

## Gender Statistics in Science and Technology in the Philippines<sup>1</sup>

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### ABSTRACT

This paper looks into the data sets available at the Philippines' Department of Science and Technology (DOST) for assessing the involvement of women and men in science and technology. These data sets are informed by the same rationale underlying most other gender-disaggregated data and management information systems with a specific focus on scientific and technological activities. The initial part of this paper briefly reviews this rationale, after which an analysis of gender differentials in science and technology is made using the available data from DOST. The paper concludes with a summary of the major trends and findings revealed by the DOST's gender statistics and a few observations on further improving these.

### I. The Rationale for Monitoring Gender Differentials in Science and Technology

Science and technology are widely acknowledged in modern-day societies to play a vital role in human progress and social development. Science and its applications (commonly referred to as technologies) have wrought improvements in virtually all areas of social life. These have increased productivity and generated further employment, and contributed vastly to improvements in health, transportation, communications, leisure and recreation. In view of their quantitative and qualitative contributions to societal well-being, science and technology have spawned an optimistic ideology of progress and are often considered essential for economic development.

At a more micro-level, science and technology represent the cumulation and acquisition of new knowledge and skills which constitute the seed for personal autonomy, and which opens to individuals avenues for better employment and increasing incomes, and prestige and social recognition. Hence, access to science and technology and their associated skills becomes an increasingly important determinant of a person's social status and life conditions.

Gender considerations in science and technology therefore, stem basically from women's and men's differential access to scientific and technological activities and resources. The generally lower participation rate of women in the sector is traced to women's historical subordination in social and economic life and which has reduced their opportunities for education and employment in fields requiring scientific and technological skills and applications. Data from most countries that there are fewer women graduates in science and technology fields despite increasing female enrollment at all educational levels. Employed women are also found mostly in sales and services work with little scientific and technological content, whereas men outnumber women in jobs with greater science and technology requirements.

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Because of the genders' differential access to science and technology, women expectedly also benefit less from ongoing developments in the sector. They do not share equally in the opportunities for developing innate talents and potentials for science and technology. Neither do they share equally in the higher prestige or status bestowed on science and technology educational degrees and achievements, nor in the higher salaries or incomes commanded by science and technology occupations. Likewise, little thought has been placed on the differential impact of scientific and technological innovations on women and men. Although new technologies have undoubtedly improved the lives of both men and women, their adoption and propagation are often based on other considerations, i.e., as their commercialization potentials, to the neglect of their differential impact on the sexes and other subgroups in the population.

Finally, because there are generally fewer women than men in science and technology, women are also under-represented in science and technology policy-making bodies. As a result, science and technology innovations are rarely directed towards improving productivity in areas of endeavor where women are found, or to meet particular women's needs. For a long time for example, scientific and technological innovations in agriculture were directed to men even as worldwide, women constitute a significant proportion of the agricultural labor force. Not until recently were agricultural extension services extended to women farmers, and farm tools and equipment designed to ergonomically fit the physique of women, reduce the tediousness and drudgery of their work, and improve their productivity on farms. Similarly, in the development of contraceptive and reproductive technologies (i.e., surrogate breeding and in-vitro pregnancies), little consideration was initially placed on the safety of these on women's health and on their implications on gender roles. In brief, for women to contribute to and benefit equally from science and technology, there is a need to close the gaps in the sexes' access to science and technology knowledge and resources, and in their involvement in the design and application of S and T policies and programs. It is mainly for this reason that a statistical data base and system are usually set in place to monitor male and female participation in science and technology.

## **II. DOST's Gender-Disaggregated Statistical Information**

In response to the increased awareness of the value of gender-disaggregated statistics, much effort has been exerted within the Philippine Statistical System to present population-related statistics (i.e., labor force, education, health and other demographic data) in gender-disaggregated form. Each government department has been similarly enjoined to build and use gender-disaggregated databases in their planning functions, as well as in monitoring the implementation of, and evaluating the impact of their services and programs. Being the lead agency for science and technology, DOST provides the major data inputs necessary for assessing male and female participation within its sector.

The data available at DOST for profiling the involvement of women and men in S and T are of different types and come from different sources. For purposes of this presentation, these data sets are classified into 3 major clusters, namely: 1) data provided by science and technology agencies and institutions on the composition and characteristics of their personnel; 2) data drawn from other surveys or sources (i.e., labor force surveys and education statistics) and used for determining/estimating available human resources for S and T development ; and 3) data

provided by implementing agencies of S and T programs on their program beneficiaries and participants.

