

Did she Jump or was she Pushed? A Study of Women's Retention in the Engineering Workforce*

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Women now constitute 15% of students in Australian undergraduate engineering courses, but they represent only 5% of the professional engineering workforce. If engineering industry is to enjoy the benefits of diversity, it is important to retain, as well as recruit, women into the profession. The Careers Review of Engineering Women (CREW) project was undertaken in 2000 to investigate the issues surrounding women's retention, satisfaction, and progression in the professional engineering workforce. All Australian-resident female members of the Institution of Engineers, Australia were surveyed, together with a matched sample of male engineers. The survey found that similar proportions of female and male engineering graduates joined the profession. Differences were found in the nature of the engineering work undertaken by women and men, with more women describing their work as engineering-technical, and more men describing their work as engineering-managerial. Women were more dissatisfied with workplace culture and conditions, they received lower pay and benefits, and were far more likely to experience sexual harassment and discrimination than their male counterparts. The data indicate that women over 30 are leaving the profession, particularly if they are combining career and family responsibilities. This paper examines the implications of these and other results from the CREW study, set in the context of the literature, and suggests strategies to improve workplace retention and satisfaction.

INTRODUCTION

THE PERCENTAGE of women undertaking engineering degree courses in Australia has steadily increased from 3.3% in 1980 to 14.8% in 1999 [1]. Although women have constituted more than 10% of the student population since 1990, they currently represent only 5% of the professional engineering workforce [2]. Concern amongst Australian women engineers that many of their colleagues were leaving the profession a few years after graduation led to the demand for the Careers Review of Engineering Women, or 'CREW' study, which was undertaken in 2000 by the National Women in Engineering Committee of the Institution of Engineers Australia (IEAust).

CREW is the first major Australian study that examines the issues surrounding the retention, satisfaction and progression of professional women engineers in the Australian workforce. The study comprised both an extensive review of Australian and international literature to explore the existing data and explanations for women's retention and disadvantage in the engineering workforce, and a survey of the current Australian situation. The aim of the study was to provide hard data about women's retention and experiences of the engineering workforce, which can be used to inform government, employers and women

engineers about strategies and programs for improvement.

THE LITERATURE SURVEY

Over the last two decades there have been marked changes of emphases in the arguments presented for women's equitable representation in the engineering profession. In the 1980s the arguments were primarily based on social justice and equity: that women should have the same opportunities as men for interesting and well-paid employment, and accordingly the focus was on increasing women's access to engineering courses [3–5]. Later it was recognized that the unfriendly, even hostile culture of engineering, as experienced by both female students and engineers in the workforce, constitutes an even greater barrier to women's recruitment and retention [6–8].

More recently the value of diversity in the profession and workforce is increasingly recognized, together with the consequent need to bring about cultural change [1, 9]. As a result, the research emphasis in the field of women's engineering employment has shifted from recruitment to retention [10, 11]. There are also increasing calls for hard data about issues such as recruitment, retention, pay and promotion (such as those provided in the biennial US National Science Foundation

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reports [12]), to complement qualitative studies (such as those of Evertts [13, 14] and Drake [10]).

Existing Australian data

Data on engineering employment conditions, pay, and levels of responsibility are regularly collected by the Association of Professional Engineers, Scientists and Managers, Australia (APESMA). The 1999 data [15] show that on graduation at least 75% of both female and male graduates stay in the profession: as employed engineers, or looking for work as engineers, or undertaking further engineering study.

APESMA classifies levels of responsibility as ranging from Level 1 for the commencing graduate engineer to Level 5 for the senior engineering administrator or consultant. In terms of career progression, APESMA data [16] show that above Level 2 (the experienced professional engineer), the numbers of women steadily decline; while men are significantly more likely to reach Level 3 (the first level that involves responsibility for assigning and supervising the work of other professional and technical staff). Studies from the USA and UK also indicate that overall, women engineers occupy lower status positions than male engineers and that those women who do gain promotion to management levels appear to be assigned less responsibility than their male counterparts [11–13].

