

Gender, Higher Education, and Science & Engineering Research Reforms in Sweden



By Yolanda S. George

Yolanda S. George has been on staff at the American Association for the Advancement of Science (AAAS) since 1985. She is now Deputy Director, Directorate for Education and Human Resources (EHR) Programs. Her current work includes research and evaluation policies, practices, and programs related to undergraduate and graduate school student recruitment, admissions, and retention. She is particularly interested in efforts to increase the participation of African Americans, Hispanic Americans, Native Americans, women, and persons with disabilities in the science and engineering PhD workforce.

Since the mid-1980s Sweden has been involved in reforms to increase the number of women in science and engineering (S&E) in higher education and in the workforce. This report summarizes these reforms, including strategies and data. Data indicate that these reforms have dramatically increased entry of women into postgraduate programs and the production of women doctorates in Sweden.

The Policy Framework

S&E gender issues in Sweden are rooted in the 1970s and 1980s gender equality movement. Specific higher education policies that included goals for achieving gender balance were put into place in the mid-1990s.

In 2001, Sweden adopted a research policy that reinforces the gender balance mandates in higher education. This policy recognizes that increasing the participation of women in the S&E enterprise is one of the key elements for making Sweden a leading research nation.

Sweden's research policy is designed to counteract the large number of PhD scientists and engineers in academia now approaching retirement, as well as to meet the needs for PhDs in government and business. High priority research areas include the biological sciences and biotechnology, information technology (IT) research, and materials science and material technology.

This material is the first in a series based upon work supported by the National Science Foundation under NSF Grant No. 0120181.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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Swedish government instructions and measures to promote gender equality are aimed at changing practices and cultures within universities, research councils, and government. Both the mainstreaming and special measures are used to stimulate changes in higher education admissions and faculty hiring.²

As of 1997, colleges and universities in Sweden must meet percentage targets which are negotiated with the government and related to gender distribution of new undergraduate and graduate students (Tables 1 and 2), and newly recruited professors. Failure to meet percentage targets may have financial consequences.³

Higher education institutions are mandated to increase the proportion of women students in the natural sciences and technology fields and men students in teacher training and nursing. Also, in terms of new faculty recruitment, in cases where there is little or no difference between the qualifications of competing applicants, preference should be given to applicants of the under-represented sex in the department.⁴

Strategies to Achieve Gender Balance

To ensure that higher education institutions in Sweden attain gender balance, government funding has been provided for graduate school and postdoctoral fellowships. In addition, a number of other strategies have been used.

In 1995, the government created 32 full professorships (Tham-Professors) that were co-funded with research councils and universities. Men were allowed to apply for the Tham-professorships

Table 1. Newly Accepted/Registered Research Students by Number and Percent of Women, 1999-2002 at KTH

New Students Per Research Field	2002		2001		2000		1999	
	Total	Of which awarded to women	Total	Of which awarded to women	Total	Of which awarded to women	Total	Of which awarded to women
Mathematics	12	25%	8	0%	12	8%	14	7%
Chemistry	13	54%	23	39%	20	40%	28	29%
Information Technology	41	15%	34	12%	37	14%	39	18%
Engineering Physics	22	32%	39	33%	19	26%	25	12%
Electrical Engineering, Electronics and Photonics	28	11%	24	17%	22	5%	38	11%
Chemical Engineering	28	71%	27	33%	34	53%	43	37%
Biotechnology	31	45%	17	29%	5	80%	18	61%
Engineering Mechanics	45	13%	64	16%	65	11%	43	9%
Materials Science	25	28%	13	31%	16	19%	24	17%
Civil Engineering and Architecture	26	42%	14	43%	32	28%	17	24%
Engineering and Business Management	55	38%	31	52%	26	23%	30	37%
Environmental Engineering	4	50%	6	33%	2	50%	1	0%
Engineering Science (other)	5	80%	6	50%			5	40%
Total New Research Students	335	33%	306	28%	290	23%	325	23%
Total Number of Students Registered:	1,884	26%	1,906	24%	1,855	24%	1,853	24%

Table 2. Number of All Students and Percent of Women Awarded Doctorates, 1999-2002

Doctorates per Research Field	2002		2001		2000		1999	
	Total	Of which awarded to women	Total	Of which awarded to women	Total	Of which awarded to women	Total	Of which awarded to women
Mathematics	4	0%	12	8%	8	13%	5	0%
Physics	2	0%	1	100%	3	33%	3	0%
Chemistry	15	40%	14	43%	16	44%	12	25%
Information Technology	20	5%	22	32%	17	6%	6	17%
Engineering Physics	17	12%	17	29%	16	13%	11	0%
Electrical Engineering, Electronics and Photonics	24	8%	20	5%	22	0%	23	9%
Chemical Engineering	19	21%	25	52%	16	44%	20	30%
Biotechnology	11	73%	14	29%	1	0%	15	27%
Engineering Mechanics	26	15%	33	6%	29	14%	25	8%
Materials Science	13	15%	10	30%	16	25%	15	27%
Civil Engineering and Architecture	7	29%	20	25%	16	31%	15	33%
Engineering and Business Management	16	38%	11	18%	10	30%	9	11%
Environmental Engineering	1	100%	3	33%	1	100%	2	100%
Engineering Science (other)							2	50%
Total	175	22%	202	25%	171	21%	163	19%

