

Women Engineers -Their Life Values In Australia

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Abstract

This paper covers the life journeys, issues and concerns facing women engineers in Australia. The influence of our backgrounds, cultures, families and values have in the decisions made. Twelve women whose ages ranged from 22 to 56 years told their stories and the paper will be presented based on these oral history findings. A summary of their reflections in the different phases of women engineers' lives, the paths followed since graduation, the lengths of professional work and family life balance are significant factors that have led them to continue in their engineering career or have career changes. The interesting findings will be discussed further as some have had multiple career changes which have enriched their lives. Science and engineering training have transferable skills which have empowered many of the women to pursue what is important to them.

Keywords

Values, transferable, empower, women, engineers

I. Introduction

People chose to study engineering for many reasons. Typically the profile is the person is good in mathematics and physical sciences and engineering is a practical science. The person is predominantly male. There are also many branches of engineering and in Australia and it can also be studied in conjunction with another degree. The success of a country depends on the contribution of its citizens, and the investment on education in science and engineering disciplines is crucial. Engineers Australia has a continuing vision to attract, retain and support women in the engineering profession. However in the last 30 years, the statistics have shown that many women have left the profession. Various studies have shown that half of the population (females) that could contribute to the engineering profession has not been utilized. For many years, there have been media releases on the how to attract and increase the number of girls to do engineering. There are statistical analyses of the retention rates, the attrition rates and perceptions why not enough women are attracted to do engineering. My paper will discuss the personal views of twelve female engineers and scientists of their experiences in a male dominated profession and what they value in life.

2. Background

In Australia, there is an identified need to address Australia's engineering skills shortage. About 9,500 new engineering students graduated in Australia in 2011. However, currently there is a downturn in the industry but when times are better, there will be an urgent need for more engineers. There is a small percentage of women studying or practising engineering in Australia. The participation of female engineers hovers around 10 per cent on average. (Engineers Australia July 2012). However, there has been a concerted effort for over 30 years to encourage more women to study engineering and science. The advantages of having more women in these fields are well known as diversity will add to the richness of ideas, planning, problem solving, operation and construction of projects. Women engineers bring a different perspective of thinking, planning and implementing projects as well as dealing with people which may be complementary to male engineers or scientists. It is evident and clear that changing the gender balance of engineers has been slow. My aim is to bring forward the stories of women engineers to highlight first hand their experiences in the workforce.

I will start by sharing with you my story. I was an all rounder in school, being good in numeracy, literacy, science, arts and sports. I was also a leader in an all girls school and continued to do so when I went to a boys school which had coeducation in the senior levels. Being a positive and confident person, I always wanted to be an engineer as I wanted to be able to do practical things to help others. I went on to graduate from the University of Melbourne in engineering. From a young age, we were encouraged to continue our study in whatever field we were good at. There was no pressure from my family to study a specific course. This I believe is positive upbringing, with

encouragement from my family for which I am grateful. I have also continued this practice with my own children, pursuing what they are good at. We are fortunate to be fluent in at least languages. As in we are now in Bali, Indonesia, there is a difference in the home culture in Asia and Australia. Professional women in Asian countries such as Malaysia and Singapore could afford to have inhouse helpers or maids to assist in the domestic chores. In Australia, the majority of women are responsible for their own domestic chores such as washing, cooking, cleaning and bringing up children plus caring for their elderly parents at times. They are independent and also do not have drivers or housemaids. Most men share in the housework, fix the house and as well as raise a family. It is a joint effort.

I have had a good engineering career in Melbourne. After graduation, I worked in the private sector designing irrigation and agricultural projects for the Middle East. I then worked as a water supply engineer and I was involved in many other interesting projects. I have a wide range of engineering experience and professional network. I remember when I was leaving to have my first maternity leave in 1987, my male engineer friend told me that I was the first engineer to have maternity leave in the organization! I have 3 children, and continued to work part time in engineering and it was a good balance. My manager, a sensitive new age man was very understanding and encouraged me. I also have teaching and sustainability postgraduate qualifications. In teaching, I majored in Physics and Mathematics as well as English as a second language. I am also a qualified clinical pastoral carer for the sick in hospitals.. I enjoyed volunteering and held many leadership roles over the years. In 2011, I helped to organise a very successful 30 year engineering reunion for the University of Melbourne. I have been listening to many life journeys, issues and concerns facing women engineers . Our backgrounds, cultures, families and values influenced the way decisions are made. Twelve women told their stories and the paper is based on these oral history findings.

