

The role of women in the engineering profession



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Women have been categorised as inferior to men and as a result are assigned the position of minors in both public and private sectors of life (National Gender Policy Framework, 2003). Additionally, most women arguably accept secondary roles without hesitation (Mathur-Helm, 2005: 63).. Education at school level is only part of the battle to recruit more women into the construction industry. Male builders need to accept women in the building workplace (Thompson, 1996: online). There is a relationship between higher education and the employment choices of women (Phaahla, 2000). Women tend to congregate in areas considered traditional outlets for female employment. Female staff and students are typically drawn to faculties such as the humanities, education and the social sciences. Generally women do not make up large numbers in technology and applied science areas of study. Consequently, the jobs available to women are limited for social and economic reasons. The position of women is further exacerbated by the fact that gender in South Africa is also racially and culturally segmented, creating inequalities that are race-bound. White and Black women have extremely different levels of experiences regarding job and development opportunities (Mathur-Helm, 2005: 67). Women encounter pervasive gender issues in their chosen careers which require specific strategies to deal with them (Phaahla, 2000). In particular, they need to contend with gender role stereotyping which believes that a set of traits and abilities is more likely to be found among one sex than the other (Schein, 1978: 259

Typically young people start contemplating their career choices at approximately the age of 16 or in their last years of high school. Gender-

based career stereotyping makes it particularly difficult for young girls to establish their own career choices or to diverge from the career choices dictated by their parents. A sense of isolation is another reason for high defections, with women having little chance of meeting other women working in construction. This chapter, will be a review of the primary information or the literature which has been written about challenges facing women, it will start by reviewing some literature on the skills shortages in South Africa and more specifically in the engineering sector, then women and work in South Africa and in general on the aspect of the glass ceiling. This chapter will also review literature on male dominated or traditional career.

Skills shortages

South Africa is experiencing a major shortage in skills in the engineering field, and the entry of women in this field is helping in trying to reduce skills shortages. There have been many changes in the pattern of work of women, more and women are now working outside the home. Some of the reasons that a sense of isolation is another reason for high defections, with women having little chance of meeting other women working in engineering, education at school level is only part of the battle to recruit more women into the engineering industry have been given as to try and explain why women work are: social changes and the changes in public attitudes towards women that have encouraged women to enter the job market (White et al, 1998).

An overview of women and work

All around the world, there is an increasing concern for gender equity and equality in the family and society for the benefit of children, men and

women. Women have in the past contributed to different areas of economic and social life, for example, they are farmers, entrepreneurs, traders, homemakers etc and yet they share unequally in the fruits of their labour. Women constitute a large percentage of the world's poor and continue to suffer disadvantage in education, health and employment (UN Report on the Advancement of Women, 1995). Nowadays, many more women are found in the workplace, in politics and more are getting educated than ever before. While women have advanced more rapidly in some societies than others, almost everywhere women's concerns are still accorded second priority and they continually face both subtle and flagrant discrimination (Hinson, R; Otieku, J; & Amidu, M 2006).

Women and work in South Africa

Women are still regarded as secondary to men in South African business culture (Mathur-Helm, 2005: 63). There is a view that women do not show leadership potential and behave differently from traditional male leaders (Mathur-Helm, 2004; Guppy & Rick, 1994). According to Johnson (1999), they are emotional and cannot shoulder responsibilities. What women do is rarely defined as leadership, given that masculinity is an implicit construct of leadership (Kloot, 2004: 472). The South African definition of gender equality is guided by a vision of human rights which incorporates acceptance of the equal and inalienable rights of all men and women (Kornegay, 2000). Indeed, the rights of women need to be viewed as human rights. 'Equality' is specified and enshrined in the Bill of Rights of the South African Constitution (South Africa, 1996). Section 9(3) of the Constitution provides that no one may unfairly discriminate directly or indirectly against anyone on any

