

Counting the losses.....

**The Careers Review of Engineering Women:
an investigation of women's retention in the Australian engineering
workforce.**

By Pam Roberts and Mary Ayre.

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Executive Summary

Background

In the year 2000, women constituted only 15% of students in Australian undergraduate engineering courses and less than 6% of the professional engineering workforce. This represents one of the lowest female participation rates of all the professions. The Careers Review of Engineering Women (CREW) project was undertaken by the National Women in Engineering Committee of Engineers Australia (formerly the Institution of Engineers Australia or IEAust) in 2000 to investigate the issues surrounding women's retention, satisfaction and progression in the professional engineering workforce.

A major aim of the CREW study was to provide hard data about the issues surrounding women's retention and disadvantage in the Australian engineering workforce. The findings from the literature review and survey are used to inform recommendations made in this Report to government, employers, and Engineers Australia, about strategies and programs to improve women's retention and advancement in the engineering workforce.

Summary of findings

The CREW study shows that female engineers begin their careers with similar experiences and commitments to their male counterparts. Female and male engineers join the engineering workforce in similar proportions after graduation, at 85% and 89% respectively. They work in the same major industry sectors, with the exception of environmental engineering which employs a significantly higher proportion of female engineers, and Information Technology (IT)/Software engineering which employs a significantly higher proportion of male engineers. Female engineers are slightly more likely to have post-graduate qualifications in both engineering and in management than their male counterparts. However as their careers progress, female engineers tend to become clustered in lower paid and lower status positions compared with their male counterparts.

There is a striking disparity in the age profiles of female and male engineers. After peaking at 51% in the 20-29 age bracket, the age profile for all women surveyed falls steadily. Only 15% of women are over 40 years of age. In contrast, the age profile of all male engineers peaks in the 30-39 age bracket, and after that falls gradually up to retirement age. Forty-three percent are over 40 years of age. Although a decline in women's representation by age may be expected because of the recent growth in the numbers of women graduates, the age profile of women who are no longer working as engineers indicates that women over thirty are leaving the profession.

The CREW study shows that the cultures of many engineering workplaces are female- and family-unfriendly. Women are more dissatisfied with workplace culture and conditions than their male counterparts, in particular with their opportunities for promotion, recognition and rewards, as well as with workplace communication and management. Discrimination, harassment and paternalism are rife in engineering organisations, with 50% of women reporting that they have experienced these behaviours. Women are disadvantaged by negative perceptions about their abilities and commitment to engineering, their exclusion from mentoring and social networks, and harassing behaviour from male managers, colleagues and clients. Women with responsibilities for the primary care of children report that their opportunities for interesting work and promotion are further reduced because they are not considered to be committed to their work. Disturbingly, a perception that all women have the

potential to “go off and have babies” leads to discrimination in employment and promotion opportunities.

The presence of workplace harassment and discrimination should be of significant concern to engineering employers because it contravenes the anti-harassment and the anti-discrimination provisions of Australian Commonwealth legislation. Employers and individuals can be held liable if they do not take positive measures to create workplace environments that are free from harassment and discrimination.

Many engineering organisations have underlying values that are unfriendly, and even hostile, to women because they are based on male defined priorities, values and life choices. Hostile corporate practices include an assumption that commitment is demonstrated by working long hours, sacrificing family and personal time, and exhibiting high levels of aggression and competitiveness. Organisations that exhibit these values are failing to recognise the benefits of workplace diversity and the costs of losing skilled and experienced staff.

The key to improving women’s retention and advancement in engineering lies in developing policies and programs that promote both cultural change in engineering organisations and behavioural change at the individual level of engineering managers and engineers. The first requirement for changing organisational culture is for firm and visible leadership in making women’s professional issues part of mainstream procedures and processes. These changes can be supported by actions at the corporate, government and professional levels as described in the recommendations below.

Readers seeking practical advice about how to convince managers of the importance of the issues raised in this Review, and how to implement the strategies suggested, are recommended to consult the ‘best management practice’ kit: *Engineering a Better Workplace: A Diversity Guide for the Engineering Profession* (NCGCD, 2000).

Recommendations:

Industry

Recommendation 1: That engineering organisations provide training in equity and diversity management for their employees and develop equity and diversity performance targets that are included in managers’ performance evaluation and reward systems.

Recommendation 2: That engineering organisations implement regular reviews of equity and diversity policies and organisational practices to assess their equity performance and set targets for improvement.