### III. Institution-based Data on S and T Personnel

Of the institution-based data on S and T personnel available at DOST, the largest set comes from the 1993 National Survey of Scientific and Technological Activities (NSSTA) which was undertaken among 1283 research and development (R and D) institutions in government, the academe, private industry, and other non-government science and research organizations.<sup>1</sup> The survey identified some 14,886 R and D personnel in these institutions of which slightly over half (52.7%) are male and 47.3% are female. The survey further indicates relative gender parity among the R and D personnel of institutions found in the academe and in government where women comprise 49.7% and 48.3% respectively of R and D personnel (see Table 1). Males outnumber females in private industry R and D institutions however, while women outnumber men in the few non-government and non-private sector R and D organizations. In private industry, women comprise no more than 29.6 % of R and D personnel, but 55.7% of those in non-government science foundations.

**Table 1.** Distribution of R and D Personnel by Sector and by Gender (1993 NSSTA)

Sector	Male		Female		Total
	N	%	N	%	
Academe	3448	50.34	3402	49.66	6850
Government	2838	51.68	2654	48.32	5492
Private Industry	1166	70.41	490	29.59	1656
Others	393	44.26	495	55.74	888

When the personnel complement of R and D institutions are further broken down by category of personnel, Table 2 shows slightly more women (52.9%) than men among the highest personnel category of "Scientists and Engineers", and comprising of those engaged in basic, applied and experimental R and D. There are more men than women however, among the lower-level personnel categories of "Technicians" (those with vocational/technical training) and "Auxiliary/Other" personnel (referring to the administrative/clerical/ support staff of R and D institutions). Men outnumber women 3:1 among "Technicians" and 3:2 among "Auxiliary/Other" personnel.

The 1993 NSSTA also provides a disaggregation of the "Scientists and Engineers" category by gender and field of scientific activity as shown in Table 3. The data here point to some differences in women's and men's fields of R and D specialization. Women comprise a higher 61% to 64% of scientists in the Medical Sciences, Natural Sciences, Social Sciences and Humanities. In contrast, men comprise a higher 56.7% and 61.3% respectively of scientists in the Agricultural Sciences and in Engineering and Technology.

Finally, consistent with the greater number of women among the highest personnel category of "Scientists and Engineers" and the greater number of men among the lower "Technicians" and "Auxiliary" personnel categories, the 1993 NSSTA reveals that there are more women than men R and D workers who have completed a Bachelor's degree (52.9%) or a Master's degree (56.2%). Conversely, Table 4 shows that there are more men

**Table 2.** Distribution of R and D Personnel by Category of Personnel and by Gender (1993 NSSTA)

Category	Male		Female		Total
	N	%	N	%	
Scientists and Engineers	4477	47.10	5027	52.90	9504
Technicians	974	74.24	338	25.76	1312
Auxiliary	1798	59.20	1239	40.80	3037
Others	597	57.80	436	42.20	1033

**Table 3.** Distribution of Scientist and Engineers by Field of Science Activity and by Gender (1993 NSSTA)

Scientists & Engineers	Male		Female		Total
	N	%	N	%	
Agricultural Science	1635	56.71	1248	43.29	2883
Engineer & Technology	926	61.32	584	38.68	1510
Medical Science	327	35.90	584	64.10	911
Natural Science	596	38.35	958	61.65	1554
Social Science	786	37.27	1323	62.73	2109
Others	47	39.17	73	60.83	120

(82.8%) than women among those not completing a college degree, although it is also true that there are more male (55.2%) than female Ph.D. holders among R and D workers.

In sum, data from the 1993 NSSTA indicate overall gender parity in the numbers of women and men employed in R and D institutions, but alert us to some gender gaps in the sector. These are 1) the significantly greater representation of men among the personnel of private-sector R and D institutions which probably offer the best compensation packages for scientists and technologists; 2) the tendency for women and men scientists to specialize in different fields with more men

specializing in the Agricultural Sciences and in Engineering and Technology, and with more women

**Table 4** Distribution of R and D Personnel by Level of Education and by Gender (1993 NSSTA)

Education	Male		Female		Total
	N	%	N	%	
Below BS/BA	1326	82.77	276	1723	1602
BS/BA	3465	47.12	3889	52.88	7354
MS/MA	1210	43.76	1555	56.24	2765
Ph.D.	520	55.20	422	44.80	942
Others	1325	59.60	898	40.40	2223

specializing in the Medical Sciences, Natural Sciences, Social Sciences and the Humanities; and 3) a tendency for R and D institutions to be less discriminating of male than female education. By and large, R and D jobs require of women at least a Bachelor's or a Master's degree which gives women an edge in the highest professional category of scientists, but which also limits the entry of female undergraduates in R and D institutions.

Trends showing differences in the fields of specialization of male and female scientists and in their educational characteristics find support from another set of DOST data taken from the personnel profile of the member institutions of the Philippine Council for Advanced Science and Technology Research Development.<sup>2</sup> The Council has a network of 10 universities and six R and D institutions throughout the country and its high level S and T personnel with M.S. or Ph.D. degrees, 583 (or 56.2%) are women and a fewer 454 (43.8%) are men. The majority of the Council's scientists are in Biotechnology research (583); followed by Materials Science (226); Information Technology (123), Photonics (104); and Electronics, Instrumentation and Control (42).