grounds such as, for example, race, gender and culture. This prohibition on discrimination forms an integral part of processes to achieve social justice in South Africa. Gender equality, therefore, requires that the underlying causes of discrimination be systematically identified and removed in order to give women and men equal opportunities in every sphere of life: In short, the economic integration of women, which comes only when market barriers are lowered and women are given an equal chance to attain decent work, remains a necessity for economic development and a worthy goal in its own right (ILO, 2008: 4). In South African society women historically faced the burden of unpaid household labour in addition to income-generating work. A rigid and uncompromising organisation of working hours and environment prevented them from performing well, considering that they needed to take time off for childcare and other family responsibilities (Ellison, 2001; Wilson, 1998). Often these demands reduced their chances of full-time paid employment. In addition, in terms of the South African Employment Equity Act of 1998, labour market discrimination arises when employers make decisions about employees for reasons that are not related to genuine work requirements (South Africa, 1998). Discrimination is most obvious when an employer focuses on irrelevant personal characteristics instead of work performance or merit. As a result women in many organisations have to work extra well and hard to gain any prospect of promotion. Unfortunately women have not been benefiting Acta Structilia 2009: 16(2)

50 from government policies and legislation to advance their careers (Mathur-Helm, 2005: 58). There is, therefore, no correlation between policy and practice. In South Africa, they have since put in place constitutional and

employment legislation to try and eliminate direct discrimination; it is now against the law to discriminate on grounds of gender. But there are insufficient checks, resources and sanctions in place to enforce these provisions

([www. mywage. co. za/main/women-and-work](http://www.mywage.co.za/main/women-and-work)). The following are some of the characteristics of women working in South Africa face:

Lower levels of pay in sectors which mainly employ women, Women traditionally work in welfare, such as care (nurses, social workers, etc.). Such jobs are less well paid than work, say, in production of goods and financial services ([www. mywage. co. za/main/women-and-work](http://www.mywage.co.za/main/women-and-work)).

Jobs in sectors where both men and women do the same kind of work are valued differently. Here, too, there is no objective reason for the difference in pay, “ If women do work of equal value to that of men and still receive lower pay, this means that the employer simply is putting value on the chair and not on the person sitting on it” ([www. mywage. co. za/main/women-and-work](http://www.mywage.co.za/main/women-and-work)).

At the same time the characteristics associated with traditionally male jobs (leadership, technical insight, and heavy physical work) are over-valued. These very often subconscious valuations have to be overcome by making people aware of them and then act differently. In general it may be said that too low a value is placed on characteristics associated with women, e. g. social skills, physical and emotional care, concentration. ([www. mywage. co. za/main/women-and-work](http://www.mywage.co.za/main/women-and-work))

Barriers to Women's Advancement (glass ceiling)

Morrison (1992) describes several organizational barriers which constitute the glass ceiling in organizations. These include;

1. Non-supportive working environments
2. Differences being treated as weakness
3. Exclusion from group activities
4. Lack of organizational insider knowledge

While many women insist that the glass ceiling is a real barrier to accessing male-dominated positions in business, many challengers say that it exists mostly because women choose to focus more of their time on family and, in the end, cannot dedicate as much time to their career. Others claim that women think they want to focus on their career, but in reality choose family over career. A 2005 report, reports that 43% of highly qualified, educated women with children left their jobs voluntarily at some stage of their careers. Although 93% wanted to return to their careers, only 74% did so and only 40% went back to a full time position. Of those women who wanted to return to work, only five percent desired to return to the position they had left.

(<http://www.wisegeek.com>)

Non-Traditional jobs or male dominated careers

Non-Traditional jobs and careers are ones that have traditionally been held by men. The Department of Labour classifies jobs as non-traditional when women are less than 25% of the workforce in that field. Non-Traditional

Fields include: Detective, Architect, Barber, Machinist, Computer and Office Machine Repairer, Fire Fighter, Chef, Railroad Conductor,

Construction and Building Inspector..." (<http://www.womenwork.org>).

Benefits offered in non-traditional careers.