Government

Recommendation 3: That governments strengthen and enforce equal opportunity and affirmative action legislation and reporting requirements, for example by adopting purchasing policies that reward companies with good gender-equity performance.

Engineers Australia

Recommendation 4: That Engineers Australia as a leader and representative of the engineering profession actively promotes the value of diversity to industry, government and members of the profession. This message should be reinforced at all levels of communication and representation, including the Engineering Excellence Awards, National Engineering Week, Engineers Australia and e-news.

Recommendation 5: That Engineers Australia Council ensures that adequate funding and institutional support is provided to the National Women in Engineering Committee and Divisional Women in Engineering Groups to develop policies and programs that provide women engineers with networking, mentoring and professional development.

Recommendation 6: That Engineers Australia undertakes an equity and diversity review of organisational policies and practices to assess its gender equity performance and set targets for improvement.

Recommendation 7: That Engineers Australia Code of Ethics include a specific statement that discrimination on the grounds of gender, marital status, race, culture, disability, age and sexual preference is regarded as unethical behaviour and is grounds for disciplinary action.

Recommendation 8: That Engineers Australia includes managing diversity in the requirements for key competencies for graduate formation and continuing professional development.

Recommendation 9: That Engineers Australia Council forms a committee in conjunction with the National Women in Engineering Committee that reports on the implementation and progress of these recommendations.

1. Introduction

Engineering has one of the lowest female participation rates of the professions. The percentage of women undertaking engineering degree courses in Australia has steadily, although slowly, increased from 3.3% in 1980 to 14.8% in 1999 (National Centre for Gender and Cultural Diversity [NCGCD] 2000). Although females' share of engineering enrolments has been greater than 10% since 1990, they currently represent less than 6% of the professional engineering workforce (Australian Bureau of Statistics [ABS] 1999). Many women engineers have voiced concerns that the apparently slow change in the gender composition of the workforce and lack of women in senior positions are due to their female colleagues leaving engineering a few years after they graduate.

The Careers Review of Engineering Women or CREW study was undertaken in 2000 by the National Women in Engineering Committee of Engineers Australia in order to investigate whether women engineers are indeed leaving the workforce in greater numbers than their male counterparts. 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 comprises both an extensive review of Australian and international literature and a survey of the current Australian situation.

2. The literature survey

In the literature review¹ we analyse existing Australian and international data related to women's participation and retention in the engineering workforce and profession and, where relevant, comparisons are made with data from other scientific and technical fields. We then examine the explanations that have been used to provide insight into women's apparent lower retention and disadvantage in the engineering workforce. These explanations provide the framework for the design of the questionnaire that was sent to female and male members of Engineers Australia. The survey investigated women's and men's positions, employment conditions and satisfaction in the current Australia professional engineering workforce.

Why study women's participation in engineering?

The CREW study set out to investigate specifically *women's* employment satisfaction in engineering rather than that of all engineers, primarily because of the magnitude of women's under-representation in the profession. There are strong arguments for ensuring that women are equitably represented in the engineering profession, which the European Technology Assessment Network (ETAN) Report on Women and Science (2000) summarises as *equity, excellence, efficacy* and *efficiency*. Equity and social justice arguments are based on fairness, in that women should have the same opportunities as men for interesting and well-paid employment (Glover 2000). Since the 1990s, the case for 'excellence' has been gathering strength in Australia and the US. This argument contends that an organisation benefits if its employees come from a diverse range of backgrounds, because creativity and flexibility are increased, the skills pool widened, and new markets can be accessed (Karpin 1995, Khazanet 1996, IEAust 1996, NCGCD 2000). 'Efficacy' as used in the ETAN report (2000) is the need to recruit both men and women to maintain the size of the workforce in view of the "...shrinking pool of young scientists ..."; and 'efficiency' is the requirement that government investment in the education and training of young women scientists and

¹ The literature review presented in this report summarises a more extensive review by Ayre M. "Women Engineers: The Continuing Crusade" in Roberts (Ed) *Transactions of Multi-Disciplinary Engineering: Transforming Engineering: Case studies of cultural and organisational change*. IEAust. Vol GE25, 2001.

engineers is rewarded by their subsequent employment in occupations which contribute to the growth of the country's economy.