Table 5 which presents a gender disaggregation of the Council's personnel by educational degree and field of scientific activity shows the field of Biotechnology to be predominantly female: 58.2%

of the Ph.D. holders working in this field are females as are 75.7% of those with M.S. degrees. In the field of Materials Science, 56.9% of Ph.D. holders are male although 66.1% of M.S. holders are women, suggesting that the field may eventually become gender-balanced. On the other hand, the limited number of personnel in the remaining fields (Information Technology, Photonics, and Electronics, Instrumentation and Control) are predominantly male at the Ph.D. and M.S. levels.

**Table 5** Distribution of PCASTRD Personnel by Field of Scientific Activities and by Gender (1996)

Areas of Concern	Educational Attainment								TOTAL
	M.S.				Ph.D.				
	Male		Female		Male		Female		
	N	%	N	%	N	%	N	%	
Biotechnology	73	24.3	228	75.7	118	42.0	164	58.2	282
Information Technology	59	63.4	34	37.0	23	77.0	7	24.0	30
Materials Science	42	24.0	82	47.0	29	57.0	22	43.1	51
Electronics, Instrumentation and Control	27	77.1	8	22.9	7	100.0	0	0.0	7
Photonics	47	63.5	27	36.5	29	72.5	11	27.5	40
Total	248	39.6	379	60.4	206	50.2	204	49.8	410

The predominance of women in Biotechnology receives further confirmation from the findings of another study on women scientists and managers in leading agricultural research institutions which was undertaken by the International Service for National Agricultural Research of the Hague and the Philippine Council for Agriculture, Natural Resources and Forestry Research and Development.<sup>3</sup> Of the four institutes covered in the study, Table 6 shows the personnel complement of the Institute of Biotechnology and Applied Microbiology to comprise heavily of women (73.5%). Greater gender

**Table 6.** Distribution of Scientist and Managers in Selected Agricultural Research Institute by Gender (ISNAR-PACRRD)

Institute	Male		Female		Total
	N	%	N	%	
Institute of Biotech. And Applied Microbiology	38	26.5	75	73.5	102
Institute of Plant Breeding	33	52.4	30	47.6	63
Philippine Rice Institute	59	57.3	44	42.7	103
Philippine Rootcrops Research and Training Center	17	60.7	11	39.3	28
TOTAL	136	45.9	160	54.1	296

parity is noted among the personnel of the Institute of Plant Breeding and the Philippine Rice Research Institute where women constitute closer to half (47.6% and 42.7% respectively) of these institutes' personnel stock. Representing the other extreme is the Philippine Root Crops Research and Training Center which has a greater number of men (60.7%) than women scientists and managers among its ranks.

Data compiled by DOST on the researchers of the Department of Agriculture (DA) similarly attest to improvements in the involvement of women scientists in agriculture.<sup>4</sup> Researchers engaged in the Crop Sciences account for the largest number of researchers at the DA, of which roughly equal numbers are female (202) and male (195). Table 7 indicates that DA researchers specializing in other fields (i.e. Animal Sciences, Basic Sciences etc.) are fewer in number, and that fields are gender-typed. The Animal Sciences and Soil Sciences/Agricultural Engineering are more male, while the Basic Sciences and the Social Sciences are more female. Consistent with earlier findings, data on the educational backgrounds of DA researchers show female researchers to be better educated than their male counterparts. Over two thirds of the DA researchers who are M.S. or Ph.D. graduates are women (see Table 8).

**Table 7** Distribution of DA Researchers by Field of Specialization and Gender

	Female		Male		Total
	No.	%	No.	%	
Animal Sciences	9	13.6	57	86.4	66
Basic Sciences	26	96.3	1	3.7	27
Crop Sciences	202	50.9	195	49.1	397
Fisheries	0	0.0	2	100.0	2
Social Sciences	43	63.2	25	36.8	68
Soil Science/Ag Eng'g	33	45.2	40	54.8	73
Others	9	90.0	1	10.0	10
Total	322	50.1	321	49.9	643

Source: DOST

**Table 8** Distribution of DA Researchers by Educational Level and Gender

	Female		Male		Total
	No.	%	No.	%	
BS	242	45.8	287	54.2	529
MS	73	70.2	31	29.8	104
Ph.D.	7	70.0	3	30.0	10
Total	322	50.1	321	49.9	643

Source: DOST

Similar data compiled on the researchers of the Department of Environment and Natural Resources (DENR) reveal the Department to have a much smaller research complement of only 106 researchers, around half (52) of whom are Forestry researchers who are all males<sup>5</sup> (see Table 9). The dominance of men in Forestry research accounts for the heavily male composition of DENR researchers.

