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IPENZ
ENGINEERS NEW ZEALAND

Does gender matter?

Findings from an online survey and interviews of engineering graduates from 2000 and 2005

The Ministry of Women's Affairs,
with the Institution of Professional Engineers New Zealand

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Executive summary

This report presents the findings of a study of engineering graduates. The study was conducted in two phases: an online survey of graduates from two universities offering engineering degrees, and follow-up interviews with a smaller group of the survey participants.

The purpose of the study was to understand what motivates men and women to study engineering and to learn more about their post-graduation career experiences. Surveys were sent out via email, and 150 responses were received (from graduates of 2000 and 2005 from both the University of Canterbury and the University of Auckland). Twenty one people participated in the follow-up interviews.

The influences on men and women in choosing to study engineering were similar. Parental influence was important in making this decision. Although few of the female interviewees had parents who had any experience of engineering, parental encouragement was a factor for a number of the women surveyed. Women were more likely to be motivated by a teacher and the idea that they would 'make a difference', and men were more likely to be motivated by career opportunities.

Women were less likely than men however, to know about engineering as a career option. Careers advice was a lottery for both men and women, but women in particular were provided with less information about engineering. A number of women had been motivated to study engineering through visits to their school by engineering students.

Men and women specialise in different branches of engineering. Women are more likely to be chemical or biomedical engineers, whereas mechanical and computer engineering are male domains. There are also some gender differences in pay. Although there are similar proportions of male and female survey respondents earning between $60,000 and $90,000, and between $90,000 and $120,000, twice as many men than women were earning over $120,000, and more than three times as many women than men were earning between $30,000 and $60,000.

Men and women had similar experiences of their first job. Men were slightly more likely than women to report barriers to get their first job, although four women on the survey identified gender discrimination as a barrier to getting a job. Both men and women found it hard to get a job initially, and the majority of both men and women said that they were not able to negotiate their salary at their first job (although a small proportion of people said they did negotiate; these people were more likely to be men). Women were more likely than men to have moved on from engineering as a career: at the time of the survey 71 percent of women compared with 82 percent of men, were still working in engineering. Several women stated they had not enjoyed engineering, while others had branched into different areas (e.g. corporate finance, business analyst, research). Workplace culture seemed to be connected to the retention of women in engineering jobs, as some female respondents commented that they had left jobs due to being unhappy with the workplace culture.

Overall the women interviewed were positive about their career opportunities, and some women felt they benefited by being a woman in engineering. On the other hand, some women reported they had difficulty dealing with male attitudes towards women (in terms of the men's level of comfort in having female colleagues, and their perceptions of the women's ability to do the job).

The key factor that affected the careers of the female engineers was having children. Starting a family did not have the same effect on men, as it did on women. Women were more likely to take time out of the workforce to have children, and to return in a part-time capacity (sometimes at a lower work level). Working part-time, in particular, has an impact on career progression (engineering firms often structure career progression around hours worked). Employers can make a difference in making the return to work easier for women, through flexible work practices. Flexible work is widely available but there is significant variation in practices and attitudes to flexible work in businesses. Despite the availability of flexible work practices, working long hours still seems to be the way people progress into management positions, and engineering companies are male dominated at management level.

The findings of this study indicate potentially useful areas for follow-up work. For example, it seems clear that a lack of information about career options may be compromising the study choices of students. The research suggests that visits from engineering graduates can positively influence student career choices and that visits to school classrooms are likely to be more effective than the information on websites in influencing women's choice of careers.

In addition, it seems that employers can have an influence in better supporting women in returning to the workforce and in moderating the impact of career breaks and part-time work on career progression. Examples were provided by a number of employers who had successfully introduced flexible work practices. A useful next step could be to interview some engineering firms about flexible work practices, with a view to disseminating innovative practice.

Introduction

As a profession, engineering offers excellent future job opportunities, including good remuneration and travel opportunities. Despite this, in the past decade there have regularly been global shortages of engineers.

Engineering is also a field where the majority of graduates are men. In 2010, 24 percent of graduates with bachelor's degrees in engineering and related technologies were female.[1] Female graduates made up between 18 and 28 percent of those graduating with a degree in engineering between 2002 and 2010. Women are more likely to be concentrated in the areas of chemical and process engineering, biomedical engineering and, to a lesser degree, civil engineering. In 2010, there were few women in mechanical, mechatronics or computer systems engineering.