IEAust data show that there is almost no difference in Australia between women's and men's pay at entry level [17]. At more senior levels however, significant pay differentials emerge between men and women in comparable positions. One reason for this seems to be that men are granted higher-status position titles (such as 'director' or 'general manager') than women doing the same work, and then get paid more [18]. Men are also more likely to receive other benefits, such as superior cars, and better superannuation. Overall, total salary packages for male engineers exceed women's by over 40%. Similar pay differentials are found in the UK and the US.

The data outlined above show that women engineers tend to become progressively concentrated in lower paid and lower status jobs. While some of the differentials in seniority and salary arise from the choices made by some women to interrupt their careers for family formation [19], the question why women who have not had children usually do not achieve parity with their male counterparts over a lifetime's career remains unanswered.

Reasons for women's disadvantage

Researchers commonly group impediments to women's career progression into two categories. These groupings have been variously defined as 'public lives' vs 'private lives' [20]; 'structural perspectives' vs 'gender role' issues [21] and organizational and environmental vs individual issues [22]. These frameworks indicate that women's disadvantages in the engineering profession stem

both from the attributes and priorities of individual women, and from organizational cultures and work environments that have been shaped by the philosophies, values and interests of men.

There is evidence that higher standards of achievement are expected from women than from men, and that women's mistakes are judged more severely [23]. Through 'paternalism', women are often denied the practical experience they need for promotion [23, 21]. Informally, the male network determines the standards for promotion, and supports its own candidates. Women are usually excluded from such networks, and so also miss out on the mentoring which often takes place within them [24]. Women are subject to sexual harassment, and various types of discrimination [14, 23–25].

Women's own explanations for their disadvantage partly blame the masculine ethos of the workplace, manifested by paternalism, sexual harassment, and misunderstandings arising from different styles of communication [23], and partly on the particular difficulties in this profession of combining work and family [10].

Women trying to combine work and family face additional problems. At work they may be viewed as less committed than the men to their careers, despite research proving that women value their engineering careers as much as men [21]. They are disadvantaged in male environments where professional commitment is demonstrated by working long hours and making personal sacrifice [26]. There is evidence that engineering mothers may hold back from applying for promotion, knowing that their family needs would count against them [13]. Many women engineers with children would like to work part time, but part-time work is not favored by Australian engineering employers [10, 27].

Summary of the existing literature

The literature in this field indicates that women are disadvantaged by the engineering culture, which is characterized by the dominance of male attitudes and values; and there is little recognition of women's differences in lifestyle choices and priorities. Some of the key explanations of women engineers' workplace disadvantage arise from organizational structures, selection and promotion criteria and processes, lack of mentoring, paternalism, sexual harassment, and discrimination. The inherent male network informally determines the standards for promotion and supports candidates in its own image. Women are typically excluded from such networks and so miss out on the mentoring and the privileging that takes place within them. Women with primary care responsibilities for children are doubly disadvantaged in male environments where they are assumed to be less committed to their work than their male colleagues.

These factors provided the framework for the design of the CREW survey to obtain data on

women's position and retention in the workplace, their satisfaction with organizational culture and conditions, the availability of family-friendly workplace practices and their experiences of discrimination and harassment.

THE SURVEY OF PROFESSIONAL ENGINEERS

The CREW project employed a survey method requesting responses to quantitative and qualitative questions. The initial intention of the survey was to determine whether women are leaving the profession in numbers greater than their male counterparts. This goal presented difficulties in finding a sample population that was representative both of engineers who have remained in the engineering workforce, and those who have left. Because there seemed to be no obvious source of obtaining such a representative population, we decided to sample members of the IEAust. The focus of the survey therefore changed from obtaining quantitative information about female and male retention rates, to providing comparative information about position, pay and employment conditions; experiences and satisfaction in the workplace; and intentions with regard to remaining in, or leaving, the engineering profession.