**Table 9** Distribution of DENR Researchers by Field of Specialization and Gender

	Female		Male		Total
	No.	%	No.	%	
Animal Sciences	1	20.0	4	80.0	5
Basic Sciences	5	100.0	0	0.0	5
Crop Sciences	2	25.0	6	75.0	8
Forestry	0	0.0	52	100.0	52
Social Sciences	7	41.2	10	58.8	17
Soil Science/Ag Eng'g	1	20.0	4	80.0	5
Others	11	78.6	3	21.4	14
Total	27	25.4	79	74.5	106

Source: DOST



Data provided by DOST on the personnel of five of its attached offices/agencies confirm earlier findings regarding the relatively equal representation of women and men in S and T institutions, but continuing differences in the genders' fields of specialization and educational qualifications.  
<sup>6</sup> One notes from Table 10 that of the five DOST-attached offices, Philippine Volcanology and

**Table 10** Distribution of DOST-Attached Agency Personnel by Gender and Educational Attainment

Degree	Science and Technology Information Institute				TOTAL
	M.S.				
	Male		Female		
	N	%	N	%	
B.S.	35	68.6	16	31.4	51
M.S.	3	50.0	3	50.0	6
Ph.D.	0	0.0	1	100.0	1
Undergraduate	4	50.0	4	50.0	8
Secretarial/Vocational	4	57.1	3	42.9	7
Total	46	63.0	27	37.0	73

Degree	Technology Application and Promotion Institute				TOTAL
	M.S.				
	Male		Female		
	N	%	N	%	
B.S.	29	53.7	25	46.3	54
M.S.	0	0.0	6	100.0	6
Ph.D.	1	100.0	0	0.0	1
Undergraduate	2	22.2	7	77.8	9
Secretarial/Vocational	4	80.0	1	20.0	5
Total	36	48.0	39	52.0	75

Degree	Philippine Volcanology and Seismology				TOTAL
	M.S.				
	Male		Female		
	N	%	N	%	
B.S.	58	42.3	79	57.7	137
M.S.	7	63.6	4	36.4	11
Ph.D.	2	40.0	3	60.0	5
Undergraduate	0	0.0	40	100.0	40
Secretarial/Vocational	2	16.7	10	83.3	12
Total	69	33.7	136	66.3	205

Degree	Philippine Council for Health Research Development				TOTAL
	M.S.				
	Male		Female		
	N	%	N	%	
B.S.	40	75.5	13	24.5	53
M.S.	93	87.7	13	12.3	106
Ph.D.	232	49.6	236	50.4	468
Undergraduate	0	0.0	0	0.0	0
Secretarial/Vocational	0	0.0	0	0.0	0
Total	365	58.2	262	41.8	627

Degree	Industrial Technology Development Institute				TOTAL
	M.S.				
	Male		Female		
	N	%	N	%	
B.S.	30	22.2	105	77.8	135
M.S.	198	69.5	87	30.5	285
Ph.D.	31	63.3	18	36.7	49
Undergraduate	4	36.4	7	63.6	11
Secretarial/Vocational	0	0.0	0	0.0	0
Total	263	54.8	217	45.2	480

Seismology (PHILVOCS) is the least gender-balanced owing to its dependence on engineering and other physical sciences which are male-inclined. By contrast, the Philippine Council for Health Research and Development (PCHR) is more female since health-related fields tend to be selective of women. The Industrial Technology Development Institute (ITDI) also has more women overall, partly because the Institute has a large staff (263 people) and covers many areas of specialization from Electronics, Microbiology, Food Processing, Fuels and so forth. In general, S and T institutions with a large or an expanding staff tend to be more gender-equal, as are those that recruit from several areas of specialization. One may expect that the promotion of multi- or cross-disciplinary studies or bodies of knowledge within offices and departments and the scientific community in general, will likely minimize disciplinary boundaries and erode existing differences in women's and men's areas of S and T specialization. Already, DOST has a personnel complement of 4851 of whom 51% are males and 49% are females.<sup>7</sup> Moreover, as many as 68% of the Department's technical positions are occupied by women.

Finally, the last set of institution-based data come from the National Research Council of the Philippines (NRCP) and the National Academy of Science and Technology (NAST) which represent the country's leading organizations of scientists.<sup>8</sup> Both NRCP and NAST stipulate requirements for membership, although NAST has more stringent conditions for membership admission making the Academy the equivalent of a "learned society". In this sense, the NRCP and NAST data are additionally indicative of the prestige or social recognition bestowed on scientists.

Table 11 presents data on NRCP's 1994 membership broken down by gender and by the Council's 12 major divisions. Again, one notes that there are roughly equal numbers of men and women among NRCP's 2187 members. Six of its 12 major divisions covering the Biological Sciences, Social Sciences, Earth Sciences, Governmental, Educational and International Policies, Medical Sciences and Mathematical Sciences exhibit tendencies towards gender parity, with women comprising anywhere between 40% to 56% of scientists in each of these divisions. Three other divisions are selective of females and these are the Pharmaceutical Sciences, Chemistry and the Humanities where women constitute between 61% to 96% of scientists. On the other hand, the three remaining divisions namely, Agriculture and Forestry, Engineering and Industrial Research, and Physics are selective of men. Between 66% to 80% of NRCP scientists in these divisions are men.