The Ministry of Women's Affairs, in partnership with the Institution of Professional Engineers New Zealand (IPENZ), has undertaken this research to understand what motivates men and women to study engineering and their post graduation career experiences. The research consisted of an online survey of engineering graduates who graduated in 2000 or 2005[2] from the Universities of Canterbury or Auckland, and one-on-one interviews with 21 of the survey participants. In gathering this information we were seeking to understand whether men and women have different career aspirations and whether their career paths diverge over time.

This report describes the research, discusses the key findings and sets out some possible next steps based on the research findings of what else could be done to improve the number of women in engineering.

[1] Education Counts, Students graduating in engineering and related technologies by level of study 2002-2010.

[2] The universities were asked to send the survey to students who graduated in 2000 and 2005 but there is some variation around these dates. Responses have been grouped around each date.

Method

The study of engineering graduates was undertaken in two phases. Phase one involved an online survey of engineering graduates who had graduated in 2000 or 2005 from the Universities of Canterbury or Auckland. Phase two involved one-on-one interviews with some of the survey respondents.

Phase one: survey

The survey consisted of a series of questions designed to elicit the motivations and influences of men and women who had chosen to study engineering, as well as their career experiences since graduating, and whether the career motivations and experiences differed by gender.

The survey was sent out by email from the engineering schools of the universities of Canterbury and Auckland to graduates who had completed an engineering degree around the years 2000 and 2005. It went to 317 graduates from the University of Canterbury and 393 graduates from the University of Auckland. Of the graduates the survey was sent to, 223 had graduated around 2000 and 487 around 2005. The lower number of surveys sent out to year 2000 graduates reflects the lack of email contacts for this group.

Responses were received from 150 people – a response rate of 21 percent. This is regarded as a good response rate to an email survey. Of the respondents, 88 were men (59 percent) and 62 were women (41 percent). Two-thirds were more recent graduates (a reflection of the higher numbers in this group). As only 21 percent of engineering graduates are women, women were over-represented in the responses.

The participants

Of those who responded to the survey, almost half (49 percent) were based overseas, 30 percent were based in Auckland, 7 percent each in Wellington and Christchurch. The remaining 7 percent were based in other parts of New Zealand. Women were slightly more likely than men to be overseas, and 54 percent of the women surveyed who had graduated around 2005 were currently overseas.

The majority of the respondents were employed full-time (85 percent), and most (71 percent) worked in large companies (companies with over 100 employees).

Twenty-four percent of respondents indicated they were IPENZ members and 12 percent identified as Chartered Professional Engineers. There was very little gender difference in terms of membership, but civil engineers were more likely than other branches of engineering to be members of IPENZ.

Phase two: interviews

The interviews were semi-structured and took the form of a conversation within which key questions were asked. The questions probed into the factors influencing individual decisions to study engineering, approaches to getting a job and subsequent career and employment experiences.

For participants based overseas interviews were undertaken by phone. For those based in Auckland, Wellington and Christchurch (four, two, and four people respectively) face-to-face interviews were undertaken. Phone interviews were undertaken for the five participants based in smaller New Zealand centres.

The participants

Participants in phase two of the project were selected from survey respondents who had indicated an interest in being interviewed. Twenty-one people participated in phase two. Respondents were selected across a range of variables:

- Representation of each university (13 from the University of Canterbury and eight from the University of Auckland).
- Gender (eight men and 13 women).
- Location (14 of the participants had worked overseas and six were still based overseas).
- Type of engineers (eight civil engineers; six chemical and process or chemical and material engineers; and two biomedical engineers. The other five respondents were electrical, mechanical, transportation, computer and mechatronic engineers).

The over-representation of women interviewees was deliberate given women are less likely to study engineering, and the aim of the study being to understand the motivations and career experiences of women who had chosen engineering as a profession.

The interviewees ranged in age from 27 to 52 years of age. There was an over-representation of older graduates who had graduated around 2000. This provided a more comprehensive picture as to how engineers' careers were affected when they had children.

The key findings from phases one and two are outlined below. All of the names used in this report are pseudonyms to protect the identity of those interviewed.