Data on women's under-representation in engineering

Women are severely under-represented in the engineering profession throughout the Anglo-Celtic world. In Australia membership statistics of Engineers Australia are often used as an indicator of the proportion of women engineers. Currently, women represent just over 4% of the Institution's membership at graduate status and above (IEAust 2000a). Australian Bureau of Statistics (ABS) however, provide the somewhat higher figure of 5.2%² of engineering professionals being female in 1996 (ABS 1999).

In this respect Australia trails both the UK and the US. In 1996 women represented 7% of UK professional engineers and technologists (Glover and Fielding 1999). The US appears to be marginally more successful. The US National Science Foundation (NSF 1998) reported that 9% of graduate engineers were women in 1998, while Lal, Yoon and Carlson (1999) found that in 1999 women held 10% of professional engineering jobs in the US.

Engineering employment conditions

The Association of Professional Engineers, Scientists and Managers, Australia (APESMA) regularly collects data on engineering employment conditions, pay, and levels of responsibility. APESMA data (1999a) 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 (1999b) 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 (Glover 2000, National Science Foundation [NSF] 1998, Evetts 1993).

Engineers Australia data (IEAust 2000) show that there is almost no difference in Australia between women's and men's pay at entry level. 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 (Mahony 1995). 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 indicate that women engineers tend to become progressively concentrated in lower paid and lower status jobs. While some of the differentials in seniority and salary can be attributed to the choices made by some women to interrupt their careers for family formation (Lal, Yoon & Carlson 1999), the question of why women who have not had children usually

² derived from Table 12 (ABS 1999) by subtracting 'architects and landscape architects' from total 'building and engineering professionals'

do not achieve parity with their male counterparts over a lifetime's career remains unanswered.

Explanations for women's disadvantage

Researchers commonly group the impediments to women's career progression into two categories. These groupings have been variously defined as 'public lives' vs 'private lives' (Carter & Kirkup 1990); 'structural perspectives' vs 'gender role' issues (McIlwee & Robinson 1992) and 'organisational and environmental' vs 'individual' issues (Fox 1996). These frameworks indicate that women's disadvantages in the engineering profession stem both from the attributes and priorities of individual women, and from organisational cultures and work environments that have been shaped by the philosophies, values and interests of men.

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 (National Research Council 1994), and partly on the particular difficulties in this profession of combining work and family (Drake 1996).

There is evidence that higher standards of achievement are expected from women than men, and that women's mistakes are judged more severely (National Research Council 1994). Through 'paternalism', women are often denied the practical experience they need for promotion (National Research Council 1994, McIlwee & Robinson 1992). 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 (WISSET 1995). In varying amounts, women are subject to sexual harassment, and various types of discrimination (Evetts 1998, Maskell-Pretz & Hopkins 1997, WISSET 1995, National Research Council 1994).

Women trying to combine work and family face additional problems both at work and at home. 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 (McIlwee & Robinson 1992). They are disadvantaged in male environments where professional commitment is demonstrated by working long hours and making personal sacrifice (Sinclair 1998). There is evidence that engineering mothers may hold back from applying for promotion, knowing that their family needs would count against them (Evetts 1998). Many women engineers with children would like to work part-time, but it is extremely difficult for to find part time work in Australian industry. Cavenagh (1995) reports that women who have part-time work find they are not valued as professionals.

Summary of the existing literature

The literature indicates that women are disadvantaged by the engineering culture, which is characterised 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 organisational 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 Australian women's position and retention in the workplace, their experiences and satisfaction with organisational culture and conditions, and the availability of family-friendly workplace practices.

3. The Survey of Professional Engineers

The CREW study employed a survey method that included quantitative and qualitative questions. The initial intention of the survey was to determine whether women are leaving the profession in greater proportions 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 Engineers Australia. 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 questionnaire (see Appendix 1) was sent to all female members of Engineers Australia 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. As much of the subsequent discussion relates to the ages of respondents, we note that the male and female sample populations were matched in terms of membership grade, and the respondents themselves supplied the age data. The samples were not selected by age because age is not a variable that is used by Engineers Australia to categorise their membership data.

A total of 2269 questionnaires were sent out: 1819 to female members and 450 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 the respondents, both female and male, were no longer working as engineers.

4. CREW Results

Retention in engineering workforce

The CREW study supports 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). The age profile for all women, as shown in Figure 1, falls steadily from a maximum of 51% 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.

Figure 2 shows that 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 peaks in the 20-29 age bracket and then is 20% or less in all subsequent age brackets.