In June 2000, the CREW survey was sent to all female members of the IEAust who were resident in Australia, and to an approximately 25% sample of males, matched with the female sample in terms of membership grade, engineering discipline, and geographical distribution by State. A total of 2269 questionnaires were sent out with 1819 sent to female members and 450 sent to male members.

Responses were received from 767 female engineers, 42.2% of those sampled, and 122 male engineers, 27.1% of those sampled. Some of both the female and male respondents were no longer working as engineers. As much of the subsequent discussion relates to the ages of respondents, we add a brief explanatory note here. Our samples were not selected by age since ages were not available to us in the membership data supplied to us by the IEAust. Our male and female samples were matched in terms of membership grade, and the age data were supplied by the respondents themselves.

FINDINGS

Retention in engineering workforce

The CREW findings support the APESMA data in showing little gender difference in the proportions of women and men who begin working as engineers after graduation (85% for women compared with 89% for men). As shown in Figures 1 and 2, thereafter the age profile for all women surveyed falls steadily from a maximum of 55% in the 20–29 age bracket, and only 15% are over 40 years of age. In contrast, the age profile of all male engineers peaks in the 30–39 age bracket, and 43% are over 40 years of age. Although one would expect to find higher proportions of women in the younger age groups because of the recent growth of female engineering graduates, our data indicate that women over thirty are leaving the profession. Women who are no longer working as engineers have an age profile that peaks at 45% in the 30–39 age bracket, and 17% of this group are over 40 years of age. Males who are no longer working as engineers have an age profile that

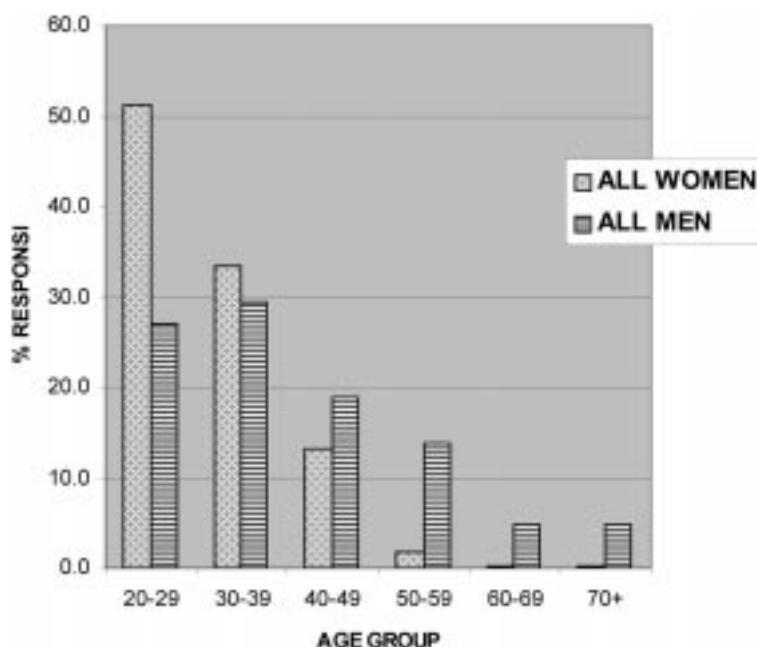


Fig. 1. Age profiles by gender.