Despite the increasing numbers of women involved in S and T activities, NAST's 1996 Directory of Academicians and Outstanding Young Scientists reveals that significantly more male scientists are awarded recognition for their achievements than women scientists. Of the 50 Academicians in 1996, only 17 were women; and of the 136 Outstanding Young Scientists during the year, only 37% were women (Table 12). Women's lower representation in scientific awards owes to the

**Table 11** National Research Council of the Philippine (NRCP) Membership 1994

Discipline	Female		Male		Total
	N	%	N	%	
Governmental, Educational and International Policies	68	48.2	73	51.8	141
Mathematical Sciences	44	40.4	65	59.6	109
Medical Sciences	104	45.0	127	55.0	231
Pharmaceutical Sciences	90	95.7	4	4.3	94
Biological Sciences	218	56.0	171	44.0	389
Agricultural and Forestry	77	28.9	189	71.1	266
Engineering and Industrial Research	52	34.2	100	65.8	152
Social Sciences	159	50.0	159	50.0	318
Physics	12	20.0	48	80.0	60
Chemistry	165	74.0	58	26.0	223
Humanities	73	61.3	46	38.7	119

Earth Sciences	42	49.4	43	50.6	•85
Total	1115	51.0	1072	49.0	2187

historical male bias of the Academy which has gone unnoticed for some time and is just slowly being rectified. Membership in the body of Academicians is limited to 50 at any one point in time, and no additional replacement is possible until the death of a member. It may be worth noting however, that eight Academicians have been awarded the title of National Scientist. Of these, four are female and four are male.

Some quarters also argue that men's higher representation in NAST awards is partly traceable to the Academy's bias for the Natural and Physical Sciences over other fields of knowledge as the Social Sciences and the Humanities. In view of women's and men's predilections to specialize in different fields, giving equal recognition to the various fields of scientific endeavor and branches of knowledge can contribute to advancing gender equity within scientific bodies.

**Table 12** Distribution of NAST Academicians and Outstanding Young Scientists by Gender and Field of Study (1996)

Academicians	Male		Female		Total
	N	%	N	%	
Math/Computer Science	1	100.0	0	0.0	1
Physical/Engineering Science	2	100.0	0	0.0	2
Bio/Chemical Science	7	46.7	8	53.3	15
Agricultural Science	11	84.6	2	15.4	13
Health/Medical Science	7	70.0	3	30.0	10
Social Science	4	50.0	4	50.0	8
Humanities	1	100.0	0	0.0	1
Total	33	66.0	17	34.0	50

Outstanding Young Scientists	Male		Female		Total
	N	%	N	%	
Math/Computer Science	9	81.8	2	18.2	11
Physical/Engineering					

Science	15	79.0	4	21.0	19
Bio/Chemical Science	18	47.4	20	52.6	38
Agricultural Science	21	65.6	11	34.4	32
Health/Medical Science	8	53.3	7	46.7	15
Social Science	14	66.7	7	33.3	21
Humanities	0	0.0	0	0.0	0
Total	85	62.5	51	37.5	136

#### IV. Data on Science and Technology Workers from Surveys and other Sources

DOST estimates of the available pool of S and T workers in the country are drawn primarily from the Scientific and Technological Labor Force Survey conducted by DOST's Science Education Institute (SEI) and the National Statistics Office (NSO) in 1990.<sup>9</sup> Using UNESCO's classification of S and T workers into those engaged in R and D, and those engaged in Science and Technology Education and Training (STET) and in Science and Technology Services (STS), the survey results indicate that the country's S and T workers consists chiefly of science education teachers. This pool of science educators and trainers totaled 208,480 in 1990 of which a large 81 % are women since the teaching field in the country is heavily dominated by women. On the other hand, the pool of workers engaged in STS and R and D is much fewer totaling only some 45,490 and 23,720 respectively in the same year. Women also claim fewer of the jobs in these two latter categories: 34.2% of STS jobs and 42.4% of R and D jobs.

The 1990 DOST-SEI/NSO survey too, presents a gender disaggregation of S and T workers using the standard classifications for major industries and occupational groups. Here, the survey results reveal that of the seven major industry classifications, women outnumber men only in the category of Community, Social and Personnel Services; and of the eight major occupational groupings, women outnumber men only in the category of Professional, Technical and Related Workers.

At this point, it may be appropriate to call attention to some of the differences in the results of the 1990 DOST-SEI/NSO survey and those of the 1988 and 1994 National Labor Force Survey rounds. Both the 1988 and the 1994 Labor Force Surveys reveal the numbers of women workers to exceed those of men in two major industry groups (Wholesale and Retail Trade, and Community, Social and Personal Services), and in four major occupational classifications (Professional, Technical and Related Workers; Clerical Workers; Sales Workers; and Service Workers). This discrepancy in the results of the 1990 DOST-SEI/NSO survey and the labor force surveys may owe to differences in the surveys' of S and T workers. The 1990 DOST-SEI/NSO 1990 survey however, does not provide a further explanation of its definitions or a listing of the specific industry activities and occupational jobs subsumed under its classification of the "S and T working population".