**Figures 1 & 2: Age Profiles of Survey Respondents by Gender
and Employment Status**

Qualifications

Women and men had similar engineering qualifications, with the vast majority having a Bachelor’s degree as their highest qualification (76% of women compared with 71% of men). As shown in Table 1 below, a smaller proportion of women than men have a Graduate Diploma in Engineering (3% compared with 12% respectively), while a higher proportion have higher degrees, including Master of Engineering degrees (16% compared with 14%), PhDs (5% compared with 2%) and MBAs (10% compared with 7%).

Table 1: Highest qualification by gender

Highest Engineering Qualification	% Women	% Men
Bachelor degree	76	71
Graduate Diploma in Engineering	3	12
Master of Engineering	16	14
PhD	5	2
Post-graduate qualifications (not engineering)		
All	20	16
MBA	10	7

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 earned less than \$50,000 compared with 24% of men, and at the other end of the scale 9% of women and 27% of men earned 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 are 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.

Table 2 shows the top ten industry sectors in which the survey respondents are currently or were employed in their last engineering position. The same industry sectors are the major employers of female and male engineers, with a higher proportion of men in construction, mining, manufacturing and transport. The employment of male and female engineers in the new economy sectors of IT and environmental engineering shows the greatest disparity, with environmental engineering being the fourth largest employer of female engineers and tenth largest employer of male engineers, while IT/Software is the fifth largest employer of male engineers and fifteenth for female engineers.

Table 2: Gender and employment by industry sector

Industry sector	% Women (Order of ranking)	% Men (Order of ranking)
Construction	17 (1)	23 (1)
Resource/Mining	13 (2)	16 (2)
Manufacturing	11 (3)	16 (2)
Environmental	9 (4)	2 (10)
Gas or water supply	9 (5)	7 (6)
Transport	8 (6)	11 (4)
Communications	5 (7)	3 (9)
Electricity/Energy	5 (8)	7 (6)
IT/ Software	1 (15)	11 (5)
Mechanical/Maintenance	4 (9)	4 (8)

Discrimination and harassment

One of the most disturbing findings of the CREW study was that 36% of women reported that they experienced discrimination while working as engineers, and 27% that they were sexually harassed. In comparison, 8% of men reported that they experienced discrimination, and 4% of men that they were sexually harassed.

Altogether 50% of the female respondents reported that they had experienced sexual harassment and/ or discrimination. Many of the incidents reported in the survey would appear to contravene the 1994 Australian Commonwealth Sex Discrimination Act.

The main forms of discrimination were found to be:

Gender-based discrimination

Colleagues, managers and clients expressed views that women are not suited to being engineers and managers. Gender-based harassment is a common form of discrimination that occurs in male dominated environments (WISSET 1995) and primarily involves the negative stereotyping of women in relation to their attributes, interests and abilities.

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

During job interviews. In one extreme case I was told that I couldn't do the job properly because I was female and the men would not listen to, or respect me.

Gender-based 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.

Fewer opportunities and rewards than male colleagues

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

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

Boys' club culture and exclusion from mentoring and social networks

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

Family responsibilities and pregnancy – actual and potential

Women reported that their opportunities for interesting work and promotion were reduced when they became pregnant and took on caring responsibilities for children, because they were no longer seen to be fully committed to their careers.

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 reported 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".

Workplace satisfaction

The study explored seventeen individual factors contributing to workplace satisfaction and an overall rating. Table 3 and Figures 3 to 8 show women's and men's ratings of the workplace conditions in order of those that women found to be most dissatisfactory. In evaluating their overall satisfaction with workplace conditions, 60% of all women reported that they were satisfied and 19% that they were dissatisfied, compared with 70% of all men who were satisfied and 10% who were dissatisfied. The conditions that women found to be most dissatisfactory were related to opportunities and recognition for promotion, paid staff development, pay, workplace management, and the communication and dissemination of information. There are statistically significant differences in the levels of satisfaction that women and men experienced in their opportunities for promotion, workplace management, communication and dissemination of information their overall satisfaction with their jobs. The differences between mean levels of satisfaction for women and men were tested using t-tests at $\alpha < 0.01$

Figures 3a to 8a provide a further breakdown of the data by gender and employment status. Women who are no longer working as engineers expressed greater levels of dissatisfaction with their last engineering position than all other groups. Men no longer working as engineers were the group which in general was most satisfied with their last engineering positions, a difference which suggests that these men did not leave the engineering profession because they were dissatisfied with their jobs.

