



WOMEN IN ENGINEERING

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ABSTRACT

There is a growing concern in many countries that the under-representation of women in engineering will deprive society of the special talents and contributions of a substantial proportion of the population in these fields. Even though the enrolment of women at tertiary level has exceeded male enrolment in many countries, enrolment in engineering has not increased substantially. This paper discusses some of these issues and presents some available data on the participation of women in engineering.

INTRODUCTION

Although the participation of women in tertiary education has increased many fold, few women today choose to enter science and engineering fields. In the US, women earn more than half of all bachelor's degrees, yet only 1.7% of them earn bachelor's degrees in engineering, compared to 9.4% of men who graduate with engineering degrees. Men are more than five times more likely than women to choose engineering as a field of study (Carnes and Donofrio, 2000). Thus, women are underrepresented in key segments of the technical workforce. However, there is some statistical evidence to suggest that the situation is improving, especially with regard to the proportion of female students who study science and engineering in universities (Oldham and Achmad, 1999).

Not all countries are experiencing the same situation. There appear to be few major obstacles to women pursuing rewarding careers in science and technology in a few countries, but in most of the world, there are major problems. A few, especially those in

Eastern Europe and some in South East Asia, there's a distinct parity between men and women who obtain professional qualifications in science and engineering and those who enter scientific and technical careers. But even in these countries the most senior jobs still go disproportionately to men. The pursuit of new scientific and engineering knowledge and its use to society requires the talent, perspective and insight that can only be assured by increasing diversity in the science, engineering and technological work-force. The increasing importance of scientific and technological literacy to the national and global economy requires contribution from women. It is essential that women not only benefit from technology, but also participate in the process from the design to the application, monitoring and evaluation stages. The importance of being educated in science and technology prepares women to take on an active role in the technological and industrial development of their countries.

DO WE NEED WOMEN IN ENGINEERING?

Women have made important inroads in science and engineering since the early 1970s. However, there is a growing concern that the under-representation of women in engineering will deprive society of the special talents and contributions offered by women in these fields. Though women are no longer barred from entering fields that interest them; they encounter hurdles that make their progress more difficult (Pardue et al., 1999).

A thematic meeting on mainstreaming women in science at the

UNESCO/ICSU World Conference on Science in 1999 received reports from six regional meetings, which WF indicated that the participation of women in science and engineering is important for human rights and social justice, scientific and economic reasons, social and economic reasons, and in enriching the pool of insights and motivations (Oldham, and Achmad, 1999).

OVERVIEW OF WOMEN IN ENGINEERING

In the US, despite advances made in the proportion of women choosing to pursue science and engineering careers, women continue to be significantly underrepresented in almost all science and engineering fields, constituting only about 22% of the science and engineering workforce at large, and less than 20% in science and engineering faculties in 4-year colleges and universities. They hold an even smaller percentage of high-ranked positions ([http:// research.isiproducs.com/sciwise/swob4639.htm](http://research.isiproducs.com/sciwise/swob4639.htm)). Data from Canada and the USA show that far fewer women are successfully engaged in scientific enterprises than would have been expected given the increasing numbers of women in the workforce (Lane, 1999).

In UK, although still a minority, the proportion of those taking science and engineering degrees who are women has generally increased over the past ten years. However, the enrolment in engineering and mathematical sciences are at only 14% and 22.6% respectively, compared to the biological sciences at 64%. It was also found that there are fewer women the higher up one goes in Science, Engineering and Technology (SET) (<http://www.britcoun.org/science/science/pubs/briefsht/wise/wise3.htm>). Women account for 25% or less of the workforce in some SET-related industry sectors compared to 80% in health and social work and 45% for all sectors. The number of female SET graduates within SET occupations ran at just over 80,000 in 2002, compared with around 400,000 male SET graduates in SET occupations.

MALAYSIAN WOMEN IN ENGINEERING

There is a paucity of information with regard to women in engineering in Malaysia. Studies on the participation of women in engineering, problems, career path's at undergraduate, postgraduate and professional levels are lacking. Thus, most of the information obtained were raw data that had to be compiled from various sources and analysed. Statistics available on engineers' registration obtained from the Board of Engineers, Malaysia as of 31st December 2001 indicate out of 10,578 professional engineers registered only 216 or 2% were women. Women graduate engineers made up 9% of total graduate engineers registered (2774 out of 29,584).

