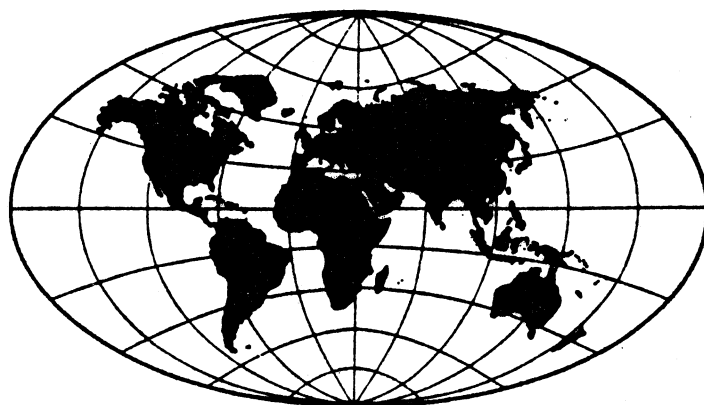


SCIENTISTS AND ENGINEERS IN SOUTH KOREA: 1990

by

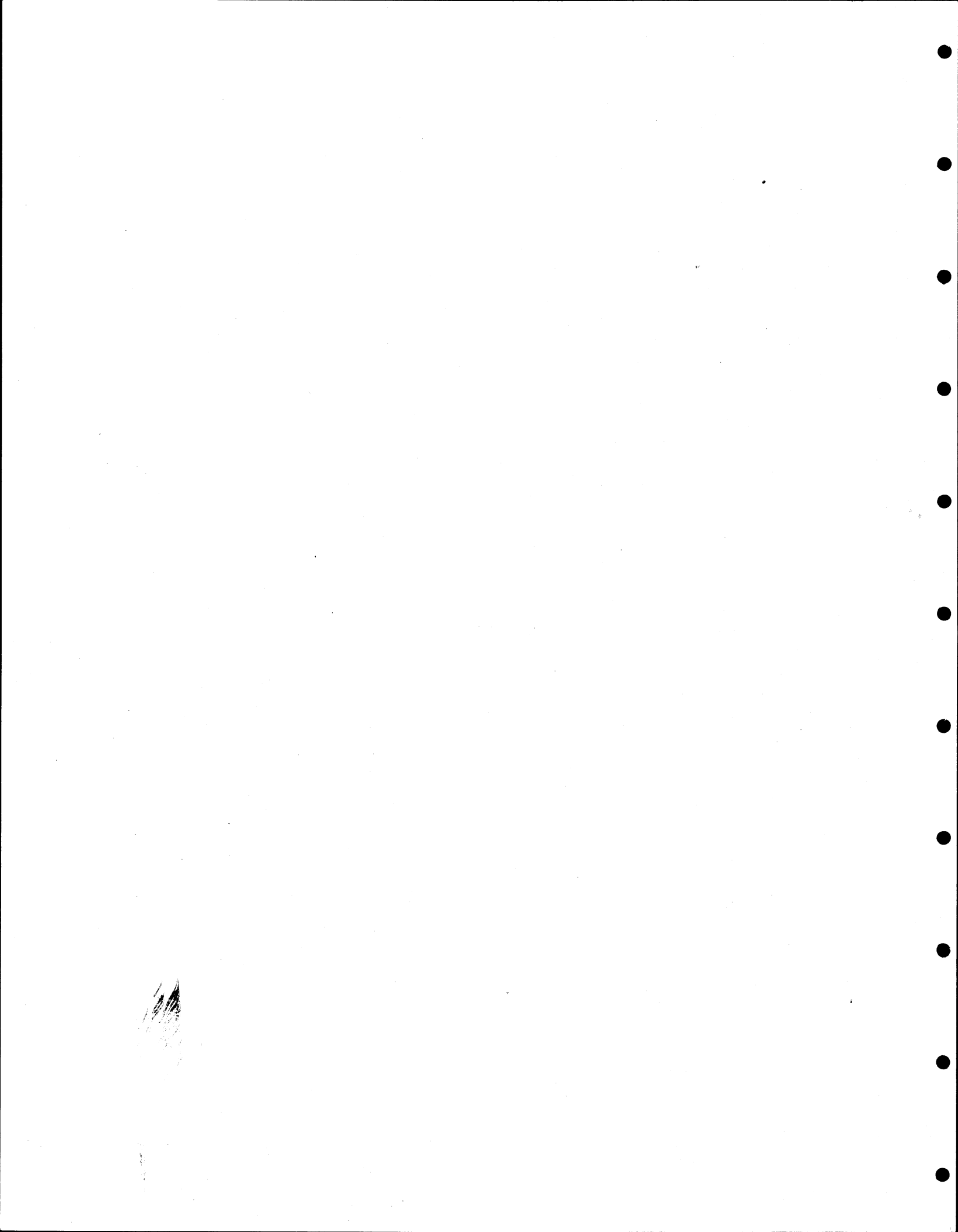
David Zaslow



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

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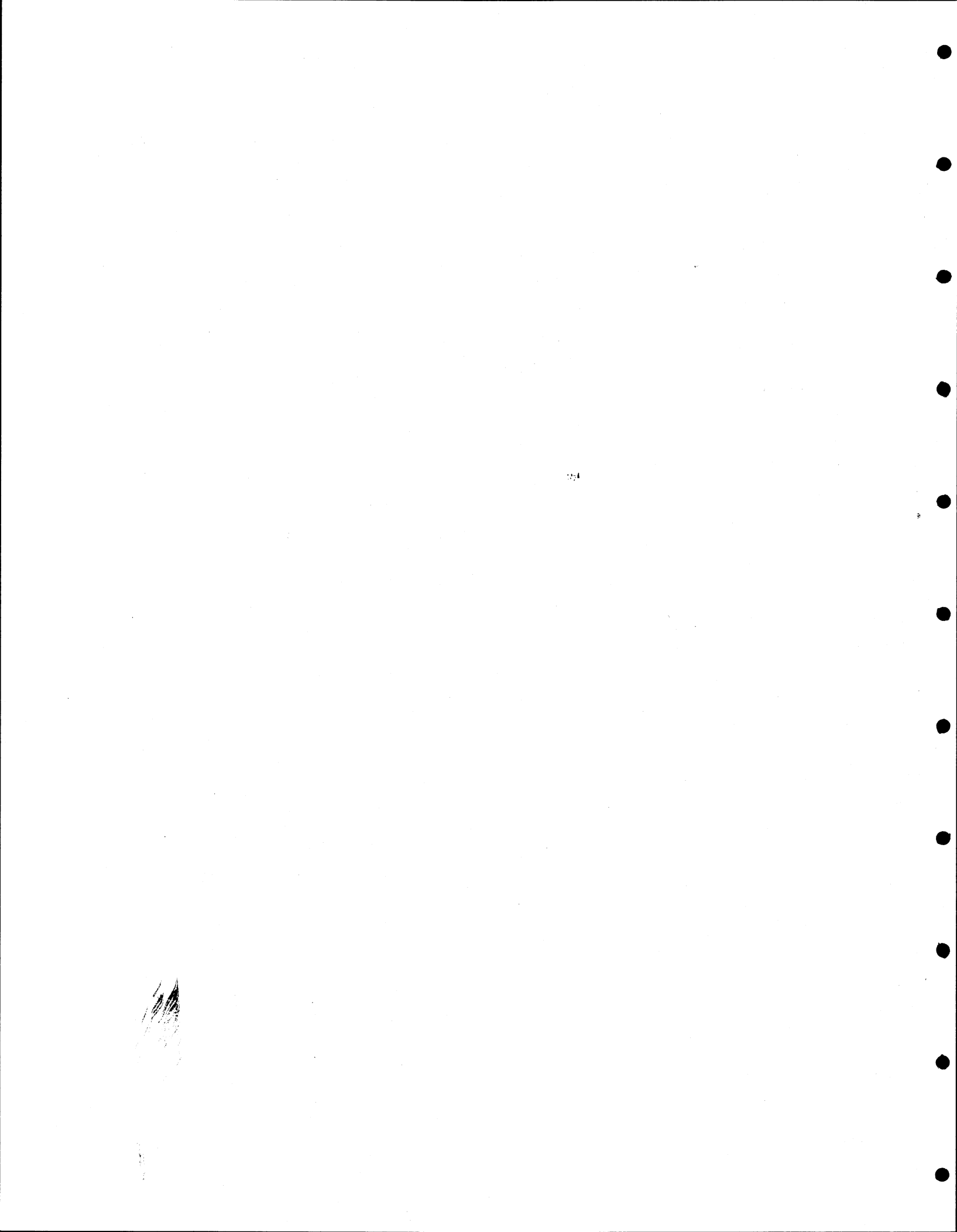


EXECUTIVE SUMMARY

The typical member of the group "Scientists and Engineers" (S/E)¹ in South Korea is a male, junior-college graduate in his late 20's to early 30's, who works for the most part in manufacturing. There are exceptions to this characterization, since females, who comprise less than six percent of scientists and engineers, are far more likely to be employed in services than in manufacturing, and are more likely to possess a four-year college degree or higher. Scientists and engineers are playing an increasingly important role in South Korea's economy, as the government has bolstered South Korea's research and development (R&D) capacity, a key component in efforts to increase the country's output of leading edge technologies.

