a pattern which has remained fairly static since 1980. In addition, all sectors showed increases in numbers of scientists and engineers.

Further analysis of the data show that S/E employment shares and the gross domestic product (GDP) share by sector of industry are correlated positively.¹⁴ The 1990 data produce a .89 correlation coefficient (based upon all sectors listed in Table TW-3(90), except mining & quarrying and public administration) (Taiwan Council, 1996, p. 38; and Table TW-3(90)). In addition, between 1980 and 1990, scientists and engineers' share of the labor force and the area's gross domestic product nearly tripled (Taiwan Census Office, 1992, p. 155; and Taiwan Council, 1996, p. 27). Although these associations do not necessarily imply causality, they suggest that growing S/E employment may be linked to robust economic growth. A more comprehensive assessment would require that other factors that also contribute to development, such as capital investment, be considered. Nevertheless, Taiwan's leaders perceive a relationship between scientific and engineering knowledge and economic performance. As a first attempt to explore this relationship, we examine share of the labor force data and productivity levels in manufacturing. These data indicate that productivity improved considerably during the 1980s, rising from an index value of 100 to 167 over the decade (Taiwan Council, 1996, p. 24). This level of increase tracks the growth in S/E's share of the labor force.

¹³Two 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 both scientists and engineers are rather low, at .30 (there is no threshold for significant concentration). The coefficients of variation for scientists and engineers are 1.40 and 1.39, respectively.

¹⁴Due to incomplete data on gross domestic product by sector, this comparison is based upon sectors that comprise 94 percent of GDP and S/E.

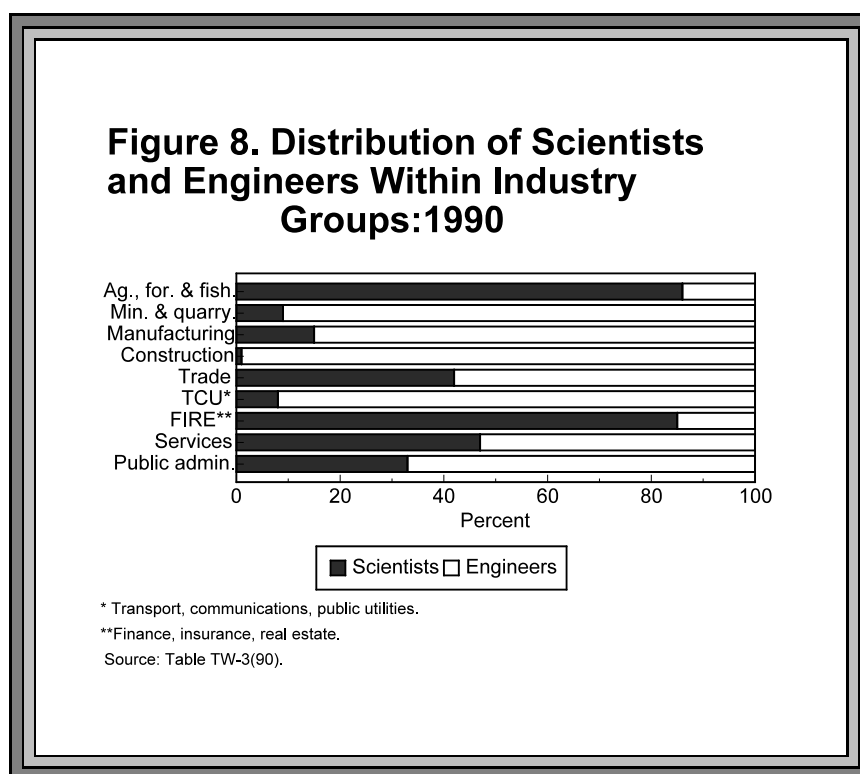
Figure 7. Scientists and Engineers by Industry: 1990



* Transport, communications & Public utilities.
Source: Table TW-3(90).

Hiring preferences vary widely across industries.

Most industries exhibit a marked hiring preference for either scientists or engineers (Figure 8). Since scientists and engineers study different disciplines and develop different skills, hiring practices probably reflect a matching process based on technological considerations. Agriculture, forestry and fishing (as a single category), and finance, insurance and real estate (also as a single category) generally employ scientists. By way of comparison, the mining & quarrying, manufacturing, construction, and the trade, communications and utilities (as a single category) sectors opt for engineers. Trade, services, and public administration are split more evenly between the two occupation groups. Construction has the most pronounced imbalance, with engineers comprising 99 percent of S/E (Table TW-3(90)).



S/E employment in manufacturing is focused in a few industries.

Seventy-nine percent of scientists and engineers in manufacturing work in just two sub-sectors (Table TW-4(90)). The largest employer of S/E in manufacturing (machinery & equipment) (Figure 9) employs 63 percent of the group's S/E, and the second largest (chemicals & related products) employs 15 percent.¹⁵ The average of the other sectors is just 4 percent.¹⁶

Manufacturing is important to Taiwan's export-oriented economy. Manufacturing has the highest share of GDP of any economic sector, at 28 percent in 1995, albeit having fallen from 33 percent in 1990 (Taiwan Council, 1996, p. 38). Taiwan is a key producer of electronics and petrochemicals (The International, 1997, p. 1). It is the world's leading exporter of computer scanners, mice, motherboards and modems, and produces one-fourth of the world's 8-inch silicon wafers (U.S. Information Agency, 1997, p. 4).¹⁷

There is ample evidence of dynamic adjustments in the economy. Taiwan is attempting to create an aircraft industry, bypassing the development of basic industries, such as steel and automobiles, which are comparatively small in Taiwan (Reier and Morris, 1993, p. 55).¹⁸ Moreover, as the targeted export industries have grown, the older sectors have declined. Integrated circuit production rose nearly eight-fold since the mid-1980s, while television, radio, calculator, and electronic watch output declined (Taiwan Council, 1996, p. 88). High-technology's share of total exports doubled from 1982 to 1995, from 18 to 36 percent, although no precise definition of the term is offered (Taiwan Council, 1996, p. 190).

Taiwan's high-technology export sectors continue to develop, despite limited private sector support for research. Many Taiwan firms reportedly view R&D as beyond

¹⁵The sums of the two sectors round to 79 percent.

¹⁶The H Indexes for scientists and engineers are .46 and .42, respectively, and the coefficients of variation are 2.06 and 1.90, respectively.

¹⁷In 1995, including Taiwan's firms located abroad, information technology firms' output was valued at U.S. \$21.3 billion, making Taiwan the world's third largest computer hardware exporter (R.O.C. Government Information Office, 1997b, p. 1).

¹⁸One indication of the nascent development of Taiwan's automotive industry is that there are twice as many motorcycles as cars in use (a situation seen in other Asian countries, such as Japan, earlier in their development) (Taiwan Council, 1996, p. 110).

the focus of their businesses (Yeh, 1996, p. 11).¹⁹ Manufacturing firms spent just 1.3 percent of their sales revenue on R&D in 1992 (Lee, 1996, p. 50). The government stepped in to fill the breach, in 1994, by providing 48 percent of Taiwan's R&D funds (although businesses perform most R&D), while encouraging increased private sector R&D spending (Taiwan Council, 1996, pp. 103, 105; Wang, 1995/6, p. 551; and Figure 10).²⁰ The new program provides support funds and tax incentives to spur development of targeted industries and technologies (Lee, 1996, p. 40). These have been used to encourage Taiwan's computer companies to raise R&D expenditures to 5 percent of revenues (Gwynne, 1993, p. 12).