Key findings

This section discusses the findings of the research, including the factors influencing decisions about studying engineering generally and specialisation within engineering, experiences in their first job and career experiences of the graduates to date.

Factors influencing decisions to study engineering

Survey respondents were asked about the factors influencing them to study engineering (see Table one). Overall, there were similarities in the responses of the male and female respondents. One exception was that the career choices of women were more likely to be influenced by their teachers than they were for men.

Table one: Factors influencing choice of engineering as focus of study[3]

Influencing factors	Women (%) n=62	Men (%) n=88
Career opportunities	51	58.1
Parental influence	28.6	29.2
Earning potential	22.4	25.8
I wanted to make a difference	28.6	22.6
Careers guidance	20.4	21
Teacher influence	12.2	3.2

The interviews elicited more information about these career influences.

Parental influence was important

All of the interviewees had parents who wanted them to do well in whatever they did. Although few of the female interviewees had parents who had any experience of engineering, Gina's mother had encouraged her to pursue this option given her strengths in science and maths.

Amanda had been encouraged by her physics teacher to do engineering because she was good at sciences and maths. Her parents (one was a doctor, the other a lawyer) had offered further encouragement to pursue engineering.

Denise observed that the role of parental influence was very strong among her class-mates and she felt that she would have had a better idea of career options if one of her parents had been an engineer.

[3] Note the percentages add up to more than 100 percent as participants could select more than one factor that influenced their choice.

Richard, one of the Asian male graduates, stated "*medicine, law, accounting and engineering, they are the top four*". Asian students accounted for more than half of the total engineering graduates from Auckland engineering school in both 2000 and 2005.

Good careers advice about engineering was absent

All of the interviewees said they had been good at science and maths at school so wanted to study something that would allow them to use these skills. Almost all of the interviewees, however, commented on the absence of good careers advice when they were at school and the general lack of knowledge regarding career opportunities for those with an interest in science. Girls were encouraged to study law or medicine if they were "bright". In a number of private girls schools that these women had attended, engineering had never been mentioned as a possible area of study. As a consequence most of the women entering study in the mid to late 1990s (graduating in 2000) had fallen into engineering by chance, and several had taken some years after finishing school to choose to study engineering.

Carla, for example, had seen her neighbour (an engineer), design a hydraulic slide which she thought looked like fun and her father had encouraged her to pursue engineering. But although she had attended two different secondary schools and was good at maths and science, engineering was never mentioned as a possible career option.

Naomi, whose favourite subjects at school were physics and maths, was advised at the age of 15 by a careers advisor to take up typing as this would offer better career prospects. This was a subject she hated and resulted in her dropping out of school, returning to get sixth form certificate and then completing a certificate in horticulture. It was not until Naomi was 22 and met an engineer and a surveyor she realised that engineering was what she really wanted to do. At 22 she enrolled at a polytechnic where she completed a certificate in engineering and then to university where she specialised in civil engineering. She is now a specialist in high rise building structures and is based overseas.

Women were less aware of engineering as a career option

Women were more likely to state they had no idea what engineering was or what job opportunities it could provide. Men, on the other hand, usually knew that engineering was a possible career path if they were good at science and maths and they often had a family member or friend of the family who was an engineer.

There was evidence of some improvement in the careers information available to young women in the latter group of graduates. Several of the 2005 cohort had gone into engineering following a visit to their school by engineering students. In Denise's case this had resulted in the opportunity to spend a day at the engineering school on campus. As a result of these interactions three of the girls from the girls high school Denise attended had taken up engineering.

Factors influencing differences in specialisation

Table two below shows the fields of engineering of the survey respondents.

Table two: Percentage of men and women graduating by engineering specialisation

Branch of Engineering	Women (%) n=62	Men (%) n=88
Civil	26.2	21.2
Chemical and materials	29.5	18.8
Mechanical	13.1	24.7
Electrical and electronic	8.2	16.5
Mechatronics	3.3	8.2
Software and computer systems	4.9	8.3
Biomedical	8.2	1.2
Engineering science	4.9	2.4
Civil and environmental	3.3	1.2

Women were most likely to have chosen chemical and materials engineering, biomedical engineering or civil engineering as their area of specialty. This appeared to be a matter of preference and interviewees stated that all engineering specialties were equally emphasised in their first year.