¹

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

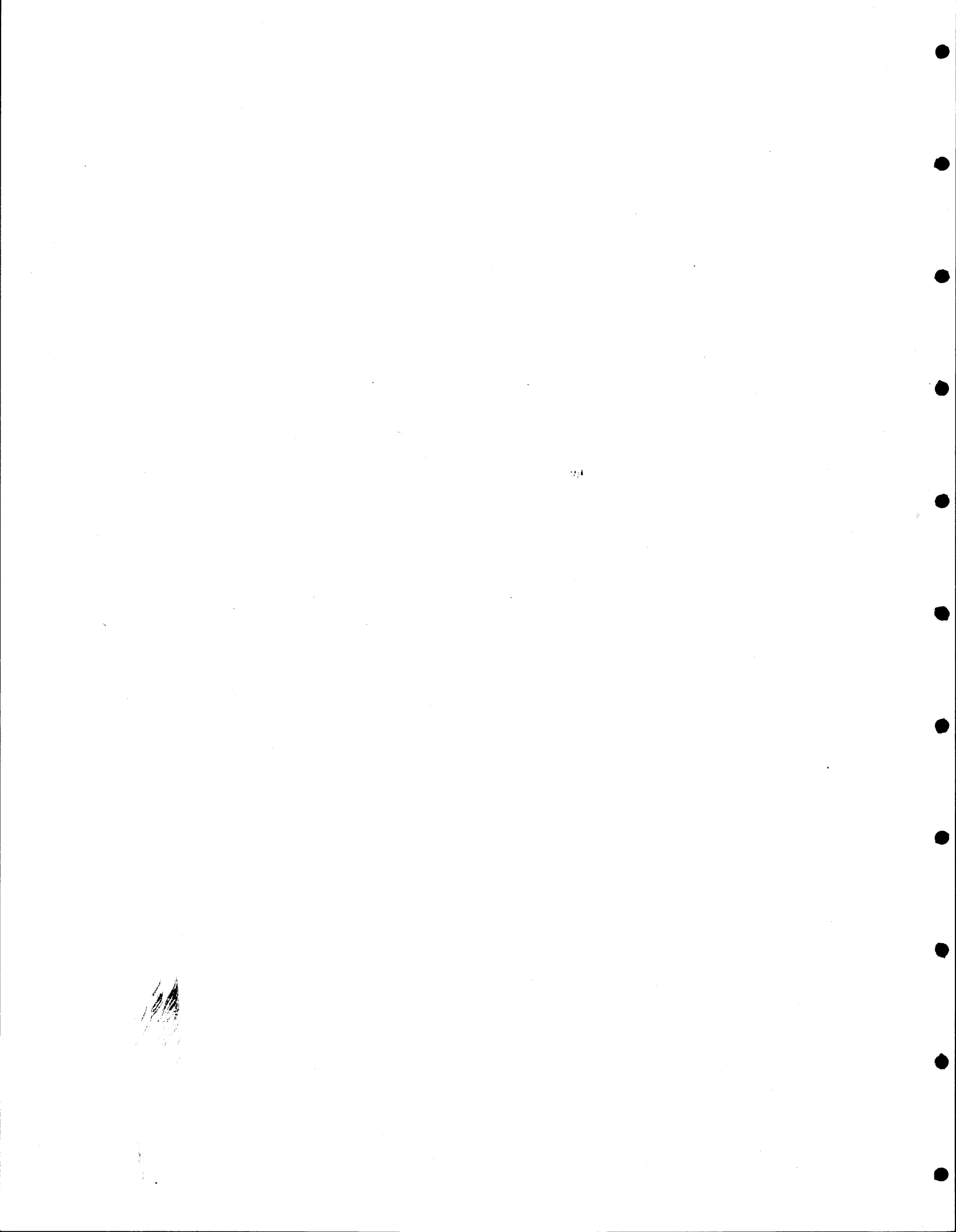


PREFACE

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 the National Statistical Office of South Korea for their assistance in providing data from the 1990 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. Any shortcomings in the report are the responsibility of the author.

Comments and questions regarding this study should be addressed to David Zaslów, Eurasia Branch, International Programs Center, U.S. Bureau of the Census, Washington, D.C. 20233-8860; telephone (301) 457-1362; e-mail: dzaslow@cemail.census.gov.



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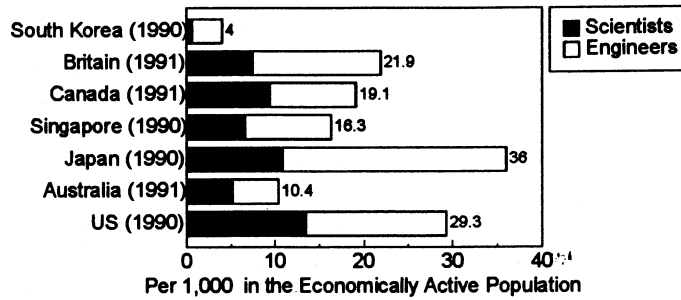
INTRODUCTION

This report summarizes educational and occupational statistics on scientists and engineers² in South Korea, based on data derived from the 1990 census. South Korea lies at the low end among countries reported in this series in terms of the number of scientists and engineers, relative to its economically active population. In 1990, South Korea had four scientists and engineers per 1,000 members of its economically active population (Figure 1). This comparatively low rate (compared to leading industrialized countries) is due, in part, to the large numbers of South Koreans who obtain degrees at foreign universities, but do not return to work at home (Aubert, 1996, p. 36). The Korean government has tried to counter this problem by enticing South Korean scientists and engineers from foreign employment (Vambery and Tae, 1993, p. 55). Data tables in the appendix provide detailed information upon which the graphic presentation is based. Users who wish to compare data presented in this report to those of other countries should consult the list of IPC and CIR Staff Papers, in the back of this report. The most recently published report of this series is "Scientists and Engineers in Great Britain: 1991."

2

All data in this report refer to non-academic scientists and engineers.

Figure 1. Scientists and Engineers per 1,000 Members of the Economically Active Population: 1990*



* Working age populations; Differences in age inclusion between countries may distort cross-national comparisons.
Source: Table Kor-1(90); Korea Stat. Yearbook 1995, 1995, p. 65; Zaslav, 1997.

The vast majority of scientists and engineers are male.

Nearly all (94 percent) scientists and engineers are male (Table Kor-1(90))³. This contrasts sharply with the gender composition of the South Korean economically active population, in which males comprise a much smaller majority, 66 percent (*International Database*). In each of the countries that have been reviewed in recent reports of this series -- Australia, Britain, Canada, Japan and Singapore -- males are far more heavily represented among scientists and engineers than in the overall economically active population (Zaslow, 1997, p. 3).

Given the sex composition of the overall economically active population and the scientist and engineer population in the five countries already studied, South Korea exhibits striking male predominance (in numerical terms). South Korea has the highest share of males among its economically active population (66 percent), with Australia's 58 percent being the next closest. Regarding scientists and engineers, South Korea, at 94 percent, has the highest share of males, followed closely by Japan, at 93 percent. Regarding females' share of S/E in South Korea, it is nearly as high as that of Japan (six percent for South Korea versus seven percent for Japan), even though females have a much smaller share of the South Korean economically active population (34 percent for South Korea versus 51 percent for Japan).

Although males will presumably continue to dominate science and engineering, data on new entrants to these fields suggest that the gap will diminish. Nearly one-half (45 percent) of scientists and engineers below age 25 are female (Table Kor-1(90)). It may be that some of the increase among women in the youngest age cohorts is due to increased employment opportunities in South Korea's rapidly expanding export industries. Moreover, female representation among scientists and engineers could be higher if more child day care were available. Many women with college degrees exit the labor force during the ages 25-34 to raise families ("Women's Employment Lagging Far Behind Advanced Nations," 1996, p. 1).

³ When consideration is given to employment in full time worker equivalencies, the share for females (six percent) may drop somewhat, if employment patterns among S/E are similar to those of the national economically active population. In 1990, 1.5 percent of employed females worked part-time, compared to eight-tenths of one percent of employed males (*Korea Statistical Yearbook 1995*, 1995, p. 65). These shares are extremely small compared to data for Britain. In 1991, 34 percent of British females and three percent of British males defined themselves as part-time workers (with no official definition existing of "part-time" status) (Zaslow, 1997, p. 3). South Korean data define part-time workers as those employed less than 18 hours per week (*Korea Statistical Yearbook 1995*, 1995, p. 65).

Scientists and engineers are concentrated in a few employment categories.