Taiwan's authorities have set up new avenues for performing R&D. Government research laboratories, working with Taiwan's companies, create products that are in the public domain. Thus, Taiwan's authorities seek to help develop technology, rather than to decide which firms benefit. Much of this research occurs in research parks, bringing together large and small companies, along with academic and other research organizations. The example of the Hsinchu Science-Based Industrial Park illustrates how the authorities require firms to spend a set share of revenues on R&D and employ a specific share of scientists and engineers in their workforce (Gwynne, 1993, p. 12). These parks tend to focus on specific technologies: the Hsinchu park initially stressed development of computers, and later telecommunications. More recently, it has devoted its energies to biotechnology (Swinbanks, 1995, p. 2).

Taiwan firms also have learned to produce increasingly advanced technology through joint ventures with international high-technology companies (Vambery and Tae, 1993, p. 51). Taiwan's pollution control equipment industry is a good example of the benefits of such agreements. Taiwan firms now produce equipment that meets the pollution control requirements of small- to medium-sized firms (U.S. Information Agency, 1997, p. 18). Taiwan companies have sought to work with British and French firms to jointly develop regional commercial jets (Reier and Morris, 1993, p. 54). Taiwan firms also have gained access to modern technology by obtaining licenses to produce foreign products, most notably increasingly advanced consumer electronic products (Vambery and Tae, 1993, p. 51).

Despite Taiwan's success in high-technology exports, many high-technology sectors, nevertheless, trail international leaders in quality. Sectors experiencing

¹⁹Most R&D spending is for engineering. In 1994, approximately 72 percent of R&D was for engineering, 9 percent for agricultural science, 8 percent for natural science, 6 percent for medical science, and 4 percent for humanities and social sciences (Taiwan Council, 1996, p. 106).

²⁰In FY97, most of the funds, valued at US\$515 million, went for basic research and overall scientific development. Smaller shares were spent on research for aerospace, advanced computing, and precision instruments (R.O.C. Government Information Office, 1997a, p. 1).

problems include electronic industry products and components, plastic materials and resins, industrial process controls, and chemical industry equipment (U.S. Information Agency, 1997, pp. 18, 19). Some writers attribute quality control problems to underinvestment in R&D. While Taiwan's share of GDP devoted to R&D is comparable to other leading countries (Figure 11), R&D funding parity is a recent phenomenon. R&D's share of GDP rose from .96 to 1.8 percent between 1984 and 1994 (Taiwan Council, 1996, p. 103).

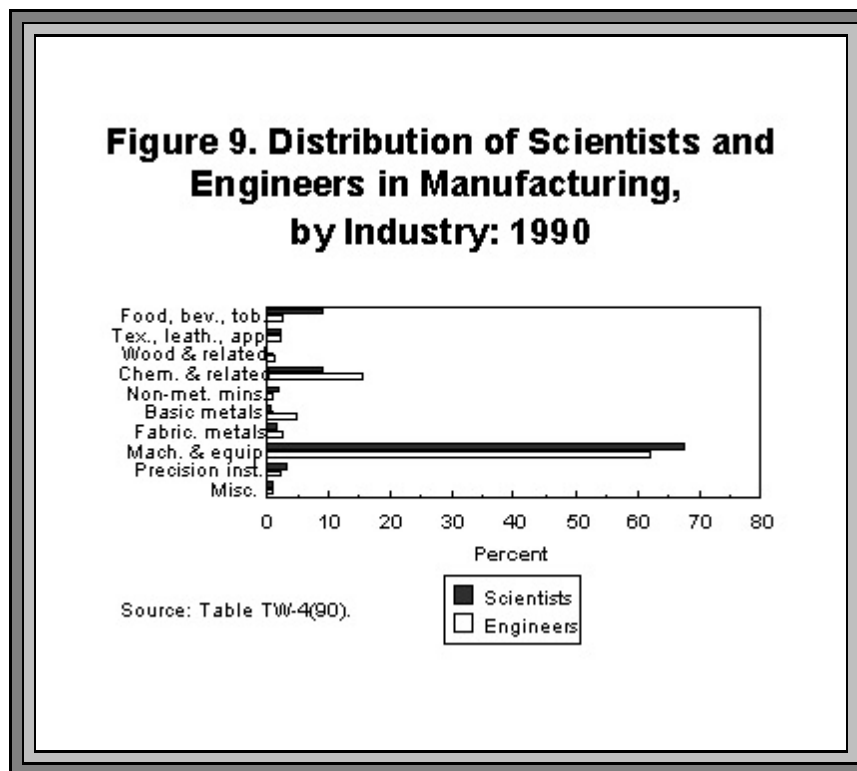
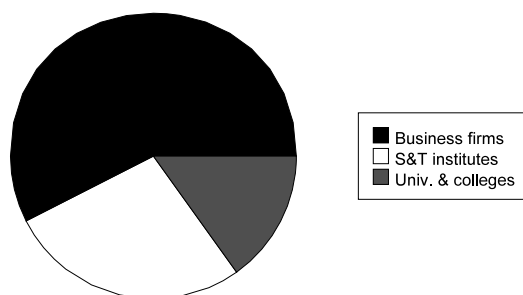
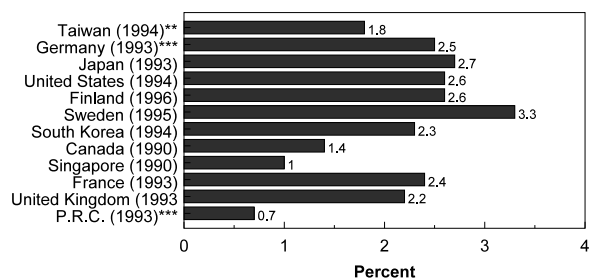


Figure 10. Research & Development by Sector of Performance: 1994



Source: Taiwan Statistical Data Book 1996, 1996, p. 105.

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

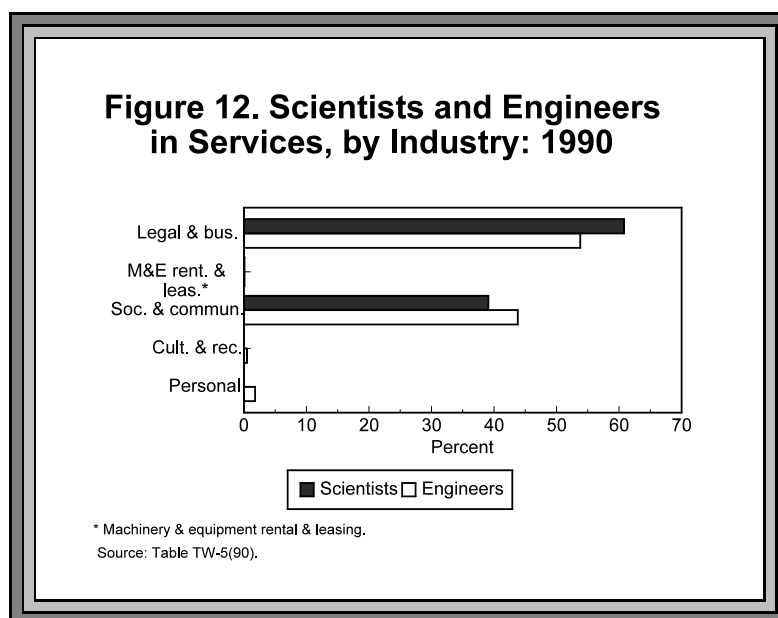


* Research and Development; ** Excl. defense R&D; ** Estimate
 Source: Taiwan Council, 1996, pp. 103, 106;
 Zaslou, 1997a, p. 14.