3. Methodology

I intentionally met and listened to twelve women engineers whose ages range from 22 to 56 years of age. They are now living in Perth, Brisbane and Melbourne. They shared their experiences. The women were very cooperative and also keen to express their feelings. For many, this is the first time they are reflecting on their experiences. I will name them E1 to E12 consecutively for confidentiality reasons. Conversations ranged from their reflections in the different phases of their lives, the paths followed since graduation, the lengths of professional work and family life balance.

4. Case Studies

E1 (49 years) is a high achiever who went to a selective school for girls. She obtained high marks in Mathematics and Chemistry as well as English. She chose to study engineering and science as she is interested in both the applied and theoretical disciplines. Her physical stature is petite. She recalled with sadness that she was always given the role of note taking and writing data during all the practical work at the university. She could not reach the equipment because of her height. The boys would be setting up and conducting the experiments. Upon graduation, she applied for many jobs but she was unsuccessful. Eventually she worked as a management trainee in the corporate world. Her biggest regret is she never worked as an engineer after studying hard and getting good marks. However, she was successful in a corporate sector as she could implement logical thinking processes to her varied projects. Her workplace was inflexible and working hours were long. She only took 3 months maternity leave for her first child and then only 9 months with the subsequent child. Her marriage failed and to make matters worse, she had to continue working full time. She worked with many high profile companies and then lost her job in the last company restructure. She set up her own consultancy, training in occupational health and safety and first aid. In hindsight, she said she would have chosen to study a more female orientated profession as she felt she was never given a chance to work as a professional engineer. She feels she has taken control of her life again after 22 years. She is now a trainer as she left the corporate world exhausted as combining motherhood with long hours was unsustainable. The stress of a marriage breakdown and being a single mother of two young children, now teenagers, means having to work harder and long hours. Her values have now changed and she decided to train and teach according to the hours and jobs she prefers. She values her children and health highly.

E2 (42 years) is highly stressed because she feels she would prefer to have more time at home to look after her four and six year old children. She works long hours to make ends meet for her family. She told me that females are more cooperative and nurturing so that is natural for women to be at home to look after the children until they are ready to start school. She had a difficult time during her undergraduate days because she came from a small town in the

country. As many students from another town, she had to rent in shared accommodation and sometimes had insufficient money for food. She did not work for seven years when she had her children. She would have preferred to stay at home until her children are older. She did a postgraduate masters qualification while she was staying home with the children. She is empowered, now self-employed and her business is growing fast. She values family, wellbeing and good ethics.

E3 (52 years) worked in a small mining town in the late 1980s. She is a determined person and she got along well with the male blue collar workers and other male engineers her age. Her male supervisor was sexist and she felt ostracized from social functions after work. She soon left the company and moved with her husband to Melbourne. She applied for many jobs and she never received any interview, which she felt was because she had a female name on the resume. Eventually she joined the CSIRO, a Commonwealth Scientific Research Organisation, where new conditions were introduced to support equal opportunity in the workplace. She has three children and it became harder to juggle a family while working fulltime, she subsequently resigned. She then volunteered in school and kindergarten. She is now playing golf, singing and managing the family's finances while her engineer husband continues working at a senior level.

E4 (53 years) is good in numeracy and she was encouraged by her mother to do engineering. She was not a confident person. She got along well with the other students at her College which had programs to support girls in engineering. She worked in administration part time, and then changed to an engineering position in the same organization upon graduating. She was unhappy at work as her supervisor was unsupportive. She resigned from her position when she had her first baby in 1987. She regretted the decision as she found that it was very difficult to return to engineering after many years out of the workforce. She organized many school and many sporting activities. In Australia, most of us do our own housework and some also help in the extracurricular activities in our kindergarten and schools. She has 3 adult daughters and she now works in a performing theatre as an usher. She suffers from a debilitating illness and so does her sister, another engineer. She values her family and health.