Non-traditional careers offer women many benefits that traditionally female careers do not have, these include the following: Higher Pay - Women in non-traditional careers generally make 20-30% more money than women in traditional careers, Opportunity for Advancement - Non-traditional careers often have career paths that allow women to quickly move up the ranks, Better Benefits Packages - Women in non-traditional careers generally have better benefits packages, including health care, vacation and sick leave, pension/retirement plans and life insurance, Expanding Job Availability - Non-traditional careers are generally in fields that are growing, thus there are many new jobs and positions being created, (<http://www.womenwork.org>.)

Challenges facing women in non-traditional careers

Women are facing challenges in the non-traditional, though there are many resources and support programs to help women overcome these difficulties, some of the common problems encountered by women are as follows:

Discrimination or Harassment - Many women face discrimination and/or harassment in a non-traditional workplace, Hazardous Environments - Non-traditional careers can be in hazardous conditions for example in the mines or engineering, Family and Friends May Not Be Supportive - Many women find that their family and friends are not as supportive as they could be

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about their new career choices, Isolation - With few other women in the non-traditional workplace, many women feel isolated and lonely in their careers. Again, women can find supportive networks and groups with other women experiencing the same situations and environments, Transportation and Child Care Difficulties - Some non-traditional jobs are at odd times and sites. This can make transportation and child care difficult to find and maintain.

Some of the strategies to deal with these challenges

Young females who are in male dominated careers can try to alleviate the changes which face them at work, by having personal board of directors which can be a group of four to five people. Members of ones board can be mentors, peers, friends, or colleagues. These individuals will support you and are willing and able to help you get where you want to go, you should cultivate many developmental relationships instead of searching for one " perfect mentor." Your personal board of directors is a group of four to five people, hand picked by you to be your own fan club. Members of your board can be mentors, peers, friends, or colleagues. These individuals can support them and help them get where you want to go. There is great power in the support the younger females receive from women facing similar challenges, the benefits include:

Knowledge that you're not alone

Concrete suggestions and helpful guidance

A forum in which to share your thoughts and feelings with others who can relate

One can build personal board of directors by following the following steps: the first step is to reach out to other women for support. Too many female professionals are afraid to ask women in their field for assistance and guidance. However, what most women do not know is that most accomplished women want to help others like them succeed. By developing these mutually relationships it can help one to create an alliances which is essential to a long and successful career. (<http://www.eurekalert.org>)

Stereotype of engineers

puts women off the job

<http://www.hrmguide.co.uk/diversity/engineering.htm>

March 10 2006 - Classic stereotypes of engineers as men who are brilliant at and passionate about technology, but not very good at dealing with people, do not reflect real engineers and their work, according to Dr Wendy Faulkner from the University of Edinburgh. Moreover, such stereotypes are hampering efforts to recruit women into the engineering profession.

According to Dr Faulkner, who interviewed and observed 66 male and female engineers from a range of industries,: “ Women and men engineers alike get excited about technology - even though fewer of the women have a ‘ tinkerer’ background. There are ‘ gadget girls’ as well as ‘ boys and their toys’ in engineering. At the same time, many different types of men and women enjoy engineering work - very few fit the classic stereotype.

Wendy Faulkner adds: “ In practice, engineering encompasses a wide variety of jobs and roles. It is a ‘ broad church’ with room for a diverse range of

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people. Yet the image of engineering - and often the culture - remains a narrowly technical, 'nuts and bolts' one.

"Retention is as important as recruitment - many of those women who do complete engineering degrees don't go onto engineering jobs or leave the industry after only a few years," says Dr Faulkner. "Part of the issue is that women who enter engineering have to become 'one of the lads' in order to fit in. Many subtle aspects of the culture, which may appear trivial individually, when taken as a whole have a 'dripping tap' effect - making it harder for women to belong, and get on in engineering."