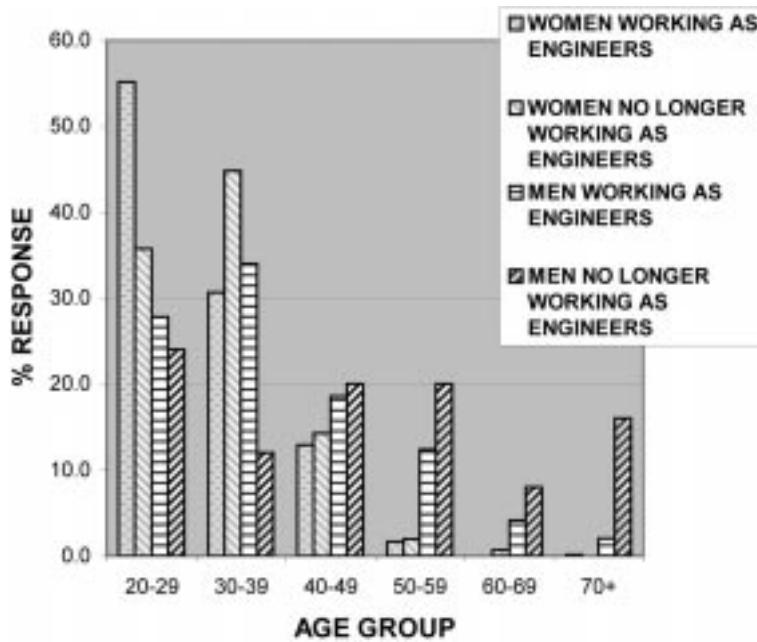


Fig. 2. Age profiles by gender and employment status.

peaks in the 20–29 age bracket and subsequently remains fairly flat (at less than 20%) across other age brackets.

Salary and nature of engineering work

Information on salary ranges was requested from respondents who were currently working as engineers. Significantly more women were found in the lower paid salary groups and more men in higher paid groups. 48% of women earn less than \$50,000 compared with 24% of men, and at the other end of the scale 9% of women and 27% of men earn more than \$81,000. Several female respondents reported that they receive lower salary packages, including extras such as cars and mobile phones, than male colleagues who were sometimes younger and less experienced.

The CREW survey also found differences in the nature of engineering work undertaken by women and men. Forty-eight percent of women described their work as engineering-technical, compared with 23% of men, while 17% of men described their work as engineering-managerial compared with 10% of women. A total of 76% of men described a managerial component to their work compared with 45% of women.

Workplace satisfaction

The study explored seventeen individual factors contributing to workplace satisfaction, and also invited an overall grading in this area. In evaluating their overall satisfaction with workplace conditions, 60% of all women reported being satisfied and 19% that they were dissatisfied, compared with 70% of all men who were satisfied and 10% who were dissatisfied. The workplace conditions that women found most dissatisfaction were those related to the opportunities and recognition they

received for: promotion, paid staff development, workplace management, the communication and dissemination of information, and their rate of pay. Women who are no longer working as engineers expressed greater levels of dissatisfaction with their last engineering position than any other group. Men no longer working as engineers were the group who in general were most satisfied with their last engineering position, a difference which suggests that these men did not leave the engineering profession because they were dissatisfied with their jobs.

Discrimination and harassment

One of the most disturbing findings of the survey was that 36% of women reported that they experienced discrimination while working as engineers, and 27% that they were sexually harassed, compared (respectively) with 8% and 4% of men. Many of the incidents reported in the survey would appear to contravene the 1994 Australian Commonwealth Sex Discrimination Act.

Twelve percent of women reported that they were given fewer opportunities for interesting work than their male counterparts, and this in turn reduced their opportunities for gaining experience that would lead to more responsibility and promotion:

'Promotion unlikely because I am not called 'John'. Quote from big boss which he later retracted but it still applies.'

Eighteen percent of all women reported that colleagues, managers and clients demonstrated views that women were not suited to being engineers and managers. These views represent gender harassment which is a common form of

discrimination that occurs in male dominated environments [24] and primarily involves the negative stereotyping of women in relation to their interests, abilities, behaviors and attributes.

'Just because I was a woman, they didn't think I belonged in the workplace and let it be known.'

'Expectation that women do QA, filing, report writing and all tedious repetitive work such as data collection.'

Women described the workplace as a boys' club in which they felt excluded from social and other networks:

'All networking opportunities were male oriented and not appropriate for me to attend. Many other similar and subtle forms of discrimination.'

Discrimination was exacerbated by racist attitudes towards women from other cultures, particularly those from non-English speaking backgrounds, and also by ageism, related to both youth and older age.