The number of women completing civil engineering degrees at the University of Canterbury in both 2000 and 2005 was around 17 percent. At the University of Auckland the overall number of civil engineering graduates was smaller but women made up 27 percent and 23 percent of the total in 2000 and 2005. Women who had gone into civil engineering were interested in the range of career opportunities available and the opportunity to make a difference. Making a difference was a common motivating factor for both men and women.

Women are more likely to be chemical or biomedical engineers

The women who were interviewed and had chosen chemical and materials engineering had done so for reasons that included: having been impressed by the lecturer, having it recommended by a family friend who was a chemical engineer, or for the career opportunities it offered. Women were represented in more equal numbers in chemical engineering where, for example, 45 percent of the 2005 class of graduates from the Auckland school of engineering were women.

The one area of engineering where women outnumbered men was in biomedical engineering. Biomedical engineering is only available at the University of Auckland and was introduced seven years ago. Classes typically have around 20 people in them. Of the class of 2005, 12 of the 21 total who graduated were women. Thirteen of the 21 graduates were Asian. Two-thirds (eight) of the women were Asian.

Mechanical and computer engineering are male domains

Tony, who had graduated in computer engineering noted that in his class of 42, five were women, all Asian. Most of the women who were questioned regarding the low number of women in mechanical engineering felt women were less interested than men in how things work and, in the case of mechanical engineering, less interested in a job where you were likely to "*get your hands dirty*". Men who were questioned also tended to explain the absence of women in these fields as simply a reflection of preferences.

Experiences of first job

Most of those surveyed (95 percent) had worked in an engineering role when they first graduated. Many people obtained their first job through graduate recruitment programmes with one of the large consulting companies, or by sending out CVs to targeted employers. Others obtained their first job as a result of their summer internship (work experience is part of the degree requirements). Some of the interviewees who had graduated in 2005 noted that it was much easier to get work in 2005 and 2006 than it was following the global financial crisis.

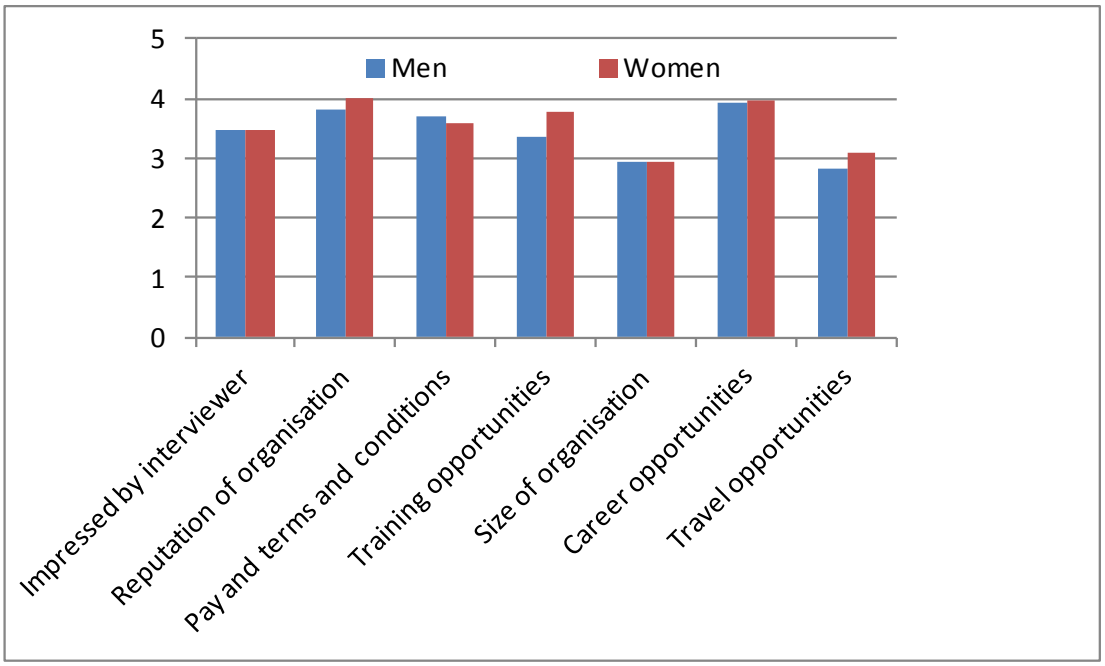
A few of the men interviewed had been directly recruited by Australian consulting engineering companies that recruit in March/April. These companies offer similar training opportunities to their New Zealand counterparts, albeit with better starting salaries and apparently faster salary progression. John, who had graduated in 2005, thought he was unlikely to return to New Zealand because the salary and the opportunities offered by the company he works for are far better than he could get in New Zealand. The results from our on-line survey showed that that over 50 percent of 2005 graduates and 42 percent of 2000 graduates were still overseas in 2011.