Other estimates of the country's supply of S and T workers come from education-related data, particularly current enrollment rates in colleges and universities and data on college graduates by major fields of studies. The data used by the DOST-SEI Report on "Gender Data on S and T Manpower Development" and taken from the Bureau of Higher Education focus on the Basic Sciences, Applied Sciences, Engineering Sciences, and Science Education for the period 1990 to 1993.<sup>10</sup> The data here (Table 13) indicate substantially higher proportions of female graduates in the Basic Sciences (65%) and Science Education (63%) but much lower proportions in the Applied Sciences (28%) and Engineering Sciences (16%). Although these patterns are in accord with earlier noted trends regarding the gender-typing of fields of studies, the total number of "college science and technology graduates" point to a far greater gender gap (of 75% male and 25% female) in science and technology than is suggested by the earlier mentioned institution-based and labor force surveys which show men overall to have only a slight edge of a few percentage points over women in science and technology activities. Likewise, the DOST-SEI Report on college graduates show Science Education graduates to comprise the smallest proportion of graduates (3240 out of 113,608 or 2.85%), whereas the 1990 DOST-SEI/NSO survey indicates that workers engaged in Science and Technology Education and Training comprise the largest proportion (75%) of the country's S and T working population. Such discrepancies again are due likely to definitional differences in the use of the term "science and technology". The Bureau of Higher Education data set analyzed by DOST reflects the common bias of delimiting science and technology to the natural and physical sciences as against a probably more inclusionary usage of the term in other data sources or surveys.

#### V. Data on S and T Program Participants and Beneficiaries

DOST has also begun to build up a gender-disaggregated data file on the recipients of S and T programs and projects. It administers several such programs, the more important of which are grants and scholarships; other programs designed to modernize production sectors through technology transfer, financing assistance and the adoption/commercialization of new technologies; and consultancy services to upgrade the technological content of various industries.

The first of DOST's scholarship programs is the Engineering and Science Education project (ESEP) for high school students financed by the World Bank.<sup>11</sup> Since its inception, ESEP has received some 16,346 applicants from elementary school graduates of whom two-thirds or a full 67% are female and 33% are male. A lower 53% of the female applicants successfully qualified for the program as against 58% of the male applicants. However, female students still constitute 65% of the program's 8934 qualifiers or recipients. After one academic year moreover, ESEP's female scholars outperformed by a slim margin their male counterparts in English tests; whereas the latter outperformed, also by slim margins, their female counterparts in Science and Math tests.

No actual numbers have been reported on the recipients of DOST's college undergraduate S and T scholarships. The DOST-SEI report however, mentions that 59% of program's applicants are male and 41% are female. Men also claim a higher 63% of program qualifiers, with women accounting for the remaining 37%. Interestingly however, the majority of female (60%) and male (69%) S and T college scholars have opted to pursue degrees in the Applied Sciences. But owing

likely to self-selection processes, there are somewhat more women opting for degrees in the Basic Sciences (29% vs. 25% for males) and in Science Teaching (11% vs. 6% for males).

The DOST-World Bank grant program for MS and Ph.D. students in the Sciences, Math and Engineering on the other hand, had 508 grantees from 1989 to 1996, 59% of whom are females and 41%, males. Women's overall advantage is reflected both at the level of MS grantees and Ph.D. grantees, with women accounting for 57% and 68% respectively of grantees at these levels.

**Table 13.** Total Number of BS, MS and PhD, graduates in the Basic Sciences, Applied Sciences, Engineering Sciences and Science Education by Gender, 1990-1993

	Male		Female		TOTAL
	N	%	N	%	
Basic Sciences	3,319	35.1	6,129	64.9	9,448
Applied Sciences	20,434	71.8	8,006	28.2	28,440
Engineering Sciences	60,651	83.7	11,829	16.3	72,480
Science Education	1,189	0.0	2,051	0.0	3,240
Total	85,593	75.3	28,015	24.7	113,608

Source: Bureau of Higher Education cited in "Gender on S and T Manpower Development", Ester B. Ogena, Ph.D., Science Education Institute, DOST (no date)

Shown next in Table 14 are data on the beneficiaries of some of DOST's ongoing programs for modernizing production processes and directed at companies and entrepreneurs.<sup>12</sup> Here, the data on four DOST programs reveal that this has reached many more male beneficiaries (62%) than women beneficiaries (38%). Moreover, of the total 60 female beneficiaries, 45 are beneficiaries of a single program which provides financing to high-school seniors to start-up businesses or companies. DOST's three remaining programs (the Inventors/Inventions Assistance, Technology Financing and Technology Business Incubators programs) each have a fewer number of beneficiaries who are overwhelmingly male (over 80%).