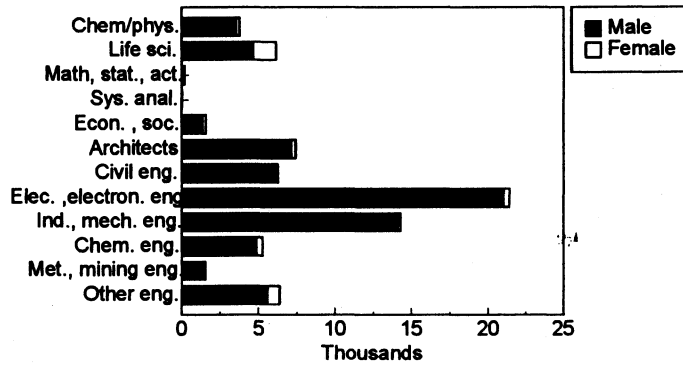
Within the employment category, "Scientists and Engineers,"⁴ those with specialties in electrical and electronic engineering are the most numerous. Males account for nearly all of the 21,408 S/E in this field which, including both males and females, comprises 29 percent of all scientists and engineers (Table Kor-1(90)). Among males, in addition to electrical and electronics engineers, there are substantial numbers of mechanical engineers, architects and town planners, civil engineers and chemical engineers (Figure 2).⁵ Among female S/E, the largest share are bacteriologists, pharmacologists and related scientists (30 percent). The percentage shares of electrical and electronics engineers, chemical engineers and architects and town planners are much lower (Figure 3).

Among the employment categories with comparatively few scientists and engineers, the small number of industrial engineers (Table Kor-1(90)) has reportedly impaired the development of South Korean corporations. Services such as time study, process, quality and inventory control, normally provided by industrial engineers, are in short supply, which limits organizational effectiveness (Cho, 1993, p. 219).

⁴ See Table Kor-1(90) for a list of occupations that constitute the category, "scientists and engineers."

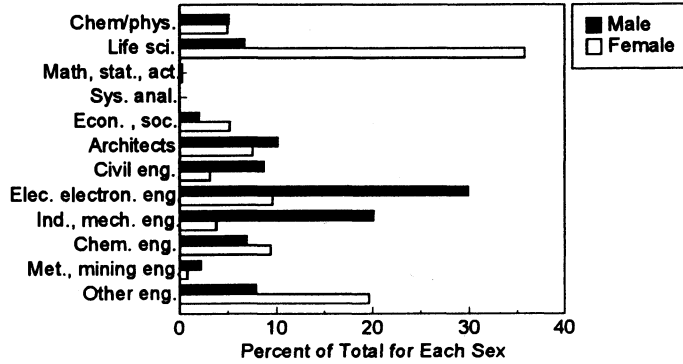
⁵ In Figures 2, 3 and 6, the term "life scientists" refers to the following three occupational categories: biologists, zoologists and related scientists; bacteriologists, pharmacologists and related scientists; and agronomists and related scientists.

Figure 2. Scientists and Engineers, by Specialty and Sex, for South Korea: 1990



Source: Table Kor-1(90).

Figure 3. Distribution of Scientists and Engineers by Specialty and Sex, for South Korea: 1990



Source: Table Kor-1(90).

South Korea has experienced rapid, export-driven growth over the past decade in industries associated with advanced science and technology capability.

Despite its comparative lack of scientists and engineers (Figure 1), the South Korean economy has grown rapidly in recent years in many industries that indicate an advanced science and technology (S&T) capability. After developing a reputation as an emulator of low technology products, South Korea reportedly has become a key innovator in nuclear power, semiconductors, memory chips, image processing, modern steel production processes and materials processing. The country is the world's fifth largest auto producer⁶ and a major manufacturer of consumer electronics (Sung and Chung, 1996, p. 1591).⁷

South Korea's development of these industries is based on several factors. Among the most important has been the significantly increased funding of college-level education, and research and development. South Korea has a substantial network of higher educational institutions, with 134 colleges and universities, and 152 junior colleges (the latter play a key role in the education of scientists and engineers). Much of the recent rise in post-secondary educational attainment is seen at the junior college level, where enrollment has nearly doubled between 1990 and 1996 (*Korea Statistical Yearbook 1991, 1991*, p. 377; and *Korea Statistical Yearbook 1996, 1996*, pp. 573).⁸ The South Korean educational system is intended to help meet the government's goal of increasing the number of scientists and engineers three-fold (compared to levels of the early 1990's) by early in the 21st century (Swinbanks, 1992, p. 2). Another important component of improving human capital is funding for R&D. This has increased in relation to gross domestic product (GDP), from 0.8 percent in 1980 to 2.3 percent in 1994 (Aubert, 1996, p. 35), which is comparable to R&D levels in several industrial countries (Figure 4). This rapid rate of growth is projected to continue, given the Korean government's call for R&D's share of GDP to more than double to five percent of GDP by early in the 21st century (Gwynne, 1993, p. 13).

The South Korean government seeks to continue this advance in the development of high technology products by coordinating and funding research for the development of products that are not yet in broad commercial use. These programs are referred to as Highly Advanced

⁶ South Korean automotive exports jumped from \$973 million in 1985 to \$6.6 billion in 1994 (*Korea Statistical Yearbook 1990*, p. 270; and *Korea Statistical Yearbook 1995*, p. 300). Within South Korea, the number of registered passenger cars rose from approximately 557,000 in 1985 to 5.1 million in 1994 (*Korea Statistical Yearbook 1990*, p. 292; and *Korea Statistical Yearbook 1995*, p. 276). The dollar values are as reported in the statistical yearbooks.

⁷ Leading consumer electronics include VCR's, color televisions and microwave ovens (*Korea Statistical Handbook 1991*, p. 43), as well as more recently, personal computers.

⁸ As will be indicated in a subsequent section, most scientists and engineers report a junior college degree to be their highest level of educational attainment.

National (HAN) projects ("20 Percent Increase," 1996, p. 1). These programs, which are divided into two groups of technologies, are to be pursued sequentially. The first group includes technologies, such as digital communications (ISDN)⁹, biochemicals, materials for the electronics and energy industries, environmental engineering technology, and advanced nuclear reactors. Subsequent development work is to be focussed on high definition TV, flat-panel displays, bio-engineering technology, high speed railways and advanced nuclear fusion. In addition, South Korea has a small-scale space program ("20 Percent Increase," 1996, pp. 5, 6). South Korea's pursuit of these projects indicates the extent to which the country has progressed beyond merely being an adapter of imported technology to being an innovator and a leading producer of advanced technology (Figure 5).¹⁰

The majority of the research work done in South Korea is funded and performed by industry. A far smaller share is conducted in government-sponsored research centers. In 1993, 83 percent of R&D work was financed by the private sector (*Korea Statistical Yearbook 1995*, 1995, p. 570). Most of this work takes place in a vast domestic network of research institutions (3,318 in 1993) (*Korea Statistical Yearbook 1995*, 1995, p. 570), but South Korean businesses owned 15 research and development facilities in the United States, and as of 1993, were expected to increase their presence during the rest of the decade. These facilities primarily are engaged in research in electronics and automotive technology (Serapio and Dalton, 1993, p. 34). The major stated reasons for engaging in R&D in the United States are to benefit from the expertise of U.S. scientists and engineers, as well as to monitor competitors' developments better and to accommodate the needs of U.S. consumers better (in terms of developments in design trends and customizing products for the U.S. market) (Serapio and Dalton, 1993, pp. 37, 38).

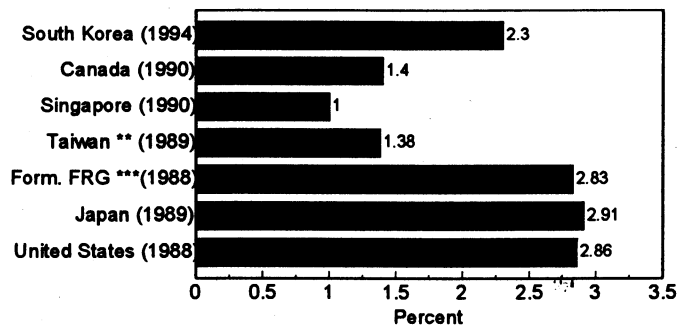
The government operates approximately 50 research institutes, 18 of which are under the Ministry of Science and Technology (Aubert, 1996, p. 36; and "20 Percent Increase," 1996, p. 1).¹¹ Many of these institutes are located in U.S.-style technology parks, following the belief that the pace of development can be accelerated by concentrating leading researchers in close proximity (Gwynne, 1993, p. 13). In addition to these government facilities, the government's FY 1997 budget also includes funding (\$131.5 million) for research projects aimed at attracting and supporting both South Korean and foreign scientists and engineers ("20 Percent Increase," 1996, p. 7).

⁹ Integrated Services Digital Networks permit simultaneous transmission of voice, data and images over telephone lines.

¹⁰ South Korea's success in developing a domestic computer industry in the mid-1980's is an example of a successful, earlier attempt to spur development of a targeted, high-technology industry (Kraemer, et al., 1992, p. 147).