Service industry's S/E are concentrated in two sectors.

Ninety-nine percent of service industry scientists and engineers provide legal and business services, and social and community services (Table TW-5(90); and Figure 12).²¹ Negligible numbers of S/E work in the remaining service sectors: machinery and equipment rental and leasing; cultural and recreational services; and personal services. Taiwan and Japan are the only areas covered in this series for which sex selection/role modeling has a negligible effect on the service sector employing a scientist or engineer (Zaslow, 1996b, pp. 28, 29). By themselves, males are concentrated only slightly more in legal and business services than are females, with 58 and 54 percent, respectively of service sector S/E in that subsector.

As for sectoral concentration, the pattern of employment among Taiwan's scientists in services is similar to that found in Canada, Britain, and Sweden, which have H Indexes of .50, .49 and .48, respectively. Taiwan's share of scientists in legal and business services most closely matches that of Canada (61 and 60 percent, respectively) (Zaslow, 1996a, p. 33; and Table TW-5(90)). For engineers, Taiwan's level of concentration (measured by its H Index) is most similar to that of South Korea (.48 and .43, respectively). Taiwan's engineers are concentrated in business and related services far less than other countries in this series (except South Korea).



²¹The H Indexes for scientists and engineers are .52 and .48, respectively. Their respective coefficients of variation are 1.42 and 1.33.

Nearly all scientists and engineers have college degrees.

Ninety-one percent of all S/E graduated college, most frequently with a 4-year degree (Table TW-6(90); and Figure 13). A higher share of engineers than scientists have some type of college degree--92 and 88 percent, respectively. Each level of college (junior college, college and university, and graduate school) produces substantial shares of S/E. Nearly identical shares of male and female S/E graduate college (91 and 90 percent, respectively). Among less-educated S/E, most graduated senior vocational, or high school.²²

For many years, shortages of college openings led many future scientists and engineers to study abroad, notably in the United States.²³ In 1994-95, 33,500 undergraduate and graduate students from Taiwan studied science and engineering in the United States (Swinbanks, 1995, p. 4). Only about 1,000 have returned each year, depleting Taiwan's S/E talent pool (Swinbanks, 1994, p. 2).²⁴ In response, Taiwan has expanded graduate education, with enrollment nearly doubling between 1990 and 1995. Another means to expand the ranks of scientists and engineers has been the authorities' recruiting abroad to fill S/E positions in Taiwan and with Taiwan's companies and research institutes in the United States (U.S. Department of State, 1995, p. 2; Directorate-General, 1996, p. 77; and Chang, 1992, p. 27). As a result, overall numbers of S/E, including some notable U.S.-trained scientists and engineers, have grown through repatriation and strengthened Taiwan's academic research base (Swinbanks, 1995, p. 3).²⁵

Scientists and engineers' education levels far exceed those of Taiwan's employed labor force. In 1990, 18 percent of the employed labor force, aged 15 and older, had a college degree. Most degrees were for completion of junior college, with smaller shares for 4-year and graduate study (Taiwan Census Office, 1992, pp. 912, 915). More generally, for the population as a whole, the high level of education is said to be a key factor in Taiwan's economic success (Lee, et.al., 1994, pp. 441, 442).

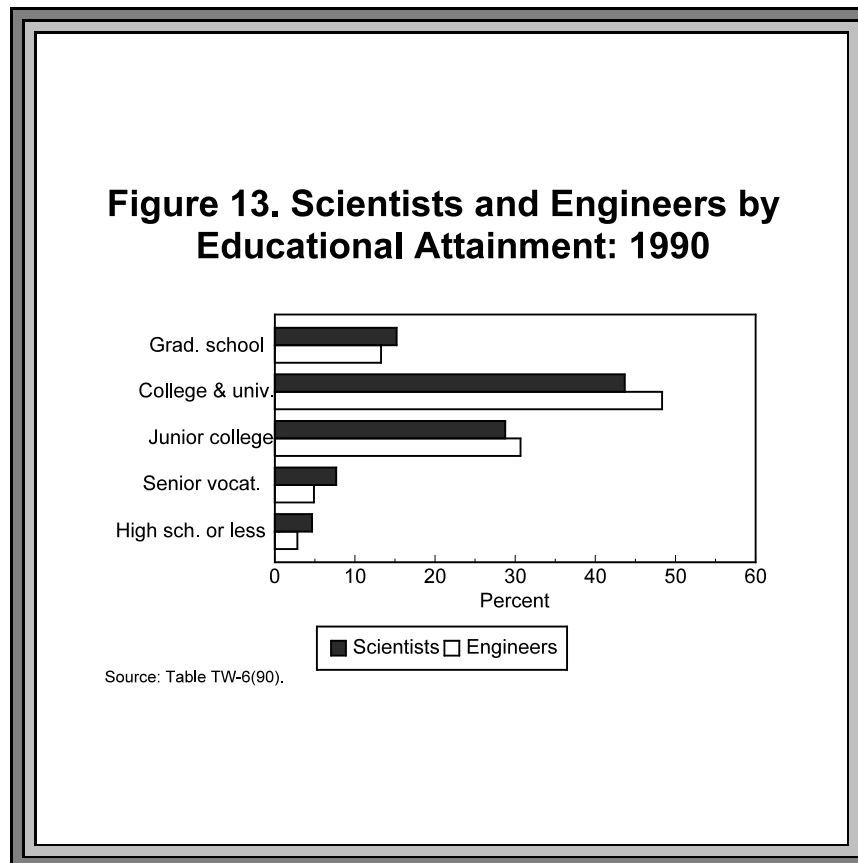
²²Overall, education levels among S/E changed little during the 1980s. The Pearson r coefficient, measuring the extent of a linear relationship between S/E education levels in 1980 and 1990, was .97.

²³On average, about 37,000 students leave Taiwan each year for graduate study in the United States in all academic disciplines (U.S. Department of State, 1995, p. 2). Presumably, most are future scientists and engineers.

²⁴Many former students from Taiwan find jobs in computer industries; it is reported that one-third of the researchers in Silicon Valley are from Taiwan-- this may refer to children of immigrants from Taiwan, as well as those who left Taiwan for study in the United States (Swinbanks, 1995, p. 4).

²⁵Over one-third of students (including both undergraduates and graduates) returning to Taiwan have degrees in science, engineering or medicine (Swinbanks, 1995, p. 3).

Among areas reported upon in this series, Taiwan's S/E are in the upper range in education. Taiwan's 61 percent of S/E with a 4-year degree is similar to Canada's 62 percent, while its share exceeding high school surpasses most areas in this series (except for South Korea's 99.8 percent) (Zaslow, 1996a, p. 36; and Zaslow, 1997b, p. 31).