E5 (56 years) was studying for her engineering doctorate. Her husband was a university engineering lecturer. Unfortunately, he had a car accident and she withdrew from her studies and cared for the family. She taught computer programming to make ends meet but she did not enjoy teaching. She now works in administration for an educational institution. She has an adult daughter who is now an engineer.

E6 (45 years) is an all rounder as she is good in both Mathematics and English. She excelled in science and she became a researcher. While she was a budding researcher, she went overseas for two and a half years as it was very important to have international experience to further progress her career in research. She now leads a group of researchers in a government organization. She has two young children and she has a flexible arrangement with her employer. Her parents also assist her when required. Her supervisor has been a great mentor and he helped to open many doors for her. All the female scientists liked and respected him. The supervisor was a caring, kind, supportive and helpful family man. Recently when she applied to reduce her working days from five days to four days, her new male supervisor in his 60s, was negative about it. She is a confident person and she knew her rights and work conditions. She persevered and fought for her rights. She was pleased that her request was approved by higher management. The culture and upbringing of the supervisor has been engrained in him because he was not used to researchers working part time in his generation. Flexibility is important to her.

E7 (35 years) achieved excellent results in school. She studied a combined degree in Engineering and Arts because she wanted to do practical work and also learn a new language. She had a scholarship throughout her university course as well as work experience. She fitted in the engineering course very well and upon graduation, she applied for many engineering jobs but received very few interviews. She finally got a job as a process supervisor in a brewery. She was chosen because the company wanted someone to help to change their internal culture. It was not an engineering position but because she wanted to work, she accepted the position. She was given shift work including overnight shifts. She faced verbal abuse and she was very unhappy. Her supervisor was unethical and sexist. He was also a bully. She told me one of the reasons was due to his upbringing and cultural background. She soon applied successfully for an engineering position with a global company and she moved to New Zealand with her engineering husband. He found an engineering position easily and this has greatly developed his skills exponentially. In New Zealand, she was in charge of a gas plant and when she was seven months pregnant, her workload in an isolated plant did not change. She had to climb up many stairs to shutoff controls which was one of her many responsibilities and she feared for her safety and health. The workplace was 70 km away from home. She

told me that this was discrimination in reverse! She should have been given lighter duties if this international company was supportive of pregnant women. She resigned. She has two young children and she is passionate about the environment. She wants to be involved with local government and the community. She retrained to be a teacher as the job is flexible and is a family friendly career. Her future aim is to be a writer.

E8 (54 years) is a woman engineer who worked hard and she supported her husband while he was studying for his PhD. She reflected fondly about the Malaysian projects she worked on and the respect she received over there. When she returned to Australia, she worked for a consultant. She went on site to discuss a major project and the client asked if she could be replaced, as he preferred to deal with a male engineer on the project. This sexist attitude prevailed for the generation of male engineers born before the 1955s. It was the time when few women were in the workforce and definitely not working in the male dominated area, she said. She took a career break when her son was born. It took a few years before she found an engineering job at a university. She had a stressful time combining full time work and looking after her family.

E9 (22 years) is a high achiever and she was one of the top students in the state. She almost broke her father's heart when she announced she was going to study engineering rather than medicine. Three years into her study of the combined degree of Engineering and Commerce, she told me that the course is too theoretical and she was pleased she is doing Commerce to balance the university experience. She said the course is tough and her mother interrupted by querying "Is it tough for girls?" To which I replied "Tough course for everyone." This brings to mind: "Does the course have to be so difficult? Is it the way it is delivered? Can it be improved?" She went to study engineering in England for 6 months, which is now a common practice at tertiary level.