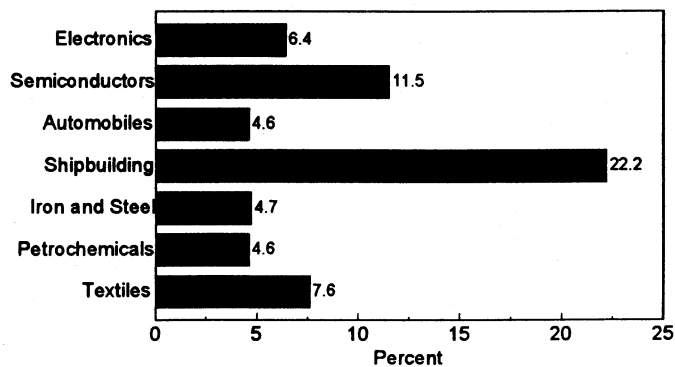
¹¹ One unique method used in South Korea to raise some of the \$561 million for these institutes is a special lottery to support science and technology ("20 Percent Increase," 1996, pp. 3, 8).

Figure 4. Share of Gross Domestic Product Used for R&D*



* Research and Development; ** GNP
 *** Federal Republic of Germany
 Source: Aubert, 1996, p. 35; Zaslowsky, 1996 (Canada), p. 7.

Figure 5. South Korea's Share of World Output of Selected Industries: 1994



Source: Aubert, 1996, p. 36.

The scientist and engineer population is comparatively younger than the country's overall economically active population.

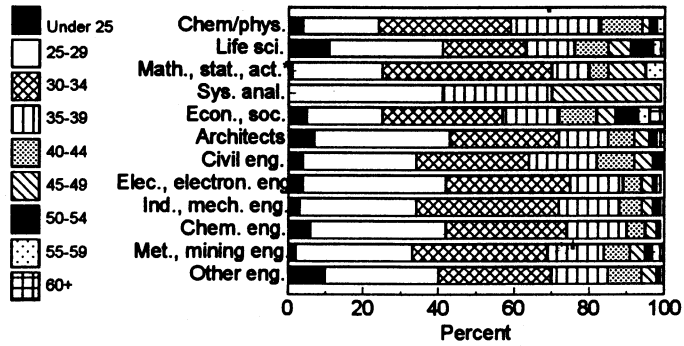
More than two-thirds (71 percent) of scientists and engineers are below age 35 (Table Kor-1(90)). These young S/E are almost equally divided between the 25-29 and 30-34 five-year cohorts. The percentage of scientists and engineers in South Korea then declines sharply for each of the older cohorts. The South Korean age distribution of scientists and engineers closely resembles that of Singapore, where 74 percent of S/E are below age 35 (Zaslow, 1996 (Singapore), p. 16). In terms of occupations, all but two categories (systems analysts and sociologists, anthropologists and related scientists) have a majority of their populations below age 35 (Figure 6).

South Korea's working age population (aged 15 and older) is distributed far more evenly between younger and older people than are scientists and engineers. In 1991, 49 percent of the country's working age population was below age 35, compared to 71 percent for S/E (*Yearbook of Labour Statistics 1992*, 1992, p. 34).

The ages of those in the S/E occupation fields vary significantly by sex. A far smaller percentage of males than females are among the younger age groups (below age 35). Male scientists and engineers who are under age 35 comprise 69 percent of all male S/E, compared to 92 percent for females (Table Kor-1(90)). As in other countries in this series, this most likely reflects the expanding role of women in the workplace. The percentage of females (age 15 and older) in the economically active population increased from 41.9 to 47.9 percent between 1985 and 1994 (*Korea Statistical Yearbook 1995*, 1995, p. 65).

Education data for South Korea suggest that there is potential for females to increase their share of the scientist and engineer workforce. Females' share of college and university enrollment in the sciences increased from 19 to 22 percent between 1990 and 1995 (*Korea Statistical Yearbook 1991, 1991*, pp. 382, 383; and *Korea Statistical Yearbook 1995*, 1995, pp.556, 557), expanding the pool of potential scientists.¹²

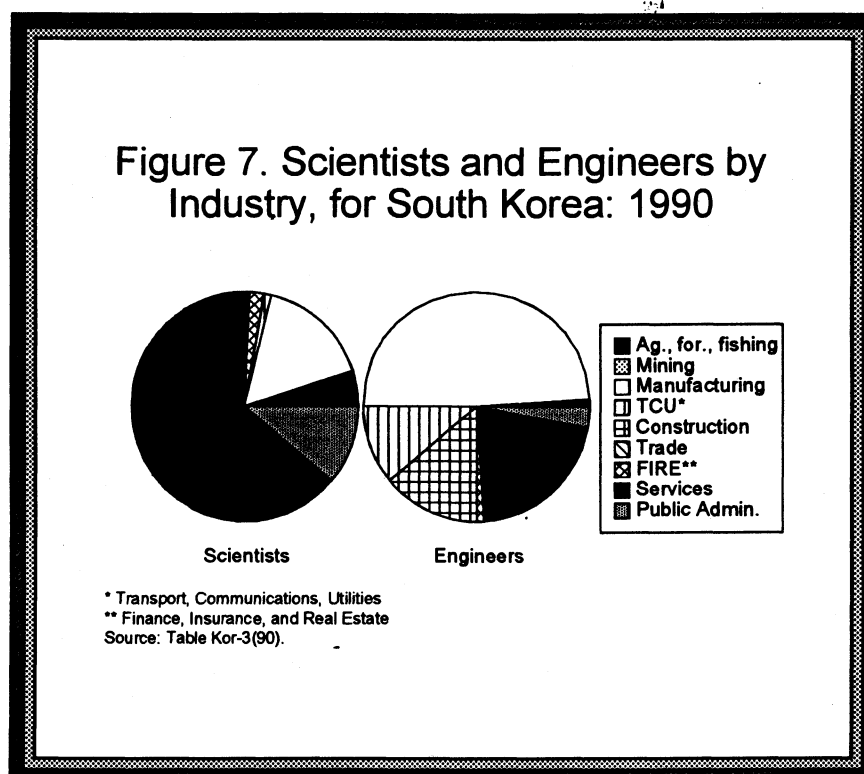
Figure 6. Scientists and Engineers by Age Group, for South Korea: 1990



* actuary
 Source: Table Kor-1(90).

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

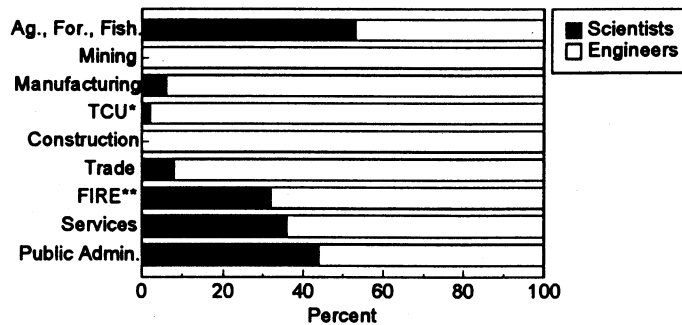
The manufacturing and services¹³ industries employ 81 percent of scientists and 70 percent of engineers (Figure 7; and Table Kor-3(90)). By way of contrast, these same industries employ only 38 percent of all employed workers (*Korea Statistical Yearbook 1991*, 1991, pp. 74, 75). Engineers comprise the vast majority of S/E in manufacturing, and to a lesser extent, in services (Table Kor-3(90)). At 72 percent, the share of South Korea's scientists and engineers engaged in manufacturing and services is identical to that of Great Britain and Singapore (Zaslow, 1997 (Great Britain), p. 12; and Zaslow, 1996 (Singapore), p. 19; and closely mirrors that found in the United States and Japan (70 and 68 percent, respectively) (National Science Board, 1993, p. 326; and Zaslow, 1996 (Japan), p. 21).



Most industries exhibit a marked preference for either scientists or engineers.

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, these hiring practices probably reflect a matching process based on technological considerations. The manufacturing, transport, communications and utilities, construction and trade sectors are heavily skewed towards employment of engineers. The most pronounced imbalance exists in the mining industry, which employed no scientists as of 1990 (Table Kor-3(90)). For the remaining sectors, the distribution between scientists and engineers is more even.

**Figure 8. Scientists and Engineers
Within Industry Groups, for South Korea:
1990***



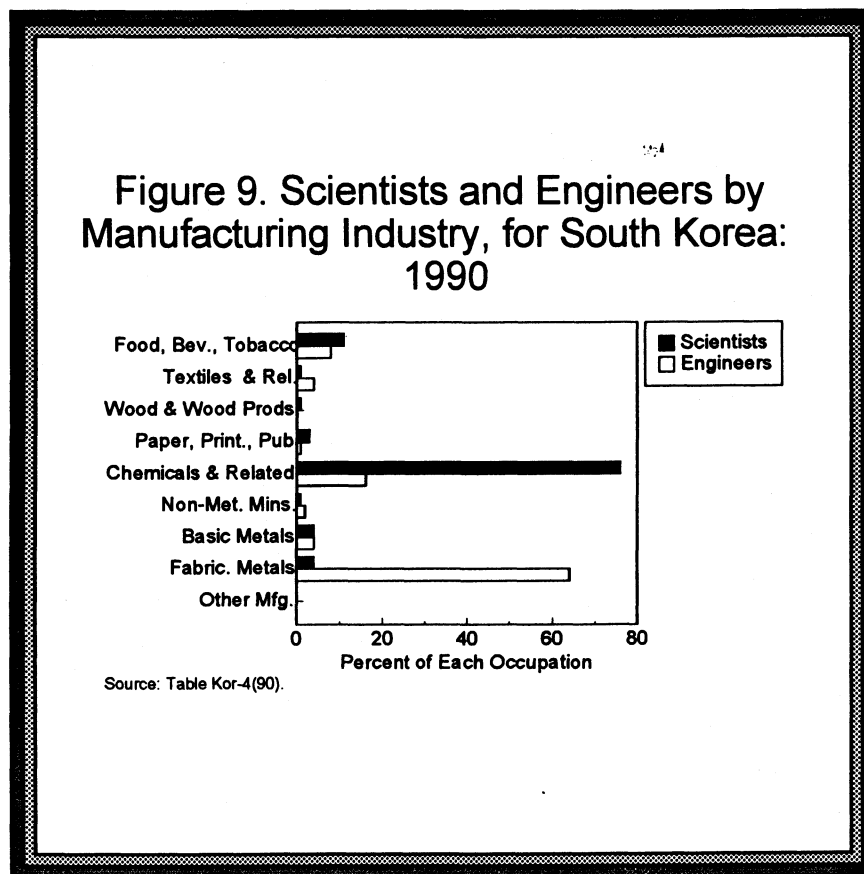
* Transport, Communications, Utilities

** Finance, Insurance, Real Estate

Source: Table Kor-3(90).