Workplace culture

In providing an overall descriptor for their immediate workplace culture, men were more likely to describe it as supportive and/or comfortable (68% men compared with 57% women), and women were more likely to describe it as competitive (18% women compared with 10% men). While 12% of all women described their work culture as uncomfortable and/or hostile compared with 10% of all men, 30% of women who are no longer working as engineers used these descriptors.

Table 3: Degree of workplace satisfaction by gender

Workplace condition ** indicates a significant difference at $\alpha < 0.01$	% dissatisfied & very dissatisfied		% satisfied & very satisfied	
	Women	Men	Women	Men
Your chances of promotion **	38	24	31	37
The way your workplace is/was managed **	37	27	31	46
Opportunities (with pay) for staff development/ training	35	28	36	48
Communication and dissemination of information about what is/was going on in the organisation **	34	27	36	48
Your rate of pay	30	18	49	52
The recognition you get/got for good work	26	15	50	53
Industrial Relations **	25	17	38	48
Opportunities to use your abilities **	24	14	53	63
Work hours	21	22	56	55
Your suggestions	17	11	53	57
Taking everything into consideration, how do/did you feel about your job as a whole? **	19	10	60	70

Figures 3-8: A Comparison of Women's and Men's Satisfaction with Workplace Conditions in Order of Women's Greatest Levels of Dissatisfaction

Level of satisfaction: 1 Very Dissatisfied, 2 Dissatisfied, 3 Neither Satisfied nor Dissatisfied, 4 Satisfied, and 5 Very Satisfied

Figures 6-8

Family-friendly workplace practices

In the study, 27% of women and 11% of men reported that they were responsible for the care of children and other dependants. The survey explored the availability of family-friendly practices in engineering workplaces and the extent to which they are used, as shown in Table 4 below. Family friendly practices are intended to assist employees to balance work and family commitments, and as a consequence to enhance their productivity. As women are still more frequently the primary care-givers for children, we would expect the availability of family friendly practices to assist their retention and career progression.

Table 4: Availability and use of family-friendly practices by gender

Family-friendly workplace practices	% reporting the availability of these practices		% reporting having used these practices	
	% Women	% Men	% Women	% Men
Flexible work hours	66	70	53	58
Job sharing	19	15	5	8
Part-time work	49	27	13	4
Leave without pay	84	77	25	14
Paid maternity leave	45	43	5	0
Paternity leave	47	29	1	3
Carers leave	48	35	5	5

Flexible work hours and leave without pay were available in more than 70% of workplaces, with other practices available in 50% or less of workplaces. Higher proportions of women than men reported that part-time work, paternity and carers’ leave were available, although this may indicate a gender difference in levels of awareness about these practices. More than 50% of women and men have made use of flexible work hours, indicating a strong need for access to this practice. Higher proportions of women than men have made use of part-time work and leave without pay. Surprisingly only 5% of all women reported having used paid maternity leave, although it is available in 45% of workplaces and 22% have had responsibility for the care of children.

Women who are no longer working as engineers report having fewer family friendly practices available in their last engineering position than women who are still working as engineers, and in particular fewer had access to flexible workhours (48% vs 70%) and part-time work (33% vs 52%).

Table 5: The use of family friendly practices by gender and responsibility for care of children

Family-friendly workplace practices	% reporting having used these practices			
	Women caring for children	Women not caring for children	Men caring for children	Men not caring for children
Flexible work hours	70	47	83	56
Job sharing	11	3	0	9
Part-time work	37	5	8	4
Leave without pay	32	22	8	15
Paid maternity leave	17	2	0	0
Paternity leave	2	0	8	2
Carers leave	17	2	17	4

Table 5 compares the use of family friendly workplace practices by women and men, who both have and don’t have responsibility for the care of children. Women caring for children utilise most of the family-friendly practices to a greater extent than men caring for children

and women and men who are not caring for children. Substantial proportions of all groups also use flexible working hours and leave without pay, which indicates that they are useful for a range of needs. These findings show that people with care-giving responsibilities require flexibility to support them in balancing work and family needs. Although these practices are available in many engineering workplaces, the willingness to utilise them is often dependent on whether they are viewed negatively by managers and co-workers.

Reasons for leaving engineering positions

The survey explored the reasons why engineers leave their positions and categorised these as ‘push’, ‘pull’ and ‘personal’ factors. As shown in Table 6 women and men reported similar reasons for leaving their engineering positions, with new experience and more pay and benefits being the most frequently reported reasons. Women placed more emphasis than men on their opportunities to use their abilities and with the management style and culture of the organisation. Women also reported high levels of dissatisfaction with similar factors related to their opportunities to use their abilities and workplace communication and management in the previous section.