Conclusions

Taiwan's concentration of scientists and engineers in its economically active population lies at the low end of the scale of areas in this series. The age structure of Taiwan's scientists and engineers is skewed more toward the younger age groups than is Taiwan's overall labor force. Males predominate among scientists and engineers, accounting for 87 percent of S/E. In this respect, Taiwan's sex distribution most closely resembles Britain, where males account for 89 percent of S/E. Taiwan's scientist and engineer sex distribution contrasts sharply with that of its labor force and economically active population. The splits are 66-34 and 50-50, male to female. Female scientists and engineers are concentrated more heavily in the younger age groups than males, and exhibit less of a preference for science over engineering or engineering over science than males.

Tables

Table		Page
TW-1(90)	Scientists and Engineers by Age and Sex, for Taiwan: 1990	21-23
TW-2(90)	Scientists and Engineers by Employment Status and Sex, for Taiwan: 1990	24-26
TW-3(90)	Scientists and Engineers by Industry and Sex, for Taiwan: 1990 . .	27-29
TW-4(90)	Scientists and Engineers by Manufacturing Industry and Sex, for Taiwan: 1990	30-32
TW-5(90)	Scientists and Engineers by Service Industry and Sex, for Taiwan: 1990	33-35
TW-6(90)	Scientists and Engineers by Educational Attainment and Sex, for Taiwan: 1990	36-38

TW-1(90)

Table 1. Scientists and Engineers by Age and Sex, for Taiwan:
1990

Both
Sexes

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
TOTAL SCIENTISTS AND ENGINEERS	92,499	7,628	28,486	22,508	14,814	8,582	4,298	2,773	1,748	1,121	541
SCIENTISTS	22,621	3,237	8,552	5,224	2,627	1,199	679	509	305	229	60
Physical/Chemical Scientists & Related Spec.	1,363	85	352	351	234	164	68	46	22	32	9
Biological Scientists & Rel. Spec.	4,014	354	714	653	664	471	416	365	223	134	20
Statisticians, Mathematicians, Systems Analysts & Related Technicians	16,527	2,729	7,250	4,064	1,623	508	167	84	41	38	23
Economists	717	69	236	156	106	56	28	14	19	25	8
ENGINEERS	69,878	4,391	19,934	17,284	12,187	7,383	3,619	2,264	1,443	892	481
Architects and Urban Planners	4,979	262	1,105	1,070	943	672	373	159	127	123	145
Civil Engineers	10,840	489	2,350	2,292	2,096	1,534	769	565	374	219	152
Electrical and Electronic Engineers	24,852	2,095	8,673	6,599	3,723	1,839	888	507	287	186	55
Mechanical Engineers	12,101	650	3,318	3,097	2,237	1,337	621	377	260	162	42
Chemical Engineers	5,385	247	1,370	1,317	1,050	640	322	235	127	49	28
Metallurgists	526	12	122	157	141	47	23	11	9	3	1
Mining Engineers	396	6	51	70	83	78	51	33	16	4	4
Industrial Engineers	3,415	195	1,006	840	638	376	153	102	58	35	12
Other Engineers and Specialists	7,384	435	1,939	1,842	1,276	860	419	275	185	111	42

TW-1(90)

Table 1. Scientists and Engineers by Age and Sex, for Taiwan: 1990--Continued

Male

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
TOTAL SCIENTISTS AND ENGINEERS	80,770	4,631	23,899	20,195	13,788	8,088	4,142	2,701	1,706	1,094	526
SCIENTISTS	15,984	1,325	5,980	3,990	2,089	974	599	474	284	214	55
Physical/Chemical Scientists & Related Spec.	1,136	41	276	290	212	149	66	44	21	29	8
Biological Scientists & Rel. Spec.	3,000	98	420	467	525	398	384	350	211	127	20
Statisticians, Mathematicians, Systems Analysts & Related Technicians	11,368	1,175	5,151	3,126	1,263	377	125	66	33	33	19
Economists	480	11	133	107	89	50	24	14	19	25	8
ENGINEERS	64,786	3,306	17,919	16,205	11,699	7,114	3,543	2,227	1,422	880	471
Architects and Urban Planners	4,535	173	934	984	898	643	363	155	123	119	143
Civil Engineers	10,282	362	2,160	2,176	2,032	1,498	757	559	370	218	150
Electrical and Electronic Engineers	22,940	1,606	7,848	6,226	3,593	1,771	871	504	285	184	52
Mechanical Engineers	11,791	593	3,193	3,032	2,202	1,321	614	375	260	159	42
Chemical Engineers	4,746	137	1,126	1,167	978	600	314	223	124	49	28
Metallurgists	510	11	113	155	138	47	23	11	8	3	1
Mining Engineers	377	4	43	68	80	76	50	32	16	4	4
Industrial Engineers	3,046	124	857	762	598	356	149	100	56	34	10
Other Engineers and Specialists	6,559	296	1,645	1,635	1,180	802	402	268	180	110	41

TW-1(90)

Table 1. Scientists and Engineers by Age and Sex, for Taiwan: 1990--Continued

Female

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
TOTAL SCIENTISTS AND ENGINEERS	11,729	2,997	4,587	2,313	1,026	494	156	72	42	27	15
SCIENTISTS	6,637	1,912	2,572	1,234	538	225	80	35	21	15	5
Physical/Chemical Scientists & Related Spec.	227	44	76	61	22	15	2	2	1	3	1
Biological Scientists & Rel. Spec.	1,014	256	294	186	139	73	32	15	12	7	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	5,159	1,554	2,099	938	360	131	42	18	8	5	4
Economists	237	58	103	49	17	6	4	0	0	0	0
ENGINEERS	5,092	1,085	2,015	1,079	488	269	76	37	21	12	10
Architects and Urban Planners	444	89	171	86	45	29	10	4	4	4	2
Civil Engineers	558	127	190	116	64	36	12	6	4	1	2
Electrical and Electronic Engineers	1,912	489	825	373	130	68	17	3	2	2	3
Mechanical Engineers	310	57	125	65	35	16	7	2	0	3	0
Chemical Engineers	639	110	244	150	72	40	8	12	3	0	0
Metallurgists	16	1	9	2	3	0	0	0	1	0	0
Mining Engineers	19	2	8	2	3	2	1	1	0	0	0
Industrial Engineers	369	71	149	78	40	20	4	2	2	1	2
Other Engineers and Specialists	825	139	294	207	96	58	17	7	5	1	1
Source: "An Extract Report on the 1990 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part I," 1992, pp. 898-901.											