The fabricated metals, and the chemicals and related products sectors are the largest employers of scientists and engineers in manufacturing.

Employment of scientists and engineers in manufacturing is concentrated within a few industries (Figure 9). The vast majority (80 percent) of scientists and engineers in manufacturing are engaged in work related to fabricated metals, and chemicals and related products (Table Kor-4(90)). The former employs 19,603 engineers, but just 83 scientists, while the latter employs 1,456 scientists and 4,814 engineers (Table Kor-4(90)).



Most scientists and engineers in the services sector work in social and community services.

Over two-thirds (68 percent) of service sector scientists and engineers are employed in the provision of social and community services. Most of the remaining scientists and engineers are engaged in business services (Table Kor-5(90)). The distribution between employment categories is more even for engineers than scientists, as visual inspection of Figure 10 shows. The remaining two service sectors (recreational and cultural services, and personal and household services) employ minor shares of scientists and engineers. Sex selection/role modeling appears to affect the general service sector groups in which a scientist or engineer is likely to work. Although both sexes are concentrated in social and community services, males are far more likely to work in business services than are females. The relevant figures are 28 percent of male S/E in business services, compared to just 11 percent of female S/E in the service sector (Figure 11).

The pattern of employment among South Korean scientists and engineers in the service industries is somewhat similar to that found in Great Britain and Australia. Scientists in these countries primarily are employed in the provision of social and community services. However, utilization of engineers differs with South Koreans engaging to a larger extent in social and community services as opposed to business services (Table Kor-5(90); and Zaslow, 1997 (Great Britain), p. 15). In Japan and Singapore, both scientists and engineers are skewed heavily towards employment in business services (Zaslow, 1996 (Japan), p. 27; and Zaslow, 1996 (Singapore), p. 22).

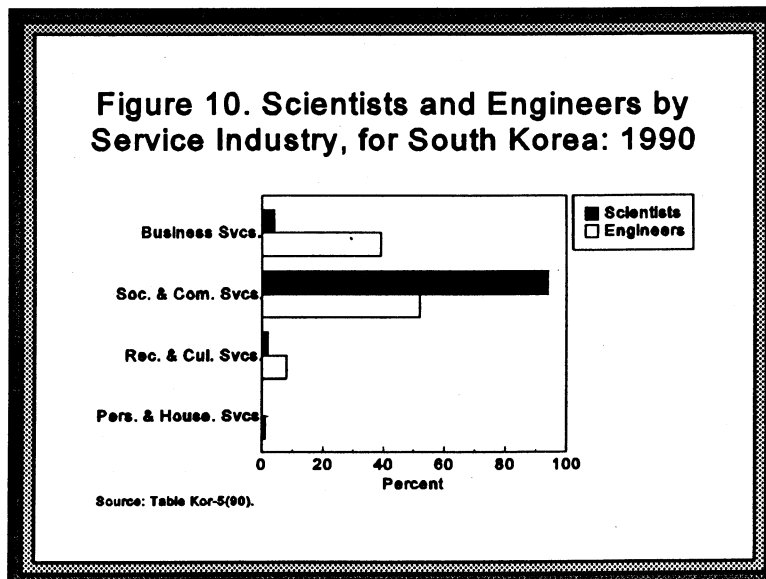
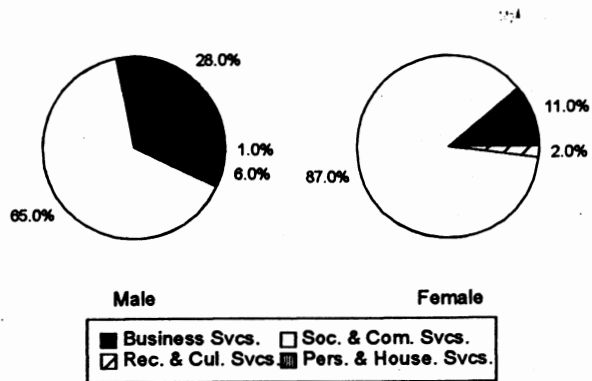


Figure 11. Scientists and Engineers by Service Industry and Sex, for South Korea: 1990

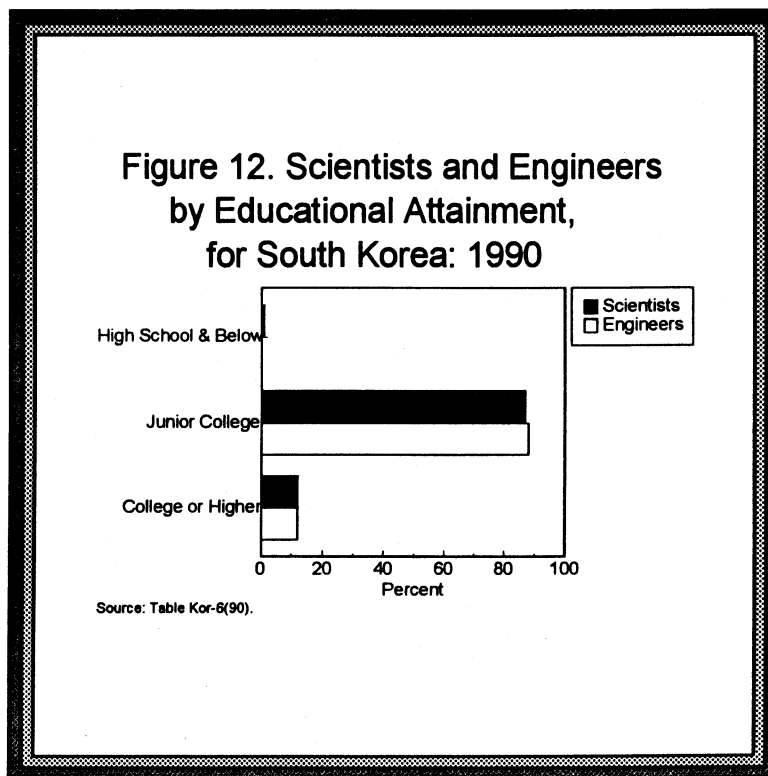


Source: Table Kor-5(90).

Nearly all scientists and engineers have some form of college degree.

Over 99 percent of scientists and engineers have earned some form of college degree. Of those who have degrees, most (88 percent) reported a junior college degree as their highest level of educational attainment, while the remainder earned a four-year bachelors degree or higher (Table Kor-6(90)). The apparent situation whereby a junior college degree is considered the entry-level requirement to become a scientist or engineer in South Korea may be changing, since currently-enrolled students are far more likely to attend colleges and universities than junior colleges (*Korea Statistical Yearbook 1995*, 1995, pp. 554, 555).¹⁴ Scientists and engineers were equally likely to possess a college or higher degree (12 percent of each employment category) (Figure 12). There were no engineers in South Korea in 1990 who reported a high school degree as their highest level of educational attainment.

South Korea has the lowest share of scientists and engineers with at least a four-year degree (12 percent) of any of the countries reported in this series. For the other countries, the shares of scientists and engineers with at least a four-year degree range from a low of 48 percent for Japan to a high of 68 percent for Singapore (Zaslow, 1995, p. 32; Zaslow, 1996 (Singapore), p. 25; Zaslow, 1996 (Japan), p. 30; Zaslow, 1996 (Canada), p. 36; and Zaslow, 1997, p. 38).



Conclusions

South Korea's concentration of scientists and engineers in its economically active population lies at the low end of the range of countries studied in recent reports of this series. The age structure of South Korea's scientists and engineers is more skewed towards younger age groups than is the country's overall economically active population. Males predominate among scientists and engineers, accounting for 94 percent of S/E. In this respect, South Korea's sex distribution most resembles Japan's (where males accounted for 93 percent of all S/E). South Korea's scientist and engineer sex distribution contrasts sharply with that of its overall economically active population. The latter split is 66-34, male to female. Female scientists and engineers are more concentrated in the youngest age groups than are males, and are far more heavily concentrated in the sciences.