KTH Annual Report (2002) (ISBN-91-7283-556-7). Stockholm, Sweden.

and could be given the job if no female candidate was suitable. However, after complaints in 2000 the European court ruled the these professorships to be unlawful.^{2,5}

In 1999, a new faculty promotion policy was introduced to enable senior lecturers with the appropriate qualifications to be appointed as professors and for junior lecturers to be appointed to the position of senior lecturer. Of 11,000 of these promotions to professors in 1999 and 2000, 18% were women.³

Resources are provided for gender research and professional development related to gender issues. In particular, a Swedish national secretariat and a national library for gender research were established at Göteborg University.

From 1996-2001, a coordinating group on gender equality worked with the research councils to ensure equitable grant peer review and to provide gender equity professional development for staff and members of scientific boards within the council. Also, the research policy indicates that every area of higher education organizing postgraduate programs should provide courses in gender perspectives and the promotion of gender equality for research mentors.⁴

Higher Education Enrollment and Degrees Awarded

Data from the Swedish National Higher Education Agency (Högskoleverket), a unit of the Swedish Ministry of Education and Science, the Royal Institute of Technology (KTH) and Chalmers University of Technology indicate that the reforms have been positive, particularly for women (Table 3).^{3,6,7}

- **New women in postgraduate programs in S&E.** Academic year 2000/01 data from Högskoleverket indicate that the proportion of new women in all postgraduate programs has increased by about 12.8% since 1995/96. In 2000/01, women were 44% of the 3200 new postgraduate students. The proportion of women among first time postgraduate students in all engineering programs was 26% and in natural sciences it was 40%. At KTH the proportion of new women research students rose from 23% in 1999 to 33% in 2002. Thus from 1999-2002, the number of new women in research training courses increased from 75 to 110, nearly a 47% change since 1999 (Table 1).
- **Overall postgraduate enrollment of women in S&E.** Since 1995/96, the percentage of change for active women

The most dramatic changes are in the number of women entering postgraduate programs and earning doctoral degrees.

Table 3. Number and Percent of PhDs and Licentiates Awarded to Women at Chalmers University of Technology 1998-2002)

	1998	1999	2000	2001	2002	Number and Percent Change for Women 1998 and 2002
Number of all PhDs awarded	98	104	94	115	130	
Number of women PhDs	21	16	19	28	38	11 (80.9%)
% of women PhDs	21.4	15.4	20.2	24.3	29.2	
Number of all Licentiates awarded	111	133	149	140	172	
Number of women awarded Licentiates	26	31	40	36	42	16 (61.5%)
% of women awarded Licentiates	23.4	23.3	26.8	25.7	24.4	

Chalmers Annual Report (2002) ISSN 0281-6629, Göteborg, Sweden.

postgraduate students in colleges and universities in Sweden increased 35%. The number of active postgraduate students in 2000/2001 was 18,100. In graduate engineering programs, women represented 26% of the students. The largest proportion of women in postgraduate programs was found in medicine (58%) (Högskoleverket).

- **Graduate degrees awarded to women in S&E.** In all colleges and universities in Sweden, the most notable increases were in doctoral degrees awarded to women. Since 1995/96, the percent of change in doctoral degrees awarded to women increased by 92%. In 2000/2001, the number of doctoral degrees awarded to all students was 2,400. Women received 24% of all the engineering degrees awarded in 2000/01 (Högskoleverket).

At KTH, in 2002, women were awarded 22% of the doctorate degrees. The highest percent of doctoral degrees awarded to women were in biotechnology (73%), chemistry (40%), and engineering/business management (38%). Since 1999, this represents a 22% increase in the number of doctoral degrees awarded to women (Table 2).

At Chalmers University of Technology, the percent of women awarded PhDs increased from 21.4% in 1998 to 29.2% in 2002. This represents an increase of 80.9% in the number of PhDs awarded to women as compared to 1998 (Table 3).

- **Women Professors in S&E.** The percent of women professors in all disciplines increased from 6% in 1990 to 14% in 2002. In 1999, the percent of women professors in technology was 6.4% and in natural sciences the percent was 9.5% (Högskoleverket). In 2002, at both KTH and Chalmers, women were about 7% of all professors.

Summary and Conclusions

Sweden's S&E research workforce development policy that includes mandated gender targets for new student and new faculty recruitment in higher education is moving in a positive direction. Even with the downturn in the Swedish economy and human adjustment associated with radical gender goals, the reforms have been particularly good for women.

The most dramatic changes are in the number of women entering postgraduate programs and earning doctoral degrees. The increases in the S&E doctoral degrees are particularly important for women, since it can lead to the professoriate, where the number of women are very low. ❖

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