**Table 14.** Beneficiaries of Selected DOST Programs by Gender

	Total # of Beneficiaries	Number of Female
DATBED	82 high school students	45
Investors/Inventions Assistance	24 investors	1
Technology Financing		
VF	55 entrepreneurs	9
STF	23 projects	4
Technology Business Incubators	6 entrepreneurs	1
Total	190	60 (31.2%)

DOST likewise enters into contracts with private sector firms to promote research and development, technology transfer and the establishment of laboratories and pilot facilities. Between 1992 to 1996, DOST entered into some 564 such contracts, 30% of which were with companies, 23% with female entrepreneurs, and a larger 47% with male entrepreneurs.

Finally, it should be mentioned that a number of DOST offices periodically submit reports on women-oriented initiatives that they are undertaking within their units. These appear to consist of two major types of activities. The first consist of various gender-related training designed to promote gender sensitivity and awareness within offices and the adoption of gender-responsive methodologies for program planning and the monitoring and evaluation of projects. The second are attempts to increase female participation in programs and projects. The Metal Industry Research and Development Center for example, reports exerting efforts to increase the number of women participants in their training programs for non-traditionally female technologies (e.g. welding and electroplating); and stepping-up its assistance to food-processing enterprises run by women. PHILVOCS reports mobilizing women in community disaster management--harnessing their organization and management skills in times of calamities and addressing women's peculiar vulnerabilities during periods of crises. Finally, PCHRD reports developing a locally fabricated diagnostic device for monitoring iron status among clients and which is particularly useful for adolescents and pregnant and lactating women who run the highest risk of anemia or iron-deficiencies.

## VI. Concluding Observations

The foregoing review of DOST's gender statistics indicate that developments in the S and T sector in recent decades have not been particularly disadvantageous for Filipino women. Gender data from DOST point to the following general patterns and findings:

1. There are indications that access to S and T knowledge and resources is relatively gender-equal. S and T institutions in the country employ roughly equal numbers of women and men, and there are slightly more women in fact among the highest personnel category of "Scientists and Engineers" in R and D institutions. However, this is traceable to the fact that S and T institutions require of women higher educational levels than they do of men. Hence, this suggests that women with less than a college education or only a college education are less likely to be recruited into S and T institutions than men of similar educational qualifications.
2. Historical differences in the sexes' areas of S and T specialization have narrowed over the years so that there is today greater gender-mixing in most fields of science and technology. Nevertheless, there are a number of fields that remain selective of either women or men. In particular, the Basic Sciences, Biochemistry and Science Teaching attract more woman, while the Applied Sciences, Agriculture, and Engineering and Technology attract more men.
3. Data on school/college enrollments and graduates suggest a continuous supply of women candidates to S and T jobs or positions. There are more women recipients of DOST high school scholarships and women recipients of DOST college scholarships though fewer than males are increasingly opting for degrees in the Applied Sciences. Data on the country's



college graduates too, indicate that there are more women completing college and pursuing post-college degree and non-degree programs than men and which accounts for the earlier noted advantage of women in landing higher level S and T positions.

4. Despite the increasing entry of women in science and technology and presence in S and T institutions, most scientific awards go to men. This is due in part to the traditionally male bias of scientific societies and to the tendency of science academies to favor the Natural/Physical Sciences (with more males) over other branches of knowledge that attract women or both women and men. Ongoing trends towards the integration of knowledge and towards multi-and cross-disciplinary research and studies may be expected to erode the gender-typing of S and T specialization and improve the social recognition of women's S and T contributions.
5. The DOST is staffed with about an equal number of women and men, but 68% of its career service technical positions are occupied by women. In addition, the Department has eight women Bureau Directors, four women Regional Directors, two women Assistant Secretaries and two women Undersecretaries. Although a woman has yet to be appointed as Head/Secretary of DOST, women are relatively well placed to influence the S and T bureaucracy and public sector S and T programs.
6. Currently available data cover mostly ongoing S and T activities in government and the academe and fewer data have been generated for the private sector or for businesses and industries which are likely the prime movers and users of S and T. The limited data available on the private sector suggest that private-sector R and D institutions employ more men than women. Likewise, data from DOST reveal that more men than women are availing of its production-or business-oriented programs (see below).
7. With regard the beneficiaries/recipients of S and T programs, the data from the DOST show that more women than men availing of S and T scholarship and training grants. More men on the other hand, avail of programs designed to improve production activities through the adoption or application of new technologies. Nonetheless, DOST has moved to sensitize its offices and projects to gender concerns and to raise women's involvement in otherwise traditionally male-oriented S and T projects.