Her study shows details how the topics engineers talk about, as well as their style of humour and the social activities they engage in, reflect men's interests and ways of bonding. Women are left on the margins of this male society, finding it difficult to break into the 'inner circles' that carry influence on how the job gets done and who gets promoted.

"By contrast, engineering workplace cultures accommodate a range of men - laddish blokes, family men, pranksters, macho men, nerdy men, urbane men, genteel men - and so they are likely to feel comfortable to the great majority of men," says Wendy Faulkner.

"If more women are to stay and progress in engineering workplaces, there is a strong business case for employers to introduce sustained and sensitive diversity training, to raise awareness of these kind of issues and to nurture more 'inclusive' workplace cultures in which everyone is comfortable," says Dr Faulkner.

Engineering – A Male Dominated Profession

Coming from the first year engineering program at UBC, I couldn't help but notice how male "dominated" the program was. I recall sitting in my Physics 153 class and being able to pick out the number of women on one hand.

I began to question as to why engineering is associated with males more than females. Is it course difficulty? Interests? Or simply stereotypes?

I've transferred schools and am now in my first year (yes, again) in Mechatronics Engineering program at SFU Surrey and I'm still observing the same thing - a larger male population in engineering.

I decided to sit down with Rebecca, a first year Tech One student who plans to go into Mechatronics, and asked her a couple questions regarding my observation.

Me: "Hi, Rebecca. Thanks for taking time out of your busy schedule to talk to me."

Rebecca: "No problem, I had an hour break anyways."

Me: "So, what program are you in right now?"

Rebecca: "TechOne right now, but I plan to go to Mechatronics Engineering if I get the grades after."

Me: "Good for you. What got you interested in engineering in general?"

Rebecca: " Well, I really enjoy math. I also like problem solving and working in teams. It's always nice working with other people and getting everyone's ideas together. After all, two heads are better than one!"

Me: " Very true! Is there anything else besides that?"

Rebecca: " Actually, my parents kinda pushed me to choose something right away. Mechatronics seemed to be the only interesting career path for me. It is a little weird though."

Me: " What is?"

Rebecca: " I don't know if you notice but there aren't that many girls in engineering"

Me: " You took the words right out of my mouth! I noticed the same thing. How do you feel about that?"

Rebecca: " I don't feel out of place or anything. Just because I'm a girl doesn't mean I'm not fit to be an engineer. It can be a little intimidating, though. Prior to choosing Mechatronics, I never would've expected this many guys in my class."

Me: " Why do you think there are so many guys in engineering?"

Rebecca: " Well, I think it's labeled as a male's job. Typically, you see the majority of engineerings being guys. That's basically it. It's stereotypical."

Me: " So does this change your willingness to stay in Mechatronics?"

Rebecca: “ Not at all. It is easy however, to question whether you’re in the right program or not but for me, I don’t think I would question it because there are so many guys compared to girls, but because I don’t know if it’s something I can see myself doing in the future.”

Me: “ Well, thanks for answering some of my questions, Rebecca. I’ll let you get back to your studies.”

Rebecca: “ No problem. I’ve got a lot of math to catch up on.”

After speaking to Rebecca, I couldn’t help but get a little bit of a better understanding about women in engineering. I don’t think it matters to her, or to other women, that a “ man’s job” should only be meant for a man. At the same time, I don’t find that women do it to prove to men and society the famous saying, “ Anything you can do, I can do better.” When choosing a career path, it’s important to think about what you’re interested in and whether you see yourself succeeding in that field. You can compare this same idea to male nurses. It is stereotypical to see a nurse as a female job but today, I see more and more men becoming nurses. In fact, a buddy of mine is studying to become one as we speak.

Engineering is a challenging career path for anyone, male or female. Before making a career decision, it is important to block out any stereotypes that may come along with that profession. I strongly believe that people choose career paths to prove to themselves, and only themselves, that they can do anything they put their mind

I. Introduction

Attracting Women into Engineering – a Case Study

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The economic well-being of Canada and the development of its technological base depends to a great extent on the effective employment of engineers.