Women with responsibilities for the primary care of children describe discrimination that is shown by not being offered promotions, senior positions and jobs. Those women working part-time believe they are further discriminated against because they are not considered to be committed unless they are putting in the long hours at work:

'My boss told me as I was going on maternity leave that my contract would not be renewed as the job was not suitable for a wife and mother. Fortunately, the boss changed and I am doing well in the position two years later.'

Women without children report that they too experienced discrimination based on assumptions that all women will have children:

'Manager commented to another worker that I wasn't being considered for a managerial position because I was going to 'go off and have babies.'

DISCUSSION

The findings of the CREW survey are consistent with those reported in the literature from the US and the UK, as well as Australia. Although similar proportions of Australian male and female engineering graduates enter the profession, the numbers of women decline steadily with age. The skew in the age profile of women who are no longer working as engineers indicates that women over thirty are leaving the profession in greater proportions than men.

Women receive lower salaries than men, and are more likely to describe their work as being engineering-technical than engineering-managerial. The higher proportion of men in higher paid salary groups is frequently justified by the clustering of women in younger age groups resulting from recent increases in the numbers of female engineering graduates. The CREW findings that women are indeed leaving the profession after about 10

years of experience show that the recent influx of young female graduates is not the only reason for this clustering. Women who have acquired some experience are more dissatisfied than men with the culture of the engineering profession, and many are leaving.

The CREW study confirms that the cultures of many engineering workplaces are female- and family-unfriendly. Women are generally more dissatisfied with workplace culture and conditions than their male counterparts, in particular with their opportunities for promotion and recognition. Women are disadvantaged by negative perceptions about their abilities and commitment to engineering, their exclusion from social and other networks, and harassing behavior from male colleagues and clients.

In our survey many women report that having children reduces their opportunities for interesting work and promotion because it is assumed that they are no longer committed to their careers. These findings confirm those of Maskell-Pretz and Hopkins [25] and Glover [11], that women's disadvantage is exacerbated by the additional responsibilities of work and family that occur during their thirties, at the time when men begin to move into management careers. It is very worrying that the perception that women may 'go off and have babies', is used to discriminate against all women.

These findings provide valid reasons for sufficient dissatisfaction amongst women engineers to cause them to leave the profession. The findings also suggest compelling reasons for employers to develop policies and programs to eliminate discriminatory behaviors and create workplace cultures that are free from harassment. Current management reports [1, 28] advocate the benefits which arise from management styles that are consensual, and that focus on building teams, coaching and mentoring. Workplace harassment can breach both the anti-harassment and the anti-discrimination provisions of Australian Commonwealth legislation. Employers are responsible for creating workplace environments that are free from harassment and both individuals and organizations can be held vicariously liable for the acts or omissions of their staff, unless they can demonstrate they have taken all reasonable steps to prevent the acts from occurring.

RECOMMENDED STRATEGIES

The literature makes many recommendations of strategies that can be employed to address the issues identified above. Although some of the strategies recommended can be implemented by individual women for their own benefit, effective and lasting change requires attention at governmental and organizational levels.

At government level, stricter enforcement of the existing equal opportunity and anti-discrimination

laws is required. Additional government activity is recommended too, such as the regular production of detailed statistics about the status and success of women in engineering, and use of the 'contract compliance' device to reward companies for good practice in the field of equal opportunities [24, 29].

It is the corporate level of engineering however, which requires most of the attention in this field. The underlying values of engineering organizations are viewed as alien (sometimes even hostile) to women generally. Women who choose to raise a family or undertake other caring responsibilities encounter these attitudes to an even greater degree.

The values identified as unfriendly to women include the dominance of technical, impersonal and hierarchical work arrangements, while many women prefer to work cooperatively, and with a holistic perspective. The first requirement for changing the culture is for firm and visible leadership in making women's professional issues part of mainstream procedures and processes. Gender equality must become as regular an organizational function as budgeting and annual reporting. In organizations which reward their managers for achieving targets, rewards should also be given for performance in promoting gender equity [29].

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