Career opportunities and organisational reputation matter more than pay

Figure one on page 13 illustrates the importance attached by survey respondents to different factors, on a scale of one to five with one being not important and five being extremely important.

For both men and women, the most common factors influencing a person's decision to take their first job included the reputation of the organisation and career opportunities. For men, pay was the third most important factor, while for women it was training opportunities.

Figure one: factors influencing men and women graduates' decision to take a job (all respondents)



Barriers to getting a job

When the survey participants were asked about any barriers encountered in getting a job, women were slightly less likely (15 percent) than men (17.9 percent) to have encountered barriers. Barriers encountered included lack of experience, the global recession and limited job opportunities, particularly in the biomedical field in New Zealand.

Four women from the survey who had encountered barriers identified discrimination *("lack of respect towards female engineers"*; "*When I was interviewing for large engineering firms for graduate roles I also felt up against a lot of gender prejudices")* as barriers. Two women also mentioned a perceived bias against migrants in New Zealand ("*Hidden negativity towards immigrants in the country*").

Several of the interviewees noted it had been hard to get a job initially and in the case of two interviewees, this had resulted in them undertaking extra study. Some of the 2005 graduates mentioned feeling relieved they had graduated when they did because getting an engineering job in New Zealand following the global financial crisis had become more competitive. One interviewee mentioned a number of redundancies occurring at her organisation in 2008.

Pay

Graduates appeared to be recruited at the same salary level, although the pay seemed to vary depending on the quality and level of a degree. Pay increases appeared to be fairly standard and graduates were expected to put in long hours. For some of the interviewees, this experience confirmed to them this was not the type of career they wanted in the long term. After completion of training, pay increases were understood to be based both on individual performance and company performance.

Most graduates were not able to negotiate their initial salary and hours of work

The majority of men and women who responded indicated they had not been able to negotiate their salary or their hours of work in their first job. Of those who said they did negotiate their salary, twice as many were men (17.6 percent were men and 8.3 percent were women). Around 12 percent of both men and women had been able to negotiate their hours of work.

Job opportunities

There were a number of comments from respondents regarding the difficulties in getting their first job because of a lack of experience. There were also suggestions that the salaries of engineers in New Zealand are not competitive relative to what they can earn overseas. These two factors may help explain why 50 percent of the engineering graduates who responded to the survey are overseas.

"*The shortage of engineers in New Zealand is not mysterious. One reason is that New Zealand pay is too low to retain engineers. I went overseas for the money and opportunities." (Male)*

"Employment within New Zealand is not competitive in remuneration with overseas operations, and the type of work does not compensate, with the majority small scale projects with little variety. The lifestyle in New Zealand, and the fact it is "home" gives me the desire to work there, so I went back and worked for 18 months in attempt to make New Zealand "home" again. However the significant decline in salary and interest at work resulted in me opting to leave again for better opportunities overseas." (Male)

"Brain drain. Time to incentivise young kiwis to stay." (Male)

"Often there are barriers due to lack of "experience" in engineering which is a good reason to find another career. If the focus was on ability instead it would be more attractive". (Male)

Kara and Nicole, interviewed from the 2005 cohort of graduates, both had Masters Degrees in biomedical engineering. Their first jobs had been with a research institute and Nicole had completed her PhD while working there. Nicole observed the limited job opportunities for biomedical engineering graduates in New Zealand and estimated that around 50 percent of the class had probably gone on to do PhDs. Kara is now based in a university in Perth but has found there is limited career progression unless she does a PhD, something she is not keen to do at this stage.