E10 (50 years) is strong in numeracy compared to literacy. She went to college 30 years ago and she was very well supported by her lecturers as they were encouraging girls to study engineering. This was a commendable move. Upon graduation, she worked in a consultancy where she was highly regarded. Her director asked her to work on a project three months after her first baby was born. She loved working and continued to work very hard until her second child was born. She asked her director if she could bring the baby into work, her request was refused. She felt compromised and resigned soon after that. She continued teaching at her engineering college for a few years as well as setting up her clothes making business. Her engineer father was her mentor. She later set up her own engineering consultancy business from home. She is very busy bringing up teenagers while working fulltime and helping her aged parents. She is juggling many issues and she loves being in control of her engineering projects.

Twenty five years ago, E11(52 years) was promoted to a senior research position. Her male colleague who failed to get the position, was upset and tried to sabotage her research. She complained to management but she received no support. A common bullying tactic is exclusion which she received. She moved to other positions in her working life and she has since gained much experience. She also has a family. She felt that she should have had a mentor like the other male researchers if one were to progress in the organization. She volunteers in environmental educational program.

E12 (31years) has always enjoyed working outdoors. She wanted to be an engineer as it is an applied science. After finishing high school, she was highly stressed and decided to take some time away from studies. A year later, she enrolled to study engineering at the university. She started as a design engineer and then briefly in construction. She was discouraged to continue onsite and transferred to the design office. She soon resigned and she now works long hours as a construction engineer in another company. She enjoys the outdoor work but she now finds herself exhausted when she comes home. The older male engineers treated her like an assistant administration officer. She gets on well with contractors as she is physically strong and tolerant. She is not sure if she could combine family and work in the future, as the four women engineers she works with, three have no children or one with grown up adult children.

5. Discussions

5.1 Reasons women left engineering

In Australia, housework is normally done by the husband and wife. Women bear the larger proportion of housework and raising a family. Many are also have the responsibility of looking after their aged parents. They are exhausted from working fulltime at work and continuing to work more at home. Unless there is flexibility in their engineering

profession, more women engineers will be leaving the profession during this stage of their lives. Some companies are already giving some financial incentives to encourage women to return to work part time after maternity leave.

The attitudes of some older male engineers towards women engineers. This was more prevalent before 1990s as few women were studying engineering. Many older men also have been brought up thinking that they know best. They are also in the supervisory roles and decision makers. There was some resentment that women got the job male engineers used to have. Women engineers are not treated as equals by some older male engineers. Sexual harassment which was mainly verbal in this study and the culture in the workplace with inappropriate visual displays which made women engineers felt uncomfortable. Some workplaces organized meeting during times which did not suit mothers with young children. Some women engineers faced some discrimination and even bullying (verbal and physical abuse) and exclusion in social circles. There is insensitivity towards an expectant engineer's duties, as the work had to be done and no adjustment was made based on the woman's pregnancy.

Some are disappointed because they are given a non-engineering role. Women were not ready to bargain or know their rights. They have no mentors in many cases. For the changes in the work place to seriously take place, attitudes and stereotyping of women have to change. Women should also be encouraged to return to work after maternity leave by giving flexibility and incentives to resume their career. Some companies are already implementing this policy in 2013 by giving a small financial support for returning.

Flexible working legislation, Fair Work Act 2009 was introduced in Australia. This is to encourage the retention of experienced people in the workforce. As a result, there have been women design engineers working part time when they become mothers. Time will tell if this legislation will help to encourage more girls to choose engineering as a career. The number of women doing engineering is plateauing, not increasing overall.

5.2 Participation of girls in engineering

The main factor why there are low participation of girls in engineering is related to the decline in the number doing Applied Mathematics and Science in high school. The ones that study Mathematics and Science have a wider range of careers to choose from which are more family friendly. My observation shows this results in the low participation rate of girls entering the engineering faculties.

5.3 Literacy and numeracy

Most women surveyed had very strong numeracy skills compared to their literacy skills. There were no mentors encouraging them to do the course. Most thought that the course was useful in helping them in their everyday life. Most have transferable skills and they turned to lecturing, consulting and volunteering in the community. The Australian society viewed women engineers with high esteem because the impression is that they must be very smart to be in the male dominated field.