Although the gender statistics being compiled by DOST now allow us to note movements in women's and men's involvement in S and T, there are also a number of areas where these can be further reviewed, situated, and improved. One such area is perhaps the development of a conceptual framework that reflects the context of S and T development in the Philippines and which would then guide the collection, analysis and interpretation of S and T statistics. Being a country of limited resources, the Philippines may be expected to improve its S and T capacity more through the diffusion and adoption of foreign-made technologies than by trailblazing in scientific discoveries and inventions. Such technological diffusion and adoption probably occur more at the level of businesses and enterprises but which are least covered in the country's S and T statistics. The S and T information that we have available focus more on the education and supply of scientists and technologists in government and academic institutions, and on the participants of public-sector S and T programs and projects.

A profile of national S and T activities cannot be complete without the generation and analysis of private-sector S and T statistics, particularly in view of policy reforms directed at economic liberalization. In turn, the generation of private-sector S and T statistics requires additional background studies on the S and T content and/or requirements of industries of varying types (e.g., garment firms, appliance manufacturers, plastics, and resins companies etc.) and scales (SMIs, large businesses) and the capacity of these industries to absorb new technologies. Part of the difficulty in interpreting the available data on the S and T labor force by major industry (and occupational) groups is that little is known about the S and T requirements or demand of the industries in which workers find themselves. Tracking the placement/recruitment of male and female personnel in industries of varying S and T content (high, medium and low technology industries) thus becomes important in assessing the genders' overall participation in science and technology activities.

Another area for improving S and T statistics is in the definition of "science and technology" fields and activities. Current usage is far from uniform and various data sources including those reviewed here do not adhere to the same definition and classification of S and T activities. Two points are worth considering in attempts to arrive at more consistent definitions of S and T. The first is to guard against the common bias of limiting S and T to the Natural/Physical Sciences and their applications, and to the exclusion of other fields of knowledge. The term "technology" for instance is often used to refer only to physical technologies or devices while ignoring a range of social, behavioral and organizational management technologies which are equally important in improving the country's capability to adopt or develop technologies appropriate to its changing conditions. The second is to guard against the equally common bias of equating science and technology to "modern-day S and T", the conduct of which requires high levels of education and complex facilities. This notion of S and T tends to exclude forms of indigenous knowledge (arrived at through historical experience rather than through controlled experiments) and the everyday kind of science played out in people's lives. Indigenous knowledge is known to form essential components of community healing/health maintenance practices, as well as of farming, fishing and other production activities. S and T definitions that are too restrictive or that are too biased in favor of certain activities directly affect the statistics generated for the sector and the distribution of men and women in S and T endeavors.

### Notes and References

<sup>1</sup>*National Survey of Scientific and Technological Activities (NSSTA): Integrated Report, S and T Resource Assessment and Evaluation Division (STRAED) and Planning and Evaluation Services (PES), DOST. n. d.*

<sup>2</sup>*Women Participation in Advanced Science and Technology, Virginia G. Novenario, Philippine Council for Advanced Science and Technology Research and Development, DOST. n. d.*

<sup>3</sup>*Women Scientists and Managers in Agricultural Research in the Philippines. International Service for National Agricultural Research (The Hague) and Philippine Council for Agriculture, Natural Resources and Forestry Research and Development (Los Baños, Philippines), October 1993; see also ISNAR Research Report 7 by Edwin G. Brush, Deborah Merrill-Sands, Dely P. Gapasin and Virginia L. Mabesa, April 1995.*

<sup>4</sup>Data on DA researchers supplied by DOST.

<sup>5</sup>Data on DENR researchers supplied by DOST

<sup>6</sup>Data on the personnel profile of selected DOST agencies are based on reports submitted by the Science and Technology Information Institute, Technology Application and Promotion Institute; Philippine Volcanology and Seismology, Philippine Council for Health Research Development, and Industrial Technology Development Institute.

<sup>7</sup>*Gender Analysis in Industrial Science and Technology under APEC*. Amelia C. Ancog, Beatriz D. del Rosario, Maruja V. Lorica, Virginia Novenario, Karen Castañeda, Aida Ansaldo and Emilio Amparo, DOST. n. d.

<sup>8</sup>Data on NRCP scientists are from Sylvia H. Gurerrero's article on "The situation of Women Scientists and Managers in Asia" appearing in "ASEAN Symposium on Women in Science and Technology: Papers and Proceedings". Women in Science and Technology Development Foundation, Inc., Manila:1994; NAST-related data are from NAST's 1996 Directory of Academicians and Outstanding Young Scientists.

<sup>9</sup>Figures from the 1990 DOST/SEI-NSO S and T Labor Force Survey are cited in *Gender Data on S and T Manpower Development*. Ester B. Ogena, Science Education Institute. DOST n. d.

<sup>10</sup>Also cited in Ogena, above.

<sup>11</sup>Also cited in Ogena, above

<sup>12</sup>See Ancog et. al. above. Other data on DOST program beneficiaries are based on agency/unit reports submitted by MIRDC, Philvocs and PCHR.