Tables¹⁵

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¹⁵ Tables are numbered to be consistent with other reports of this series. Any breaks in numerical sequence are due to unavailability of data. Also, the letters "nec" in some of the occupational listings signifies categories that are "not elsewhere classified."

Kor-1(90)
 Table 1. Scientists and Engineers by Age and Sex, for South Korea: 1990

Occupation	Total	Sexes									
		Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60+	
TOTAL SCIENTISTS AND ENGINEERS	74,327	3,899	24,548	23,967	11,308	5,187	2,719	1,564	791	344	
SCIENTISTS	11,763	921	2,990	3,291	1,984	1,106	560	246	105	0	
Chemists	1,068	34	260	393	237	81	12	21	30	0	
Physicists	1,878	69	287	719	509	221	54	10	9	0	
Physical scientists, nec	828	33	217	198	177	100	21	51	31	0	
Biologists, zoologists and rel. sci.	834	54	162	290	145	91	41	31	10	10	
Bacteriologists, pharm. and related scientists	3,577	532	1,296	725	394	250	162	146	51	21	
Astronomists and related scientists	1,733	112	391	361	254	198	157	197	53	10	
Statisticians	76	1	24	30	21	0	0	0	0	0	
Mathematicians and actuaries	131	1	26	63	0	11	20	0	10	0	
Systems analysts	34	0	14	0	10	0	10	0	0	0	
Economists	809	54	173	305	123	51	51	20	21	11	
Sociologists, anthro., and related scientists	795	31	140	207	114	103	32	84	31	53	
ENGINEERS	62,564	2,978	21,558	20,676	9,324	4,081	2,159	1,004	545	239	
Architects and town planners	7,428	528	2,671	2,148	955	529	301	164	91	41	
Civil engineers	6,246	226	1,863	1,874	1,106	611	322	163	50	31	
Electrical and electronics eng.	21,408	847	8,227	7,143	3,030	1,098	590	279	152	42	
Mechanical engineers	13,760	415	4,374	5,208	2,137	850	441	187	106	42	
Chemical engineers	5,264	317	1,921	1,663	817	275	158	72	21	20	
Metallurgists	1,167	26	415	431	132	82	47	1	22	11	
Mining engineers	380	10	66	126	95	32	10	31	10	0	
Industrial engineers	544	3	91	204	95	55	51	34	11	0	
Engineers, nec	6,367	606	1,930	1,879	957	549	239	73	82	52	

Kor-1(90)

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

Male

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60+
TOTAL SCIENTISTS AND ENGINEERS	70,235	2,147	22,937	23,564	11,119	5,093	2,697	1,554	780	344
SCIENTISTS	9,870	205	2,216	3,058	1,910	1,043	548	550	235	105
Chemists	940	8	208	382	217	62	12	21	30	0
Physicists	1,834	48	285	698	509	221	54	10	9	0
Physical scientists, nec	796	22	196	198	177	100	21	51	31	0
Biologists, zoologists and rel. scientists	777	12	159	279	144	91	41	31	10	10
Bacteriologists, pharmacologists and related scientists	2,362	46	790	599	362	207	150	136	51	21
Agronomists and related scientists	1,541	46	297	341	243	197	157	197	53	10
Statisticians	76	1	24	30	21	0	0	0	0	0
Mathematicians and actuaries	120	1	15	63	0	11	20	0	10	0
Systems analysts	34	0	14	0	10	0	10	0	0	0
Economists	692	11	131	283	113	51	51	20	21	11
Sociologists, anthropologists, and related scientists	698	10	97	185	114	103	32	84	20	53
ENGINEERS	60,365	1,942	20,721	20,506	9,209	4,050	2,149	1,004	545	239
Architects and town planners	7,123	358	2,576	2,108	955	529	301	164	91	41
Civil engineers	6,116	160	1,819	1,864	1,096	611	322	163	50	31
Electrical and electronics eng.	21,017	695	8,023	7,119	3,029	1,098	580	279	152	42
Mechanical engineers	13,604	351	4,324	5,186	2,117	850	441	187	106	42
Chemical engineers	4,881	162	1,734	1,642	807	265	158	72	21	20
Metallurgists	1,135	4	405	431	132	82	47	1	22	11
Mining engineers	380	10	66	126	95	32	10	31	10	0
Industrial engineers	543	2	91	204	95	55	51	34	11	0
Engineers, nec	5,566	200	1,683	1,826	883	528	239	73	82	52

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

Female

Occupation	Total	Under 25	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60+
TOTAL SCIENTISTS AND ENGINEERS	4,092	1,752	1,611	403	189	94	22	10	11	0
SCIENTISTS	1,893	716	774	233	74	63	12	10	11	0
Chemists	128	26	52	11	20	19	0	0	0	0
Physicists	44	21	2	21	0	0	0	0	0	0
Physical scientists, nec	32	11	21	0	0	0	0	0	0	0
Biologists, zoologists and rel. scientists	57	42	3	11	1	0	0	0	0	0
Bacteriologists, pharmacologists and related scientists	1,215	486	506	126	32	43	12	10	0	0
Agronomists and related scientists	192	66	94	20	11	1	0	0	0	0
Statisticians	0	0	0	0	0	0	0	0	0	0
Mathematicians and actuaries	11	0	11	0	0	0	0	0	0	0
Systems analysts	0	0	0	0	0	0	0	0	0	0
Economists	117	43	42	22	10	0	0	0	0	0
Sociologists, anthropologists, and related scientists	97	21	43	22	0	0	0	0	11	0
ENGINEERS	2,199	1,036	837	170	115	31	10	0	0	0
Architects and town planners	305	170	95	40	0	0	0	0	0	0
Civil engineers	130	66	44	10	10	0	0	0	0	0
Electrical and electronics eng.	391	152	204	24	1	0	10	0	0	0
Mechanical engineers	156	64	50	22	20	0	0	0	0	0
Chemical engineers	383	155	187	21	10	10	0	0	0	0
Metallurgists	32	22	10	0	0	0	0	0	0	0
Mining engineers	0	0	0	0	0	0	0	0	0	0
Industrial engineers	1	1	0	0	0	0	0	0	0	0
Engineers, nec	801	406	247	53	74	21	0	0	0	0

Source: 1990 Population and Housing Census Report, Volume 7, Industry and Occupation by Detailed Classification.

Kor-3(90)

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

Both Sexes

Occupation	Total	Agri., Forestry, and Fish.	Mining	Manufac- turing	Transport, Comm. and Utilities	Construction	Wholesale and Retail Trade	Finance, Insurance, Real Estate	Services	Public Admin.
TOTAL SCIENTISTS AND ENGINEERS	74,327	1,034	239	32,498	6,865	9,087	136	662	20,774	3,032
SCIENTISTS	11,763	546	0	1,920	145	32	11	215	7,566	1,328
Chemists	1,068	0	0	406	0	0	0	0	652	10
Physicists	1,878	0	0	79	52	0	0	0	1,736	11
Physical scientists, nec	828	0	0	14	11	11	0	0	592	200
Biologists, zoologists and rel. sci.	834	65	0	96	0	0	0	10	506	157
Bacteriologists, pharmacologists and related scientists	3,577	85	0	1,170	82	0	0	0	1,942	298
Agronomists and related scientists	1,733	396	0	66	0	0	0	11	709	551
Statisticians	76	0	0	1	0	0	0	1	64	10
Mathematicians and actuaries	131	0	0	5	0	11	0	53	52	10
Systems analysts	34	0	0	0	0	0	0	3	21	10
Economists	809	0	0	62	0	10	11	137	579	10
Sociologists, anthropologists, and related scientists	795	0	0	21	0	0	0	0	713	61
ENGINEERS	62,564	488	239	30,578	6,720	9,055	125	447	13,208	1,704
Architects and town planners	7,428	377	10	335	110	3,636	10	104	2,710	136
Civil engineers	6,246	0	22	418	370	3,805	0	74	1,002	555
Electrical and electronics eng.	21,408	11	23	11,448	4,159	1,245	32	164	4,018	308
Mechanical engineers	13,760	10	22	9,278	1,728	337	41	52	2,157	135
Chemical engineers	5,264	0	0	4,235	173	0	20	10	754	72
Metallurgists	1,167	0	0	978	0	0	0	0	189	0
Mining engineers	380	0	162	67	43	0	0	0	97	11
Industrial engineers	544	0	0	75	11	0	11	22	414	11
Engineers, nec	6,367	90	0	3,744	126	32	11	21	1,867	476

Kor-3(90)