TW-2(90)

Table 2. Scientists and Engineers by Employment Status and Sex, for Taiwan: 1990

Both
Sexes

Occupation	Total	Employers	Self- Employed	Total Employees	Private Sector Employees	Government Employees	Unpaid Family Workers
TOTAL SCIENTISTS AND ENGINEERS	92,499	692	1,633	90,044	60,763	29,281	130
SCIENTISTS	22,621	66	328	22,201	15,303	6,898	26
Physical/Chemical Scientists & Related Spec.	1,363	3	4	1,355	259	1,096	1
Biological Scientists & Rel. Spec.	4,014	4	25	3,978	892	3,086	7
Statisticians, Mathematicians, Systems Analysts & Related Technicians	16,527	55	280	16,174	13,697	2,477	18
Economists	717	4	19	694	455	239	0
ENGINEERS	69,878	626	1,305	67,843	45,460	22,383	104
Architects and Urban Planners	4,979	406	881	3,678	2,966	712	14
Civil Engineers	10,840	90	270	10,453	6,413	4,040	27
Electrical and Electronic Engineers	24,852	57	71	24,705	18,285	6,420	19
Mechanical Engineers	12,101	30	30	12,019	7,599	4,420	22
Chemical Engineers	5,385	9	3	5,368	3,379	1,989	5
Metallurgists	526	3	1	522	197	325	0
Mining Engineers	396	1	2	393	64	329	0
Industrial Engineers	3,415	9	10	3,395	2,177	1,218	1
Other Engineers and Specialists	7,384	21	37	7,310	4,380	2,930	16

TW-2(90)

Table 2. Scientists and Engineers by Employment Status and Sex, for Taiwan: 1990--Continued

Male

Occupation	Total	Employers	Self-Employed	Total Employees	Private Sector Employees	Government Employees	Unpaid Family Workers
TOTAL SCIENTISTS AND ENGINEERS	80,770	654	1,535	78,488	52,430	26,058	93
SCIENTISTS	15,984	55	289	15,629	10,626	5,003	11
Physical/Chemical Scientists & Related Spec.	1,136	1	4	1,131	192	939	0
Biological Scientists & Rel. Spec.	3,000	3	21	2,975	599	2,376	1
Statisticians, Mathematicians, Systems Analysts & Related Technicians	11,368	47	251	11,060	9,530	1,530	10
Economists	480	4	13	463	305	158	0
ENGINEERS	64,786	599	1,246	62,859	41,804	21,055	82
Architects and Urban Planners	4,535	389	846	3,290	2,646	644	10
Civil Engineers	10,282	86	261	9,911	6,025	3,886	24
Electrical and Electronic Engineers	22,940	56	64	22,806	16,704	6,102	14
Mechanical Engineers	11,791	29	29	11,715	7,400	4,315	18
Chemical Engineers	4,746	8	2	4,732	2,985	1,747	4
Metallurgists	510	3	0	507	188	319	0
Mining Engineers	377	1	2	374	63	311	0
Industrial Engineers	3,046	8	10	3,027	1,920	1,107	1
Other Engineers and Specialists	6,559	19	32	6,497	3,873	2,624	11

TW-2(90)

Table 2. Scientists and Engineers by Employment Status and Sex, for Taiwan: 1990--Continued Female

Occupation	Total	Employers	Self-Employed	Total Employees	Private Sector Employees	Government Employees	Unpaid Family Workers
TOTAL SCIENTISTS AND ENGINEERS	11,729	38	98	11,556	8,333	3,223	37
SCIENTISTS	6,637	11	39	6,572	4,677	1,895	15
Physical/Chemical Scientists & Related Spec.	227	2	0	224	67	157	1
Biological Scientists & Rel. Spec.	1,014	1	4	1,003	293	710	6
Statisticians, Mathematicians, Systems Analysts & Related Technicians	5,159	8	29	5,114	4,167	947	8
Economists	237	0	6	231	150	81	0
ENGINEERS	5,092	27	59	4,984	3,656	1,328	22
Architects and Urban Planners	444	17	35	388	320	68	4
Civil Engineers	558	4	9	542	388	154	3
Electrical and Electronic Engineers	1,912	1	7	1,899	1,581	318	5
Mechanical Engineers	310	1	1	304	199	105	4
Chemical Engineers	639	1	1	636	394	242	1
Metallurgists	16	0	1	15	9	6	0
Mining Engineers	19	0	0	19	1	18	0
Industrial Engineers	369	1	0	368	257	111	0
Other Engineers and Specialists	825	2	5	813	507	306	5

Source:

"An Extract Report on the 1990 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part 1," 1992, pp. 924-927.

TW-3(90)

Table 3. Scientists and Engineers by Industry and Sex, for Taiwan: 1990

Both
Sexes

Occupation	Total	Agriculture, Forestry, & Fishing	Mining & Quarrying	Manufac- turing	Construc- tion	Whole- sale & Retail Trade	Transport & Commun. & Public Utilities	Finance, Insurance, & Real Estate	Services	Public Admin.
TOTAL SCIENTISTS AND ENGINEERS	92,499	857	464	40,104	10,756	2,522	8,124	1,731	22,278	5,663
SCIENTISTS	22,621	734	40	6,087	160	1,065	649	1,467	10,541	1,878
Physical/Chemical Scientists & Related Spec.	1,363	0	21	157	0	0	50	0	802	333
Biological Scientists & Rel. Spec.	4,014	728	0	451	10	0	2	0	2,220	603
Statisticians, Mathematicians, Systems Analysts & Related Technicians	16,527	6	19	5,472	147	1,047	593	1,132	7,216	895
Economists	717	0	0	7	3	18	4	335	303	47
ENGINEERS	69,878	123	424	34,017	10,596	1,457	7,475	264	11,737	3,785
Architects and Urban Planners	4,979	28	1	56	1,700	5	67	56	2,760	306
Civil Engineers	10,840	28	25	435	6,903	38	817	62	1,820	712
Electrical and Electronic Engineers	24,852	11	28	15,899	718	710	3,629	84	2,932	841
Mechanical Engineers	12,101	10	36	7,631	508	312	1,493	17	1,277	817
Chemical Engineers	5,385	4	79	4,007	76	45	217	1	705	251
Metallurgists	526	1	10	456	0	1	8	0	36	14
Mining Engineers	396	1	174	161	3	6	4	0	36	11
Industrial Engineers	3,415	2	18	1,895	157	108	282	10	745	198
Other Engineers and Specialists	7,384	38	53	3,477	531	232	958	34	1,426	635

TW-3(90)

Table 3. Scientists and Engineers by Industry and Sex, for Taiwan: 1990--Continued

Male

Occupation	Total	Agriculture, Forestry, & Fishing	Mining & Quarrying	Manufac- turing	Construc- tion	Whole- sale & Retail Trade	Transport & Commun. & Public Utilities	Finance, Insurance, & Real Estate	Services	Public Admin.
TOTAL SCIENTISTS AND ENGINEERS	80,770	754	431	35,974	10,162	2,065	7,632	1,217	17,785	4,750
SCIENTISTS	15,984	643	33	4,416	103	697	445	983	7,377	1,287
Physical/Chemical Scientists & Related Spec.	1,136	0	19	128	0	0	46	0	645	298
Biological Scientists & Rel. Spec.	3,000	637	0	402	9	0	2	0	1,476	474
Statisticians, Mathematicians, Systems Analysts & Related Technicians	11,368	6	14	3,879	91	685	394	740	5,073	486
Economists	480	0	0	7	3	12	3	243	183	29
ENGINEERS	64,786	111	398	31,558	10,059	1,368	7,187	234	10,408	3,463
Architects and Urban Planners	4,535	21	1	54	1,584	4	61	50	2,492	268
Civil Engineers	10,282	28	24	412	6,590	36	798	58	1,671	665
Electrical and Electronic Engineers	22,940	10	28	14,559	691	670	3,515	75	2,613	779
Mechanical Engineers	11,791	9	35	7,440	494	304	1,470	17	1,230	792
Chemical Engineers	4,746	2	71	3,634	69	40	185	1	538	206
Metallurgists	510	0	10	447	0	0	7	0	33	13
Mining Engineers	377	1	165	154	3	6	4	0	33	11
Industrial Engineers	3,046	2	17	1,735	139	97	263	9	615	169
Other Engineers and Specialists	6,559	38	47	3,123	489	211	884	24	1,183	560