The average length of time in a first job is one to three years

At the time of the survey 71 percent of women were still working in an engineering role compared with 82 percent of men. The reasons as to why both men and women were no longer working in engineering centred on having found other roles they were more interested in *("preferred marketing", "discovered public policy was what I wanted to do", "wanted to do my own thing"*). Several of the women respondents also indicated they had not enjoyed engineering while others had branched into other areas (corporate finance, business analyst, research).

For those survey respondents who were still employed in an engineering role, 75 percent were no longer in their first job. Of the respondents who graduated around 2000, 86 percent of women and 81 percent of men were no longer with their first employer. The average length of time in a first job for both men and women was one to three years. Women were slightly less likely (45 percent) than men (48 percent) to have had three or more jobs. Of the respondents who had graduated around 2000, 53 percent of women and 73 percent of men had had three or more jobs. This suggests that one to three years is also the average length of time in subsequent jobs.

A desire to travel and limited career opportunities were reasons for leaving a job

For women, the most common reason for leaving their first job was to travel overseas, followed by better opportunities elsewhere and limited training opportunities. For men, the three most important influencers were better opportunities elsewhere, travel overseas and for a better salary. There were slight differences depending on the year of graduation. Women who graduated later cited better salary elsewhere rather than limited training opportunities as third most important reason for leaving, while men who were in the later cohort identified travelling overseas as their main reason for leaving.

Career experiences

Career experiences for men and women are similar in the first five years

The career experiences of the 21 men and women interviewed did not appear to differ greatly in the first five years following graduation and all of the women interviewed felt they had been given the same, if not better, career opportunities, as their male counterparts. Several of the women felt that, in fact, being a woman in civil engineering was an advantage as you stood out and if you performed well, were remembered and given further opportunities. Lisa, a chemical engineer, commented that one of the managers she had consulted to, told her he preferred to employ women because "*they took the time to understand the issues, questioning and talking to people before jumping to solutions*".

There are differences in salaries between men and women

Survey respondents were asked for their current salary in bands (see Figure two below which sets out the percentages of engineers in each income band).

Figure two: percentage of engineers in each income band

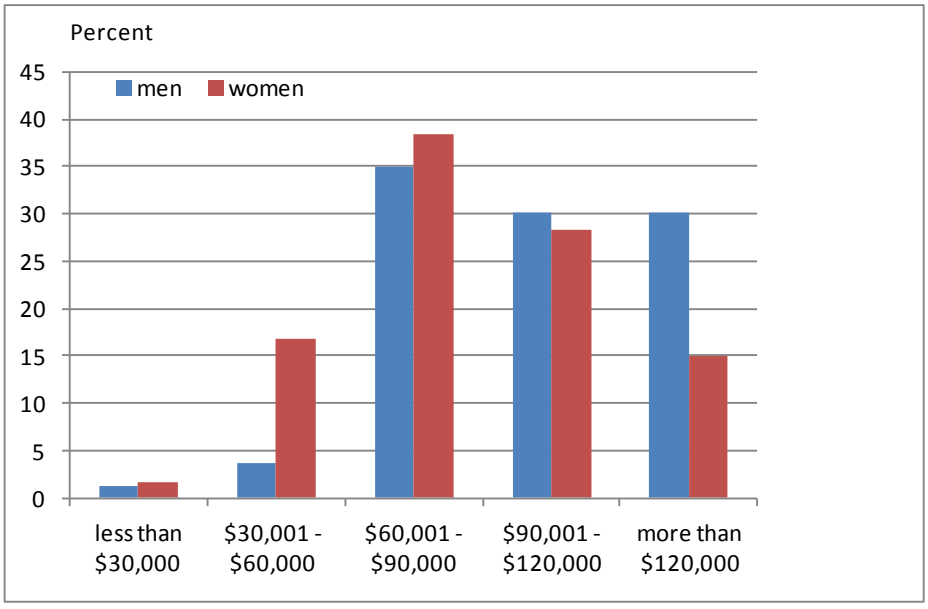


Table three sets out the income bands for the men and women from both the 2000 and the 2005 graduation groups. There was little evidence from the interviews we undertook that men and women were remunerated any differently in the first few years of a job when starting salaries were based on qualifications. This finding concurs with that of the 2011 IPENZ Remuneration Survey which shows males and females in the 20-24 year age group earn salaries of approximately $53,000 and $52,000 respectively. Similarly, for those in the 25-29 year age group, men and women appear to earn about the same ($64,000 and $61,000 respectively).