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

Male

Occupation	Total	Agri., Forestry, and Fish.	Mining	Manufac- turing	Transport, Comm. and Utilities	Construction	Wholesale and Retail Trade	Finance, Insurance, Real Estate	Services	Public Admin.
TOTAL SCIENTISTS AND ENGINEERS	70,235	943	239	31,254	6,815	8,926	116	630	18,520	2,792
SCIENTISTS	9,870	494	0	1,727	135	32	11	215	6,116	1,140
Chemists	940	0	0	374	0	0	0	0	556	10
Physicists	1,834	0	0	79	52	0	0	0	1,692	11
Physical scientists, nec	796	0	0	13	11	11	0	0	572	189
Biologists, zoologists and rel. sci.	777	65	0	96	0	0	0	10	460	146
Bacteriologists, pharmacologists and related scientists	2,362	85	0	1,031	72	0	0	0	988	186
Agronomists and related scientists	1,541	344	0	66	0	0	0	11	623	497
Statisticians	76	0	0	1	0	0	0	1	64	10
Mathematicians and actuaries	120	0	0	5	0	11	0	53	41	10
Systems analysts	34	0	0	0	0	0	0	3	21	10
Economists	692	0	0	52	0	10	11	137	472	10
Sociologists, anthropologists, and related scientists	698	0	0	10	0	0	0	0	627	61
ENGINEERS	60,365	449	239	29,527	6,680	8,894	105	415	12,404	1,652
Architects and town planners	7,123	357	10	335	100	3,518	10	104	2,553	136
Civil engineers	6,116	0	22	407	359	3,784	0	53	957	534
Electrical and electronics eng.	21,017	11	23	11,253	4,151	1,223	32	153	3,863	308
Mechanical engineers	13,604	10	22	9,184	1,717	337	41	52	2,106	135
Chemical engineers	4,881	0	0	4,029	173	0	0	10	607	62
Metallurgists	1,135	0	0	957	0	0	0	0	178	0
Mining engineers	380	0	162	67	43	0	0	0	97	11
Industrial engineers	543	0	0	74	11	0	11	22	414	11
Engineers, nec	5,566	71	0	3,221	126	32	11	21	1,629	455

Kor-3(90)

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

Female

Occupation	Total	Agri., Forestry, and Fish.	Mining	Manufac- turing	Transport, Comm. and Utilities	Construction	Wholesale and Retail Trade	Finance, Insurance, Real Estate	Services	Public Admin.
TOTAL SCIENTISTS AND ENGINEERS	4,092	91	0	1,244	50	161	20	32	2,254	240
SCIENTISTS	1,893	52	0	193	10	0	0	0	1,450	188
Chemists	128	0	0	32	0	0	0	0	96	0
Physicists	44	0	0	0	0	0	0	0	44	0
Physical scientists, nec	32	0	0	1	0	0	0	0	20	11
Biologists, zoologists and rel. sci.	57	0	0	0	0	0	0	0	46	11
Bacteriologists, pharmacologists and related scientists	1,215	0	0	139	10	0	0	0	954	112
Agronomists and related scientists	192	52	0	0	0	0	0	0	86	54
Statisticians	0	0	0	0	0	0	0	0	0	0
Mathematicians and actuaries	11	0	0	0	0	0	0	0	11	0
Systems analysts	0	0	0	0	0	0	0	0	0	0
Economists	117	0	0	10	0	0	0	0	107	0
Sociologists, anthropologists, and related scientists	97	0	0	11	0	0	0	0	86	0
ENGINEERS	2,199	39	0	1,051	40	161	20	32	804	52
Architects and town planners	305	20	0	0	10	118	0	0	157	0
Civil engineers	130	0	0	11	11	21	0	21	45	21
Electrical and electronics eng.	391	0	0	195	8	22	0	11	155	0
Mechanical engineers	156	0	0	94	11	0	0	0	51	0
Chemical engineers	383	0	0	206	0	0	20	0	147	10
Metallurgists	32	0	0	21	0	0	0	0	11	0
Mining engineers	0	0	0	0	0	0	0	0	0	0
Industrial engineers	1	0	0	1	0	0	0	0	0	0
Engineers, nec	801	19	0	523	0	0	0	0	238	21

Source:

1990 Population and Housing Census Report, Volume 7, Industry and Occupation by Detailed Classification.

Kor-4(90)
 Table 4. Scientists and Engineers by Manufacturing Industry and Sex, for South Korea: 1990 Both Sexes

Occupation	Total	Food, Beverages, Tobacco	Textiles, Apparel, Leather	Wood, and Wood Products	Paper, Print., Publish.	Chemicals and Related Prods.	Non-met. Minerals	Basic Metals	Fabri- cated Metals	Other Manufac- turing
TOTAL SCIENTISTS AND ENGINEERS	32,498	2,807	1,304	42	375	6,270	581	1,386	19,686	47
SCIENTISTS	1,920	209	14	10	52	1,456	21	75	83	0
Chemists	406	11	11	0	0	336	10	38	0	0
Physicists	79	0	0	0	0	22	11	11	35	0
Physical scientists, nec	14	0	0	0	0	12	0	0	2	0
Biologists, zoologists and rel. sci.	96	56	1	0	10	29	0	0	0	0
Bacteriologists, pharmacologists and related scientists	1,170	100	0	0	11	1,027	0	10	22	0
Agronomists and related scientists	66	42	2	0	0	20	0	0	2	0
Statisticians	1	0	0	0	0	0	0	1	0	0
Mathematicians and actuaries	5	0	0	0	0	0	0	4	1	0
Systems analysts	0	0	0	0	0	0	0	0	0	0
Economists	62	0	0	10	10	10	0	11	21	0
Sociologists, anthropologists, and related scientists	21	0	0	0	21	0	0	0	0	0
ENGINEERS	30,578	2,598	1,290	32	323	4,814	560	1,311	19,603	47
Architects and town planners	335	20	30	0	0	125	10	66	84	0
Civil engineers	418	66	53	0	0	122	43	23	111	0
Electrical and electronics eng.	11,448	116	86	0	73	213	84	237	10,628	11
Mechanical engineers	9,278	107	128	11	126	435	54	346	8,060	11
Chemical engineers	4,235	63	197	0	20	3,608	146	52	148	1
Metallurgists	978	0	10	0	0	12	0	575	381	0
Mining engineers	67	0	0	0	0	35	20	12	0	0
Industrial engineers	75	0	4	0	10	13	0	0	48	0
Engineers, nec	3,744	2,226	782	21	94	251	203	0	143	24

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

Male

Occupation	Total	Food, Beverages, Tobacco	Textiles, Apparel, Leather	Wood, and Wood Products	Paper, Print., Publish.	Chemicals and Related Prods.	Non-met. Minerals	Basic Metals	Fabri- cated Metals	Other Manufac- turing
TOTAL SCIENTISTS AND ENGINEERS	31,254	2,403	1,204	31	344	5,928	559	1,386	19,374	25
SCIENTISTS	1,727	186	14	10	31	1,308	21	75	82	0
Chemists	374	11	11	0	0	304	10	38	0	0
Physicists	79	0	0	0	0	22	11	11	35	0
Physical scientists, nec	13	0	0	0	0	12	0	0	1	0
Biologists, zoologists and rel. sci.	96	56	1	0	10	29	0	0	0	0
Bacteriologists, pharmacologists and related scientists	1,031	77	0	0	11	911	0	10	22	0
Agronomists and related scientists	66	42	2	0	0	20	0	0	2	0
Statisticians	1	0	0	0	0	0	0	1	0	0
Mathematicians and actuaries	5	0	0	0	0	0	0	4	1	0
Systems analysts	0	0	0	0	0	0	0	0	0	0
Economists	52	0	0	10	0	10	0	11	21	0
Sociologists, anthropologists, and related scientists	10	0	0	0	10	0	0	0	0	0
ENGINEERS	29,527	2,217	1,190	21	313	4,620	538	1,311	19,292	25
Architects and town planners	335	20	30	0	0	125	10	66	84	0
Civil engineers	407	66	53	0	0	122	43	23	100	0
Electrical and electronics eng.	11,253	116	86	0	73	213	84	237	10,444	0
Mechanical engineers	9,184	107	128	11	126	435	54	346	7,966	11
Chemical engineers	4,029	63	195	0	10	3,425	135	52	148	1
Metallurgists	957	0	10	0	0	12	0	575	360	0
Mining engineers	67	0	0	0	0	35	20	12	0	0
Industrial engineers	74	0	4	0	10	13	0	0	47	0
Engineers, nec	3,221	1,845	684	10	94	240	192	0	143	13

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

Female

Occupation	Total	Food, Beverages, Tobacco	Textiles, Apparel, Leather	Wood, and Wood Products	Paper, Print., Publish.	Chemicals and Related Prods.	Non-met. Minerals	Basic Metals	Fabri- cated Metals	Other Manufac- turing
TOTAL SCIENTISTS AND ENGINEERS	1,244	404	100	11	31	342	22	0	312	22
SCIENTISTS	193	23	0	0	21	148	0	0	1	0
Chemists	32	0	0	0	0	32	0	0	0	0
Physicists	0	0	0	0	0	0	0	0	0	0
Physical scientists, nec	1	0	0	0	0	0	0	0	1	0
Biologists, zoologists and rel. sci.	0	0	0	0	0	0	0	0	0	0
Bacteriologists, pharmacologists and related scientists	139	23	0	0	0	116	0	0	0	0
Agronomists and related scientists	0	0	0	0	0	0	0	0	0	0
Statisticians	0	0	0	0	0	0	0	0	0	0
Mathematicians and actuaries	0	0	0	0	0	0	0	0	0	0
Systems analysts	0	0	0	0	0	0	0	0	0	0
Economists	10	0	0	0	10	0	0	0	0	0
Sociologists, anthropologists, and related scientists	11	0	0	0	11	0	0	0	0	0
ENGINEERS	1,051	381	100	11	10	194	22	0	311	22
Architects and town planners	0	0	0	0	0	0	0	0	0	0
Civil engineers	11	0	0	0	0	0	0	0	11	0
Electrical and electronics eng.	195	0	0	0	0	0	0	0	184	11
Mechanical engineers	94	0	0	0	0	0	0	0	94	0
Chemical engineers	206	0	2	0	10	183	11	0	0	0
Metallurgists	21	0	0	0	0	0	0	0	21	0
Mining engineers	0	0	0	0	0	0	0	0	0	0
Industrial engineers	1	0	0	0	0	0	0	0	1	0
Engineers, nec	523	381	98	11	0	11	11	0	0	11