With the predicted shortage of engineers by the year 2000, employers cannot be satisfied with anything less than the very best engineers available, regardless of their gender [1], [2]. Statistics Canada figures released in April 1998 show that women make up only 12 % of 407, 130 university grads in the science and technology fields, and only seven per cent of the 588, 400 community college grads. Although women represent 55% of all undergraduate students in Canadian Universities, only 21% are enrolled in engineering programs. Furthermore, the percentage of women among practicing engineers in Canada is still very low, less than 5% [2]. For example, in 1998 only 3030 out of 61, 340 (i. e. 4. 9%) Professional Engineers registered in the Province of Ontario were women. Underrepresentation of women persists despite the fact that there are no differences in academic ability between men and women and that men and women initially pursue engineering for similar reasons [3].

A. Enrollments in Engineering in Ontario

Over the past decade the number of women in engineering undergraduate programs in the province of Ontario has been steadily increasing, but women

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are still significantly under represented in the applied science and engineering programs. While the climate for women in engineering has improved in recent years, misconceptions about engineering, lack of encouragement, peer pressure and other factors still act as barriers preventing more women to pursue a career in this non-traditional field. Trends in enrollment in engineering schools are shown in Figures 1, 2 and 3 [4].

Fig. 1. Number of Men Studying Engineering at Ontario Universities.

As shown in Figure 1, the number of male students in engineering has been declining since 1992. This is reflected in all the engineering disciplines.

Fig. 2. Number of Women Studying Engineering at Ontario Universities.

In contrast, the number of women students in engineering has been increasing, although their actual number remains much smaller than that of their male counterparts, as shown in Figure 2. The female enrollment in engineering programs in Ontario over a five year period has increased from 13% in 1992-93 to 18.5% in 1996-97 school year.

Fig. 3. Percentage of Women Studying Engineering at Ontario Universities by Discipline.

Figure 3 presents the percentage of women students in engineering by discipline. This graph shows a steady decrease in Aeronautical and Industrial Engineering enrollment since 1993. It has been suggested that women are moving from Industrial to Systems engineering, but the reason for the decrease in Aeronautical engineering is not known. It is interesting to

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observe that the total percentage of women students in engineering continues to increase, although the total number of women students has recently shown the same down turn as men.

It has been suggested that initiatives to encourage women to study engineering will soon become unnecessary because the numbers are increasing so rapidly. This would be welcome news if it were true, but in fact the gains of women in the profession are not large and are not well established yet. Although the participation of women in engineering has increased every year since 1974 (when the first statistics were recorded), when only 2.9% of full time engineering students were women, the engineering profession has not been successful in attracting women in large numbers [5]. At about 18%, the percentage of women undergraduate students in engineering in Ontario is still well below the participation rates of women studying for other professions such as law, medicine, pharmacology or veterinary science. Women practicing engineers account for only about 5% of the profession. While women have made progress in the profession, they still encounter unacceptable attitudes and behaviours, as well as the “glass ceiling” [2].

B. Why More Women Don't Become Engineers

There are a number of factors that tend to divert women away from engineering as a career:

Streaming, or the “Leaky Pipe Syndrome”: Women are diverted from math and science courses early in their high school careers. It has been argued [6] that this is associated with issues of competition, isolation, lack of female

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role models and not of lack of academic ability. Systemic obstacles [1] include: cultural influences and gender stereotyping at home and in school, peer pressure and images in the media.

Perception of Difficulty: Engineering is thought to be extremely difficult. Combined with the prevailing myth that women are poor at mathematics, women tend to choose something perceived as more achievable.

Exposure: Women do not have as many engineer role models as for other careers such as business, medicine or law. There are few women science high school teachers, women in science textbooks and among university engineering faculty in 1995, only 5.5% were women [7].

Lack of Knowledge About Engineering: Engineering is perceived as a technical, often solitary pursuit, in which one works with machines rather than people. Career options in engineering are not well known by most adults, let alone teenagers, and are not well represented in high school curricula or through career guidance counseling. This affects girls disproportionately, as they typically have less access to information about engineering outside the school environment.