5.4 Decision after maternity leave

Women engineers and scientists who took a short break to have a family, say between 3 months and 9 months, found that they could fit in easily back to the engineering profession. However, women engineers who carried on working even harder than the male engineers suffered stress which affect relationships with their family, friends, work colleagues and clients. They are trying to emulate male engineers by going on this path. There was much juggling act which has been proven unsustainable for many reasons. One of which is a breakdown in their relationships and marriages. For the women engineers who have stopped work to have children, then returned to the workforce in a more family friendly career like teaching, their skills are not wasted as they are well respected in the community and are training the next generation of young people. Some have successfully set up their own engineering consultancies where they can manage, network and are in control of their destiny. The voluntary work they do in the community is priceless. Climbing the ladder in a male dominated profession is not an easy task, but do women want to do so? Science and engineering training have transferable skills which have empowered many of the women to pursue what is important to them.

5.5 Married to engineers

The interesting observation is a high correlation of women engineers married to engineers. Their engineer-husbands hold senior positions such as directors or senior engineers of companies and other organisations. Why are the men still continuing their profession when most of their wives have not? It is clear that men continue to work fulltime in the workforce.

My study showed that if the women engineers were to return to the workforce when the children are older, their main profession has changed to teaching or administration. Why can't they return to engineering? The answer lies in the fact that many women value family, health and flexibility in their lives. After a break in career to bring up children, there is very little flexibility in working part time for these women in the engineering profession. There is still a culture that engineers must work full time which is not possible or sustainable for female engineers who want to be working mothers. Note: This culture is now changing where part time work is introduced in the public service and some organizations.

5.6 Children of women engineers

Another interesting observation is that there is very low correlation of the children of parents who are both engineers choosing engineering as a preferred course at tertiary level. My study showed one out of 20 children chose engineering. She is from an Asian family. Is this to be obedient to the family's wishes? Most of the children are high achievers like their parents. They have chosen to do other courses. This needs to be examined further as the majority of role models might have 'discouraged' their own children from choosing the profession or there are more rewarding and interesting courses on offer. The latter might be the answer.

5.7 Employers

Program to increase the participation of women engineers is commendable but the whole scheme especially the culture in the workplace needs to be investigated. The generation of men brought up according to the old tradition of where a woman's place should be, is mainly the target group. 'Walk the talk' is more effective and this must come from the top management. Women engineers have used their technical and engineering skills such as project management to further contribute to society and for the benefit of the community. It is clear that communication skills are an important part in the equation of success and leadership. Women and men who have good interpersonal and communication skills do very well in engineering, business and other parts of their lives.

6. Conclusions

My findings suggest there is still hope in increasing the number of women engineers in this currently male dominated profession provided there is more understanding, caring and flexibility for women in the different phases of their lives. Women engineers value family, health, ethics and flexibility. The acceptance of women engineers as equals is looking more achievable in the next generation. I am very pleased to report that almost all the women engineers interviewed would still choose engineering as the preferred course as they felt empowered and the skills they have mastered are transferable in their contribution to their community.

ACKNOWLEDGEMENTS

I would like to thank the women who generously shared their stories with me.

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Biography

Susan Fenton is an engineering consultant and lecturer in the project management, sustainability and natural resource management industry for 30 years in Melbourne. She is a chartered member of Engineers Australia and graduated from the University of Melbourne, specializing in soil, water and agriculture plus has postgraduate qualifications in Education and Sustainability. She has worked in both public and private sectors, with experience in local and international projects.

Besides having a strong technical and scientific background, she also has excellent communication, networking and interpersonal skills. Susan volunteers and mentors in many community groups. She enjoys helping people to learn, improve and gain confidence. Empowering people so that they can help others is important to her and she strongly believes in the 'life long learning' philosophy. She has 3 adult children and a very supportive husband. One of her many achievements included presenting a paper at the International Network of Women Engineers Conference in New Delhi in 2012.

Her leadership positions in Australia include Chairperson of Blackburn Lake Sanctuary and Vice President of Natural Resource Management Providers Network in Victoria. She is also a supporter of Box Hill Rotary Club and sponsored many international humanity projects.