TW-3(90)

Table 3. Scientists and Engineers by Industry and Sex, for Taiwan: 1990--Continued

Female

Occupation	Total	Agriculture, Forestry, & Fishing	Mining & Quarrying	Manufac- turing	Construc- tion	Whole- sale & Retail Trade	Transport & Commun. & Public Utilities	Finance, Insurance, & Real Estate	Services	Public Admin.
TOTAL SCIENTISTS AND ENGINEERS	11,729	103	33	4,130	594	457	492	514	4,493	913
SCIENTISTS	6,637	91	7	1,671	57	368	204	484	3,164	591
Physical/Chemical Scientists & Related Spec.	227	0	2	29	0	0	4	0	157	35
Biological Scientists & Rel. Spec.	1,014	91	0	49	1	0	0	0	744	129
Statisticians, Mathematicians, Systems Analysts & Related Technicians	5,159	0	5	1,593	56	362	199	392	2,143	409
Economists	237	0	0	0	0	6	1	92	120	18
ENGINEERS	5,092	12	26	2,459	537	89	288	30	1,329	322
Architects and Urban Planners	444	7	0	2	116	1	6	6	268	38
Civil Engineers	558	0	1	23	313	2	19	4	149	47
Electrical and Electronic Engineers	1,912	1	0	1,340	27	40	114	9	319	62
Mechanical Engineers	310	1	1	191	14	8	23	0	47	25
Chemical Engineers	639	2	8	373	7	5	32	0	167	45
Metallurgists	16	1	0	9	0	1	1	0	3	1
Mining Engineers	19	0	9	7	0	0	0	0	3	0
Industrial Engineers	369	0	1	160	18	11	19	1	130	29
Other Engineers and Specialists	825	0	6	354	42	21	74	10	243	75

Source:

"An Extract Report on the 1990 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part I," 1992, pp. 800-859.

TW-4(90)

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

Both
Sexes

Occupation	Total	Food, Beverages & Tobacco	Textiles, Leather & Apparel	Wood & Wood Prods.	Chemicals & Related Products	Non- Metallic Minerals	Basic Metals	Fabri- cated Metals	Machinery & Equip.	Precision Instr.	Misc. Mfg.
TOTAL SCIENTISTS AND ENGINEERS	40,104	1,651	1,137	515	6,067	540	1,907	1,184	25,436	1,136	531
SCIENTISTS	6,087	580	169	20	579	144	52	112	4,137	217	77
Physical/Chemical Scientists & Related Spec.	157	6	0	0	112	2	4	1	20	12	0
Biological Scientists & Rel. Spec.	451	377	0	0	74	0	0	0	0	0	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	5,472	197	169	20	393	139	48	107	4,117	205	77
Economists	7	0	0	0	0	3	0	4	0	0	0
ENGINEERS	34,017	1,071	968	495	5,488	396	1,855	1,072	21,299	919	454
Architects and Urban Planners	56	4	0	3	18	0	9	4	16	0	2
Civil Engineers	435	68	5	17	97	27	49	18	138	6	10
Electrical and Electronic Engineers	15,899	95	100	78	397	36	298	141	14,273	421	60
Mechanical Engineers	7,631	181	189	89	790	76	644	543	4,779	251	89
Chemical Engineers	4,007	286	151	48	3,170	52	54	27	161	27	31
Metallurgists	456	1	2	0	15	0	339	87	9	1	2
Mining Engineers	161	0	0	0	129	16	11	3	2	0	0
Industrial Engineers	1,895	97	93	33	315	38	233	113	862	56	55
Other Engineers and Specialists	3,477	339	428	227	557	151	218	136	1,059	157	205

TW-4(90)

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

Male

Occupation	Total	Food, Beverages & Tobacco	Textiles, Leather & Apparel	Wood & Wood Prods.	Chemicals & Related Products	Non- Metallic Minerals	Basic Metals	Fabri- cated Metals	Machinery & Equip.	Precision Instr.	Misc. Mfg.
TOTAL SCIENTISTS AND ENGINEERS	35,974	1,476	985	474	5,488	489	1,857	1,121	22,625	1,008	451
SCIENTISTS	4,416	482	105	11	393	115	38	95	2,968	163	46
Physical/Chemical Scientists & Related Spec.	128	6	0	0	85	2	4	1	19	11	0
Biological Scientists & Rel. Spec.	402	348	0	0	54	0	0	0	0	0	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	3,879	128	105	11	254	110	34	90	2,949	152	46
Economists	7	0	0	0	0	3	0	4	0	0	0
ENGINEERS	31,558	994	880	463	5,095	374	1,819	1,026	19,657	845	405
Architects and Urban Planners	54	4	0	3	17	0	9	4	15	0	2
Civil Engineers	412	68	2	16	94	27	47	16	127	6	9
Electrical and Electronic Engineers	14,559	92	90	70	381	32	297	133	13,029	382	53
Mechanical Engineers	7,440	180	182	84	777	75	634	530	4,653	241	84
Chemical Engineers	3,634	262	138	46	2,880	50	47	24	140	23	24
Metallurgists	447	1	2	0	14	0	334	84	9	1	2
Mining Engineers	154	0	0	0	122	16	11	3	2	0	0
Industrial Engineers	1,735	91	84	31	296	35	230	108	761	50	49
Other Engineers and Specialists	3,123	296	382	213	514	139	210	124	921	142	182

TW-4(90)

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

Female

Occupation	Total	Food, Beverages & Tobacco	Textiles, Leather & Apparel	Wood & Wood Prods.	Chemicals & Related Products	Non- Metallic Minerals	Basic Metals	Fabri- cated Metals	Machinery & Equip.	Precision Instr.	Misc. Mfg.
TOTAL SCIENTISTS AND ENGINEERS	4,130	175	152	71	578	36	53	120	2,737	128	80
SCIENTISTS	1,671	98	64	39	185	14	17	74	1,095	54	31
Physical/Chemical Scientists & Related Spec.	29	0	0	0	27	0	0	0	1	1	0
Biological Scientists & Rel. Spec.	49	29	0	0	20	0	0	0	0	0	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	1,593	69	64	39	138	14	17	74	1,094	53	31
Economists	0	0	0	0	0	0	0	0	0	0	0
ENGINEERS	2,459	77	88	32	393	22	36	46	1,642	74	49
Architects and Urban Planners	2	0	0	0	1	0	0	0	1	0	0
Civil Engineers	23	0	3	1	3	0	2	2	11	0	1
Electrical and Electronic Engineers	1,340	3	10	8	16	4	1	8	1,244	39	7
Mechanical Engineers	191	1	7	5	13	1	10	13	126	10	5
Chemical Engineers	373	24	13	2	290	2	7	3	21	4	7
Metallurgists	9	0	0	0	1	0	5	3	0	0	0
Mining Engineers	7	0	0	0	7	0	0	0	0	0	0
Industrial Engineers	160	6	9	2	19	3	3	5	101	6	6
Other Engineers and Specialists	354	43	46	14	43	12	8	12	138	15	23

Source:

"An Extract Report on the 1990 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part I," 1992, pp. 800-859.