Hobbies: Encouraged by parents and peers, boys engage in mechanically oriented hobbies, which prepare them better for the practical aspects of engineering.

Social Status of the Profession: In North America, the profession of engineering derives from the skilled trades of Britain, and therefore may be associated with the working class. This is in contrast to the European

tradition of engineering, where it has always been regarded as a profession allied to the sciences. Notice the difference between the derivation of the English word engineer (associated with engines) and the French word ingénieur (associated with ingenuity or invention). Thus engineering has a tradition of higher social status in the New World countries such as Venezuela, deriving their traditions from continental Europe, as opposed to British-influenced Canada. This is implicitly understood by parents who are considering professional careers for their daughters

4 Barriers to Women's Advancement in the Accounting Profession

Morrison (1992) describes several organizational barriers which constitute the glass ceiling in organizations. These include;

1. Non-supportive working environments
2. Differences being treated as weakness
3. Exclusion from group activities
4. Lack of organizational insider knowledge

Non-supportive working environments

Many women in business are becoming increasingly aware and indeed disillusioned with what they perceive as a lack of support in their work environments. The working environment is determined by the culture within a particular organization, namely the systems of

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shared values which create the behavioural norms. There are seven types of gender-related organizational culture, each of which in its own way contributes to a non-supportive work environment. The 'gentleman club' reinforces the notion that the woman's role as mother and homemaker and the man's role as breadwinner are natural and preordained; the "barrack yard" is an authoritarian culture where power delivers respects and as women rarely have senior status their interest are ignores; 'locker room' is an exclusion culture, where men build relationships on the basis of common agreements and common assumptions and may frequently talk about sport and make sexual references to confirm their heterosexuality; the 'gender blind' pretends that women live the same lives as men; the "smart macho" is driven by extreme competitiveness and is very much geared to the young and childless; the "paying lip-service" type of culture espouses equal opportunities policies but does little to assist practically in the development of

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women employees: and the “ women as gate-keepers” type of culture means that often the main resistance to women managers comes from other women who are less career-oriented or are wives of senior staff.

5 Differences treated as weaknesses

The Institute of Management (1992) has identified the dominance of male culture in its many manifestations as the crucial barrier for women in business to overcome. It is the prevalence and power of this culture, perceived as the norm, that lead directly to differences being regarded as weakness and hence to women being perceived as less successful managers. It is not that women do not possess characteristics, attitudes and temperaments more commonly ascribed to men and although female managers and management students no longer see the traditional male managerial job, the concept of a scientific, rational and detached male manager still persists, as being the ideal to which one should aspire. This obviously presents problems for women in managerial roles because they will frequently be considered by male colleagues and subordinates as not fitting the mould, of being an outsider

because of the gender, and they will constantly be measured against the male managerial stereotype as shown in the outline.

Masculine and feminine stereotype

Masculine Stereotype

- Competence

- Very aggressive

- Very independent

- Almost always hides emotions

- Very objective

- Not easily influenced

- Very dominant

- Distance/inexpressiveness

- Uses harsh language

- Not at all talkative

- Very rough

- Not at all aware of feeling of

others

Feminine Stereotype

- Incompetence
- Not at all aggressive
- Not at all independent
- Does not hide emotions at all
- Very subjective
- Very easily influenced
- Very submissive
- Warmth/expressiveness
- Does not use harsh language

at all

- Very talkative
- Very gentle
- Very aware of feeling of

others

Source: White (1995)

Hinson, R.; Otieku, J.; Amidu, M: Exploratory Study of Women in Ghana

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6 Exclusion from group activities

One of the problems resulting from the assumptions made about women's role in the workplace is that women are frequently excluded from group activities within those organizations where a strong male culture predominates. These activities may be business-related, for example, considering a female colleague too irrational to be involved in the development of a strategic plan, or too emotional to make a