Table 6: Reasons for leaving last engineering position by gender

Reasons for leaving last engineering position	% Women who reported (order of ranking)	% Men who reported (order of ranking)
Experience in a different aspect or field and/or opportunity to specialise (pull factor)	26 (1)	26 (1)
More pay and/or benefits (pull factor)	16 (2)	21 (2)
Given insufficient responsibility/opportunities to use my abilities (push factor)	16 (3)	11 (12)
Limited (or non-existent) chances of promotion (push factor)	15 (4)	16 (3)
Organisational management style (push factor)	12 (5)	12 (10)
More variety in the job (pull factor)	10 (9)	16 (4)
My rate of pay (push factor)	10 (10)	16 (5)

5. Discussion

Although similar proportions of Australian male and female engineering graduates enter the profession, the numbers of women remaining in the profession decline steadily with age. The recent growth in the numbers of female graduates does not appear to be the only reason that women engineers tend to be clustered in the 20-29 age bracket. Women who are no longer working as engineers have an older age profile, which indicates that those over thirty are leaving the profession. Women receive lower salaries than their male counterparts, and more are likely to be in lower status positions. These findings are consistent with those reported in the literature from the US and the UK, as well as Australia.

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 managers, colleagues and clients who express negative perceptions about their abilities and commitment to engineering, discrimination and harassment and their exclusion from mentoring and social networks. Geppert (1995) describes these behaviours as a form of ‘water torture’, in which women continually have their confidence undermined in small ways.

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 & Hopkins (1997) and Glover (2000), 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 women also experience discrimination in relation to job and promotion opportunities based on the perception that they may "go off and have babies".

6. Conclusions

The CREW study identifies sufficient dissatisfaction about workplace conditions amongst women engineers to explain their choosing to leave the profession. The findings also suggest compelling reasons for employers to develop policies and programs to eliminate discriminatory behaviours and create workplace cultures that are free from harassment. Current management practices (NCGCD 2000, Sinclair 1998) advocate the benefits that arise from management styles that are consensual, and that focus on building teams, coaching and mentoring. But it should be of more concern to employers that 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 organisations 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.

To improve the retention and advancement of women in engineering, the literature suggests that individual women may benefit by developing mentoring and support networks that reduce professional isolation and provide them with access to information about corporate culture and strategies for getting ahead. However widespread change requires attention at governmental and organisational levels.

It is the corporate and professional levels of engineering that require most attention. The underlying values of engineering organisations are viewed as alien, and even hostile, to women. These values include the dominance of technical, impersonal and hierarchical work arrangements, while many women prefer to work cooperatively, and with a holistic perspective. Women who choose to raise a family or undertake other caring responsibilities encounter discrimination to an even greater degree.

The first requirement for changing corporate and professional cultures 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 organisational function as budgeting and annual reporting. Corporate strategies to achieve such change include 'mainstreaming' – making gender equity part of the regular functions of each unit of the organisation, with its own budget, and with reporting requirements. CREW shows that areas requiring particular attention include access to training and opportunities and experiences that lead to promotion, as well as promotion procedures and practices. It is recommended that engineering organisations make part-time and other flexible work arrangements (such as job-sharing and telecommuting) available and ensure that no stigma are attached to their use. In organisations which reward their managers for achieving targets, rewards should be given for performance in promoting gender equity.

Governments have a need to ensure that their investment in the education and training of women engineers is rewarded by their subsequent employment in occupations that contribute

to the growth of the country's economy. Government can play a significant role in encouraging corporate and educational change by enforcing existing equal opportunity and anti-discrimination laws. Australian and international reports (eg WISSET 1995, ETAN 2000) have recommended additional government activity, 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.

Engineers Australia has several important roles in enhancing women's position and advancement in the engineering profession and workforce. Engineers Australia can provide the resources and institutional support for women engineers to form professional networks to reduce workplace and professional isolation, to establish mentoring relationships and gain professional development that is targeted to their needs. Most importantly Engineers Australia should demonstrate leadership by engaging in cultural change in its own organisational practices and by valuing and promoting equity and diversity in all of its interactions with government, industry and members.

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are available from:

(1) Engineers Australia.

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(2) The Secretary, National Women in Engineering Committee

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Appendix 1: CREW Questionnaire