TW-5(90)

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

Both
Sexes

Occupation	Total	Legal & Business Services	Machinery & Equipment Rental & Leasing	Social & Communit y Services	Cultural & Recreational Services	Personal Services
TOTAL SCIENTISTS AND ENGINEERS	22,278	12,722	25	9,264	58	209
SCIENTISTS	10,541	6,406	12	4,122	1	0
Physical/Chemical Scientists & Related Spec.	802	13	0	789	0	0
Biological Scientists & Rel. Spec.	2,220	0	0	2,220	0	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	7,216	6,259	11	945	1	0
Economists	303	134	1	168	0	0
ENGINEERS	11,737	6,316	13	5,142	57	209
Architects and Urban Planners	2,760	2,697	0	53	7	3
Civil Engineers	1,820	1,548	0	246	14	12
Electrical and Electronic Engineers	2,932	1,036	7	1,802	15	72
Mechanical Engineers	1,277	333	6	848	5	85
Chemical Engineers	705	64	0	637	0	4
Metallurgists	36	1	0	35	0	0
Mining Engineers	36	5	0	29	0	2
Industrial Engineers	745	201	0	542	0	2
Other Engineers and Specialists	1,426	431	0	950	16	29

TW-5(90)

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

Male

Occupation	Total	Legal & Business Services	Machinery & Equipment Rental & Leasing	Social & Communit y Services	Cultural & Recreational Services	Personal Services
TOTAL SCIENTISTS AND ENGINEERS	17,785	10,280	21	7,233	53	198
SCIENTISTS	7,377	4,574	8	2,794	1	0
Physical/Chemical Scientists & Related Spec.	645	12	0	633	0	0
Biological Scientists & Rel. Spec.	1,476	0	0	1,476	0	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	5,073	4,475	8	589	1	0
Economists	183	87	0	96	0	0
ENGINEERS	10,408	5,706	13	4,439	52	198
Architects and Urban Planners	2,492	2,442	0	41	6	3
Civil Engineers	1,671	1,422	0	226	14	9
Electrical and Electronic Engineers	2,613	921	7	1,602	12	71
Mechanical Engineers	1,230	322	6	818	5	79
Chemical Engineers	538	53	0	481	0	4
Metallurgists	33	1	0	32	0	0
Mining Engineers	33	4	0	27	0	2
Industrial Engineers	615	177	0	436	0	2
Other Engineers and Specialists	1,183	364	0	776	15	28

TW-5(90)

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

Female

Occupation	Total	Legal & Business Services	Machinery & Equipment Rental & Leasing	Social & Communit y Services	Cultural & Recreational Services	Personal Services
TOTAL SCIENTISTS AND ENGINEERS	4,493	2,442	4	2,031	5	11
SCIENTISTS	3,164	1,832	4	1,328	0	0
Physical/Chemical Scientists & Related Spec.	157	1	0	156	0	0
Biological Scientists & Rel. Spec.	744	0	0	744	0	0
Statisticians, Mathematicians, Systems Analysts & Related Technicians	2,143	1,784	3	356	0	0
Economists	120	47	1	72	0	0
ENGINEERS	1,329	610	0	703	5	11
Architects and Urban Planners	268	255	0	12	1	0
Civil Engineers	149	126	0	20	0	3
Electrical and Electronic Engineers	319	115	0	200	3	1
Mechanical Engineers	47	11	0	30	0	6
Chemical Engineers	167	11	0	156	0	0
Metallurgists	3	0	0	3	0	0
Mining Engineers	3	1	0	2	0	0
Industrial Engineers	130	24	0	106	0	0
Other Engineers and Specialists	243	67	0	174	1	1
Source: "An Extract Report on the 1990 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part I," 1992, pp. 800-859.						

TW-6(90)

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

Both
Sexes

Occupation	Total	Self-Educated	Primary School	Junior H.S.	Senior H.S.	Senior Vocational School	Junior College	College and University	Graduate School
TOTAL SCIENTISTS AND ENGINEERS	92,499	2	34	595	2,399	5,154	27,936	43,664	12,715
SCIENTISTS	22,621	2	34	184	835	1,736	6,507	9,880	3,443
Physical/Chemical Scientists & Related Spec.	1,363	0	0	17	36	64	137	444	665
Biological Scientists & Rel. Spec.	4,014	2	34	96	221	916	917	1,052	776
Statisticians, Mathematicians, Systems Analysts & Related Technicians	16,527	0	0	71	578	756	5,364	8,020	1,738
Economists	717	0	0	0	0	0	89	364	264
ENGINEERS	69,878	0	0	411	1,564	3,418	21,429	33,784	9,272
Architects and Urban Planners	4,979	0	0	69	149	374	1,214	2,566	607
Civil Engineers	10,840	0	0	72	251	644	2,808	5,770	1,295
Electrical and Electronic Engineers	24,852	0	0	88	505	1,172	9,409	10,711	2,967
Mechanical Engineers	12,101	0	0	86	233	593	4,169	5,835	1,185
Chemical Engineers	5,385	0	0	21	91	135	1,063	2,933	1,142
Metallurgists	526	0	0	1	11	14	128	280	92
Mining Engineers	396	0	0	3	20	17	82	181	93
Industrial Engineers	3,415	0	0	14	70	108	843	1,793	587
Other Engineers and Specialists	7,384	0	0	57	234	361	1,713	3,715	1,304

TW-6(90)

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

Male

Occupation	Total	Self-Educated	Primary School	Junior H.S.	Senior H.S.	Senior Vocational School	Junior College	College and University	Graduate School
TOTAL SCIENTISTS AND ENGINEERS	80,770	1	29	529	1,984	4,451	24,263	38,299	11,214
SCIENTISTS	15,984	1	29	140	540	1,263	4,302	7,013	2,696
Physical/Chemical Scientists & Related Spec.	1,136	0	0	14	30	55	111	348	578
Biological Scientists & Rel. Spec.	3,000	1	29	81	162	806	687	679	555
Statisticians, Mathematicians, Systems Analysts & Related Technicians	11,368	0	0	45	348	402	3,442	5,751	1,380
Economists	480	0	0	0	0	0	62	235	183
ENGINEERS	64,786	0	0	389	1,444	3,188	19,961	31,286	8,518
Architects and Urban Planners	4,535	0	0	64	134	336	1,089	2,367	545
Civil Engineers	10,282	0	0	70	235	624	2,625	5,507	1,221
Electrical and Electronic Engineers	22,940	0	0	80	465	1,079	8,743	9,823	2,750
Mechanical Engineers	11,791	0	0	86	219	571	4,085	5,669	1,161
Chemical Engineers	4,746	0	0	19	81	123	915	2,611	997
Metallurgists	510	0	0	1	10	12	124	273	90
Mining Engineers	377	0	0	3	20	17	81	174	82
Industrial Engineers	3,046	0	0	12	62	96	762	1,598	516
Other Engineers and Specialists	6,559	0	0	54	218	330	1,537	3,264	1,156

TW-6(90)