Source:

1990 Population and Housing Census Report, Volume 7, Industry and Occupation by Detailed Classification.

Kor-5(90)

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

Both Sexes

Occupation	Total	Business Services	Social and Community Services	Recreation and Cultural Services	Personal and Household Services
TOTAL SCIENTISTS AND ENGINEERS	20,774	5,486	14,055	1,114	119
SCIENTISTS	7,566	325	7,127	114	0
Chemists	652	0	652	0	0
Physicists	1,736	20	1,716	0	0
Physical scientists, nec	592	95	497	0	0
Biologists, zoologists and rel. sci.	506	11	453	42	0
Bacteriologists, pharmacologists and related scientists	1,942	9	1,933	0	0
Agronomists and related scientists	709	21	688	0	0
Statisticians	64	22	42	0	0
Mathematicians and actuaries	52	0	52	0	0
Systems analysts	21	11	10	0	0
Economists	579	96	483	0	0
Sociologists, anthropologists, and related scientists	713	40	601	72	0
ENGINEERS	13,208	5,161	6,928	1,000	119
Architects and town planners	2,710	2,459	173	78	0
Civil engineers	1,002	784	218	0	0
Electrical and electronics eng.	4,018	1,010	2,230	733	45
Mechanical engineers	2,157	655	1,293	145	64
Chemical engineers	754	10	734	0	10
Metallurgists	189	0	189	0	0
Mining engineers	97	22	64	11	0
Industrial engineers	414	45	369	0	0
Engineers, nec	1,867	176	1,658	33	0

Kor-5(90)

Table 5. Scientists and Engineers by Service Industry and Sex, for South Korea:

1990--Continued

Male

Occupation	Total	Business Services	Social and Community Services	Recreation and Cultural Services	Personal and Household Services
TOTAL SCIENTISTS AND ENGINEERS	18,520	5,243	12,088	1,070	119
SCIENTISTS	6,116	282	5,742	92	0
Chemists	556	0	556	0	0
Physicists	1,692	20	1,672	0	0
Physical scientists, nec	572	95	477	0	0
Biologists, zoologists and rel. sci.	460	11	407	42	0
Bacteriologists, pharmacologists and related scientists	988	9	979	0	0
Agronomists and related scientists	623	21	602	0	0
Statisticians	64	22	42	0	0
Mathematicians and actuaries	41	0	41	0	0
Systems analysts	21	11	10	0	0
Economists	472	53	419	0	0
Sociologists, anthropologists, and related scientists	627	40	537	50	0
ENGINEERS	12,404	4,961	6,346	978	119
Architects and town planners	2,553	2,324	162	67	0
Civil engineers	957	762	195	0	0
Electrical and electronics eng.	3,863	967	2,118	733	45
Mechanical engineers	2,106	655	1,242	145	64
Chemical engineers	607	10	587	0	10
Metallurgists	178	0	178	0	0
Mining engineers	97	22	64	11	0
Industrial engineers	414	45	369	0	0
Engineers, nec	1,629	176	1,431	22	0

Kor-5(90)

Table 5. Scientists and Engineers by Service Industry and Sex, for South Korea:

1990--Continued

Female

Occupation	Total	Business Services	Social and Community Services	Recreation and Cultural Services	Personal and Household Services
TOTAL SCIENTISTS AND ENGINEERS	2,254	243	1,967	44	0
SCIENTISTS	1,450	43	1,385	22	0
Chemists	96	0	96	0	0
Physicists	44	0	44	0	0
Physical scientists, nec	20	0	20	0	0
Biologists, zoologists and rel. sci.	46	0	46	0	0
Bacteriologists, pharmacologists and related scientists	954	0	954	0	0
Agronomists and related scientists	86	0	86	0	0
Statisticians	0	0	0	0	0
Mathematicians and actuaries	11	0	11	0	0
Systems analysts	0	0	0	0	0
Economists	107	43	64	0	0
Sociologists, anthropologists, and related scientists	86	0	64	22	0
ENGINEERS	804	200	582	22	0
Architects and town planners	157	135	11	11	0
Civil engineers	45	22	23	0	0
Electrical and electronics eng.	155	43	112	0	0
Mechanical engineers	51	0	51	0	0
Chemical engineers	147	0	147	0	0
Metallurgists	11	0	11	0	0
Mining engineers	0	0	0	0	0
Industrial engineers	0	0	0	0	0
Engineers, nec	238	0	227	11	0
Source: 1990 Population and Housing Census Report, Volume 7, Industry and Occupation by Detailed Classification.					

Kor-6(90)

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

Both Sexes

Occupation	Total	High school or below	Junior college	College or higher
TOTAL SCIENTISTS AND ENGINEERS	74,327	124	65,005	9,198
SCIENTISTS	11,763	124	10,188	1,451
Chemists	1,068	0	1,058	10
Physicists	1,878	0	1,867	11
Physical scientists, nec	828	0	785	43
Biologists, zoologists and rel. sci.	834	0	756	78
Bacteriologists, pharmacologists and related scientists	3,577	31	2,505	1,041
Agronomists and related scientists	1,733	32	1,464	237
Statisticians	76	0	76	0
Mathematicians and actuaries	131	0	131	0
Systems analysts	34	0	34	0
Economists	809	0	799	10
Sociologists, anthropologists, and related scientists	795	61	713	21
ENGINEERS	62,564	0	54,817	7,747
Architects and town planners	7,428	0	6,079	1,349
Civil engineers	6,246	0	5,255	991
Electrical and electronics eng.	21,408	0	19,146	2,262
Mechanical engineers	13,760	0	12,128	1,632
Chemical engineers	5,264	0	4,802	462
Metallurgists	1,167	0	1,054	113
Mining engineers	380	0	308	72
Industrial engineers	544	0	534	10
Engineers, nec	6,367	0	5,511	856

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

Male

Occupation	Total	High school or below	Junior college	College or higher
TOTAL SCIENTISTS AND ENGINEERS	70,235	102	62,094	8,039
SCIENTISTS	9,870	102	8,994	774
Chemists	940	0	930	10
Physicists	1,834	0	1,823	11
Physical scientists, nec	796	0	753	43
Biologists, zoologists and rel. sci.	777	0	711	66
Bacteriologists, pharmacologists and related scientists	2,362	31	1,899	432
Agronomists and related scientists	1,541	21	1,328	192
Statisticians	76	0	76	0
Mathematicians and actuaries	120	0	120	0
Systems analysts	34	0	34	0
Economists	692	0	682	10
Sociologists, anthropologists, and related scientists	698	50	638	10
ENGINEERS	60,365	0	53,100	7,265
Architects and town planners	7,123	0	5,878	1,245
Civil engineers	6,116	0	5,148	968
Electrical and electronics eng.	21,017	0	18,791	2,226
Mechanical engineers	13,604	0	11,995	1,609
Chemical engineers	4,881	0	4,453	428
Metallurgists	1,135	0	1,022	113
Mining engineers	380	0	308	72
Industrial engineers	543	0	533	10
Engineers, nec	5,566	0	4,972	594

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

Female

Occupation	Total	High school or below	Junior college	College or higher
TOTAL SCIENTISTS AND ENGINEERS	4,092	22	2,911	1,159
SCIENTISTS	1,893	22	1,194	677
Chemists	128	0	128	0
Physicists	44	0	44	0
Physical scientists, nec	32	0	32	0
Biologists, zoologists and rel. sci.	57	0	45	12
Bacteriologists, pharmacologists and related scientists	1,215	0	606	609
Agronomists and related scientists	192	11	136	45
Statisticians	0	0	0	0
Mathematicians and actuaries	11	0	11	0
Systems analysts	0	0	0	0
Economists	117	0	117	0
Sociologists, anthropologists, and related scientists	97	11	75	11
ENGINEERS	2,199	0	1,717	482
Architects and town planners	305	0	201	104
Civil engineers	130	0	107	23
Electrical and electronics eng.	391	0	355	36
Mechanical engineers	156	0	133	23
Chemical engineers	383	0	349	34
Metallurgists	32	0	32	0
Mining engineers	0	0	0	0
Industrial engineers	1	0	1	0
Engineers, nec	801	0	539	262
Source: 1990 Population and Housing Census Report, Volume 7, Industry and Occupation by Detailed Classification.				

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