The number of female undergraduates in Malaysian universities rose from 41.6% in 1985 to 47.7% in 1990. However, from these total enrolments, only 2% of students in Engineering in were women 1985 and 3.8% in 1990. In 1998 and 1999, the enrolment of women undergraduates exceeded male undergraduates, at 58% in 1998 and 62% in 1999. The enrolments of women in all fields are at par or exceeded male enrolment except for engineering with only 29.5%. In the various Arts/Social Sciences related fields, women outnumber men with 60% in Management and Communication to 85% in Social Sciences and Humanities. (<http://www.kanitawomen.org/SocioEcono/Trends.htm>). This trend is similar with most countries where the enrolment of women in tertiary education exceeded males but is not reflected in the engineering enrolment.

The total current enrolment of female engineering students at the Faculty of Engineering, Universiti Putra Malaysia, is about 34% of the total engineering enrolment. The female enrolment in Year 1 is less than that in Year 2 and Year 3. A comparison between first year and second year enrolment found that there has been a decrease in female enrolments in all engineering programmes offered by the faculty especially in Civil Engineering which experienced a drop of 20%, followed by Chemical Engineering (16%), Food Processing Engineering (15%), and Biological and Agricultural and Aerospace Engineering (14% each). Generally, Aerospace and Mechanical Engineering attracted the least number of women, unlike Chemical Engineering and Food Engineering (Megat Johari et al., 2002). Whether this trend is similar in other public universities in Malaysia has yet to be determined.

CONCLUSION

The development of engineering and the generation of wealth in an increasingly competitive world requires the participation of women to fully complement a country's scientifically creative minds. The inclusion of more women in engineering will enrich the total pool of talents, enrich and diversify insights and motivations, and increase the probability that engineering will better serve the needs of all humanity.

The participation of women in engineering fields can be increased by encouraging an interest in science and technology at an early age for girls and by creating the necessary and appropriate environment for women. A UK

study found that a high number of SET women are or aspire to be employed in the Higher Education sector, and it is this sector which plays a major part in shaping the attitudes of future generations. A result of a preliminary study on UPM engineering students showed that women feel engineering is suitable for them but indicate that cultural conditioning and society's views are inhibiting factors to their participation (Rosnah et al., 1997). These barriers to recruitment and retention of women in engineering are slowly being lifted as more women play a predominant role in society. Also, the realisation that if women are left out in engineering a lot of opportunities will be lost has helped in encouraging women to enter this field. ■

REFERENCES

1. Carnes, K. H. and Donofrio, N.M., 2000. *Minority Engineers, Issues in Science & Technology*, Spring, Vol.16 Issue 3, pp 19-21.
2. <http://research.is/products.com/sciwise/swobj4639.htm>. *Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers*. November 2003.
3. <http://www.britcoun.org/science/science/pubs/briefsht/wise/wise3.htm>. *Women in Science, Engineering and Technology: the UK experience*. November 2003.
4. <http://www.kanitawomen.org/SocioEcono/Trends.htm>. March 2002.
5. Lane, N.J. 1999. *Why are there so few Women in Science* http://www.nature.com/nature/debates/women/women_frameset.html. November 2003.
6. Megat Johari MMN, Rosnah M.Y., Ismail, N., and Osman M.R., 2002. *Gender Distribution at the Faculty of Engineering, Universiti Putra Malaysia in Proceedings of Engineering Education, Training & Policy, 2nd World Engineering Congress*, pp 112-114.
7. Oldham, G. and Achmad, S., 1999. *Gender mainstreaming in science and technology—a global report*. http://www.nature.com/nature/debates/women/women_frameset.html. November 2003.
8. Pardue, M.-L., Hopkins, N., Potter, M.C. & Ceyer, S. *Moving on from discrimination at the Massachusetts Institute of Technology, Nature debate*, <http://helix.nature.com/debates/women/women1.html>. November 2003.
9. Rosnah, M.Y., M.S.M. Amin, 1993. *Training of Women to Meet High Technology Requirement in Meeting the Industrial Challenge Beyond 2000*. Proc. of Conference on Engineering Education, ITMI/EM, pp 113-119.
10. Rosnah M.Y., M.S.M. Amin, R.K.Z. Shahbudin, I.B.Aris, 1997. *Women in Engineering Education and training – Trends and Challenges*. Proc. of International Conference on Global Challenges in Engineering Education – Role of Islamic Countries, FEIIC/IEM/UPM/IMCED, pp 157-161.