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

Female

Occupation	Total	Self-Educated	Primary School	Junior H.S.	Senior H.S.	Senior Vocational School	Junior College	College and University	Graduate School
TOTAL SCIENTISTS AND ENGINEERS	11,729	1	5	66	415	703	3,673	5,365	1,501
SCIENTISTS	6,637	1	5	44	295	473	2,205	2,867	747
Physical/Chemical Scientists & Related Spec.	227	0	0	3	6	9	26	96	87
Biological Scientists & Rel. Spec.	1,014	1	5	15	59	110	230	373	221
Statisticians, Mathematicians, Systems Analysts & Related Technicians	5,159	0	0	26	230	354	1,922	2,269	358
Economists	237	0	0	0	0	0	27	129	81
ENGINEERS	5,092	0	0	22	120	230	1,468	2,498	754
Architects and Urban Planners	444	0	0	5	15	38	125	199	62
Civil Engineers	558	0	0	2	16	20	183	263	74
Electrical and Electronic Engineers	1,912	0	0	8	40	93	666	888	217
Mechanical Engineers	310	0	0	0	14	22	84	166	24
Chemical Engineers	639	0	0	2	10	12	148	322	145
Metallurgists	16	0	0	0	1	2	4	7	2
Mining Engineers	19	0	0	0	0	0	1	7	11
Industrial Engineers	369	0	0	2	8	12	81	195	71
Other Engineers and Specialists	825	0	0	3	16	31	176	451	148
Source: "An Extract Report on the 1990 Census of Population and Housing Taiwan-Fukein Area, Republic of China, Part I," pp. 912-915.									

Bibliography

- Bureau of Labor Statistics. 1997. "Table 16. Taiwan: Output and Unit Labor Costs, All Employees in Manufacturing, 1970-1996," <<http://stats.bls.gov/news.release/prod4.t16htm>>; (accessed August 28, 1997).
- Canadian Department of Foreign Affairs and International Trade. 1997. "Taiwan," <http://www.dfait-maeci.gc.ca/engli...p/dfait/policy~1/1995/part3_03.html>; (accessed: June 6, 1997).
- Chang, Shirley L. 1992. "Causes of Brain Drain and Solutions: The Taiwan Experience," *Studies in Comparative International Development*, Volume 27, No. 1, Spring, pp. 27-43.
- Chemical & Engineering News*, 1995. "China Is Becoming Silent Giant Behind Pacific Rim Chemical Fortunes," <<http://pubs.acs.org/hotartcl/cenear/951211/prim.html>>; December 11, 1995.
- Directorate-General of Budget, Accounting and Statistics, 1996. *Statistical Yearbook of the Republic of China 1996*.
- Gwynne, Peter. 1993. "Directing Technology in Asia's Dragons," *Research Technology Management*, Volume 32, No. 2, Mar/April, pp. 12-15.
- The International Trade Resources and Data Exchange. 1997. "Taiwan," <<http://sys1.tpusa.com/dir03/mrktinfo/usglobal/taiwan.html>>; (accessed: June 6, 1997).
- Jamison, Ellen. "Scientists and Engineers in Taiwan: 1980," Center for International Research, August 1991.

- Kraemer, Kenneth L., Vijay Gurbaxani and John Leslie King. 1992. "Economic Development, Government Policy, and the Diffusion of Computing in Asia-Pacific Countries," *Public Administration Review*, Volume 52, No. 2, March/April, pp. 146-156.
- Lee, Maw-Lin, Ben-Chieh Liu and Ping Wang. 1994. "Growth and Equity with Endogenous Human Capital: Taiwan's Economic Miracle Revisited," *Southern Economic Journal*, October, pp. 435-444.
- Lee, Wei-Chin. 1996. "The Development of Taiwan's Commercial Aircraft Manufacturing Industry," *Asian Affairs, an American Review*, Volume 23, No. 1, pp. 34-63.
- National Science Board, *Science & Engineering Indicators-1993*. Washington, DC: U.S. Government Printing Office, 1993 (NSB 93-1).
- Reier, Sharon, and Kathleen Morris. 1993. "Britain's Fortune Cookie," *Financial World*, Volume 162, No. 23, November 23, pp. 54-56.
- R.O.C. Government Information Office. 1996. "Science and Technology-1996 R.O.C. Yearbook," <http://www.gio.gov.tw:80/info/yearbook/f_html/ch18_t.html>; (accessed: September 6, 1996).
- _____.1997a. "Public Sector Research," <http://www.gio.gov.tw/info/yb97/html/ch18_1.htm>; (accessed: June 16, 1997).
- _____.1997b. "The Republic of China Yearbook 1997," <<http://www.gio.gov.tw/info/yb97/html>>; (accessed June 26, 1997).

- Swinbanks, David. 1994. "Bioscientists Will Catalyze Next Phase of Growth for Taiwan," *Research Technology Management*, Volume 37, No. 2, March/April, pp. 2,3.
- _____. 1995. "Taiwan Welcoming Home Top Ph.D.s from U.S.," *Research Technology Management*, Volume 38, No. 2, March/April, pp. 3, 4.
- Taiwan Census Office of the Executive Yuan. 1982. "An Extract Report on the 1980 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part I and Part II." Taiwan.
- Taiwan Census Office of the Executive Yuan. 1992. "An Extract Report on the 1990 Census of Population and Housing, Taiwan-Fukien Area, Republic of China, Part I and Part II." Taiwan.
- Taiwan Council for Economic Planning and Development. 1996. *Taiwan Statistical Data Book*, Taiwan.
- U.S. Department of Energy. 1997. "Country Energy Report-Taiwan," http://www.eia.doe.gov/emeu/world/country/entry_TW.html; (accessed June 6, 1997).
- U.S. Department of State. 1995. "Taiwan Report," <http://www.usia.gov/abtusia/posts/HK1/wwwhtai3.html> published: September 1995.
- U.S. Information Agency. 1997. "Country Commercial Guide: Taiwan, Fiscal Year 1997," <http://www.usia.gov/abtusia/posts/HK1/wwwhtai8.html>; (accessed June 6, 1997).
- Vambery, Robert G., and Yun Um Tae. 1993. "Global Export Strategy: High Technology Transfer Model For Accelerating Developing Country Growth," *Multinational Business Review*, Volume 1, Issue 2, Fall, pp. 47-56.

- Wang, Vincent Wei-cheng. 1995/6. "Developing the Information Industry in Taiwan: Entrepreneurial State, Guerrilla Capitalists, and Accomodative Technologists," *Pacific Affairs*, Winter, Volume 68, No. 4, p. 551.
- Yeh, Quey-Jen. 1996. "Relating Management Practices to Job Characteristics of R&D: The Case of Taiwan," *Asia Pacific Journal of Management*, Volume 13, No. 1, April, pp. 1-18.
- Zaslow, David. 1996a. "Scientists and Engineers in Canada: 1991," IPC Staff Paper No. 82. International Programs Center, U.S. Bureau of the Census. Washington, D.C.
- _____. 1996b. "Scientists and Engineers in Japan: 1990," IPC Staff Paper No. 81. International Programs Center, U.S. Bureau of the Census. Washington, D.C.
- _____. 1997a. "Scientists and Engineers in Finland: 1993," IPC Staff Paper 91. International Programs Center, U.S. Bureau of the Census. Washington, D.C.
- _____. 1997b. "Scientists and Engineers in South Korea: 1990," IPC Staff Paper No. 87. International Programs Center, U.S. Bureau of the Census. Washington, D.C.