Table three: percentage of women and men in each income band by year of graduation

	Women (2000) (%)	Men (2000) (%)	Women (2005) (%)	Men (2005) (%)
< $60,000	9.5	0	24.2	7
$60,001 – $90,000	14.3	25	55	40
$90,001 – $120,000	43	29	19	31
>$120,000	33.3	46	2.8	22

There are, however, some pay differences between men and women. Although there are similar proportions of male and female survey respondents earning between $60,000 and $90,000, and between $90,000 and $120,000, twice as many men than women were earning over $120,000, and more than three times as many women than men were earning between $30,000 and $60,000. The larger differences in income of the 2005 graduates could suggest that men progress more quickly to higher salaries than women, although it could also be due to differences in role and the branch of engineering they are in.

Different branches of engineering appear to be paid quite differently and salaries varied quite considerably between specialties (and some remuneration packages also include benefits such as share purchase options). Thirty one percent of women who are civil engineers, for example, were earning more than $120,000 compared with 35 percent of men. On the other hand just 12.5 percent of women who work as chemical and materials engineers were earning more than $120,000 compared with 44 percent of men who work in this field. In the biomedical field, none of the women surveyed were earning more than $120,000. In terms of the hours worked, most men and women working full time indicated they worked between 40 and 60 hours a week (69 and 67 percent respectively).

Those who were living overseas were also paid more. According to one interviewee, the starting salary for a chemical and process or civil engineer in Australia is around $100,000.

There may be gender differences in bonuses and career progression

There was some evidence from the interviews that women were not always given quite the same career opportunities with some employers or the same performance bonuses. Naomi related an incident that had occurred when she was working for a large multinational company and found out that one year the men had received performance bonuses of 10 percent and the women 3 percent. As there had been no discernable differences in their performance, Naomi raised her concerns with the management who agreed to pay her the same bonus as her male colleagues. She was not, however, sure they had done so for all of the female employees.

Some of the survey participants commented that their career opportunities were limited by their gender. "*Although I am happy with my employer, I have not been offered the same opportunities as other team mates. I am also the only female in my engineering team*."

Jenny, whose husband had worked in the same consulting company as her (not an engineering company) felt that, on reflection, her husband (and other men in the company) probably had slightly better career opportunities than the women in the company. Karen, who had worked in a research institute, told the story of one manager there who had openly worked to limit the career progression of women on the basis "they were going to go off and have babies, so what was the point?"

Overall though, the women interviewed had not felt their career opportunities had been limited. If anything, the opposite was the case. Carla, a civil engineer, said she had been given fantastic career opportunities wherever she had worked and noted that in her company (one of the large consulting companies in Christchurch), the team leaders in the civil, traffic and water teams are all women.

Naomi, a civil engineer who has worked extensively overseas, also felt that she had been given excellent career opportunities. She described her first job with a consulting company based in Wellington as a wonderful experience. The people were great, there was good mentoring of staff and, while she worked long hours, she felt appreciated by her manager and recognised for what she was doing. As she put it "*I couldn't have asked for a better start*". This contrasted with her next career experience in the Sydney office of the same firm where the office culture was quite "brutal" with the same long hours but limited recognition. As a result, she left after five months to work for another multinational company. Naomi's experience highlights the influence workplace culture can have on employee retention.

Women reported experiences of gendered attitudes

Male attitudes towards women in terms of their ability to do the job and their level of comfort in having female colleagues were clearly still an issue for some women in some workplaces, as expressed by the following comments by participants in this research:

"As a building structures engineer, the consultants have been fine, however dealing with site was difficult initially as a woman. That said most are fine now." (Female)

"I have noticed that male operators tend to ask male engineers for help/opinions etc. I'm not ignored but I have to make the effort to be noticed. It may have to do with automation specifically but I'm not sure". (Female)

"I believe there is a lot of sexism against women in the engineering industry. It is hard to deal with being belittled and doubted simply because I am a woman. However, there are times when it is beneficial being a woman as I can stand out from a crowd more and be preferentially treated for being a woman." (Female)

"I haven't found any issues yet with being a female in engineering, but I have found that adopting a more male mentality – swearing, drinking, having banter with people, can get you a lot further in engineering – especially when working with blue collar colleagues". (Female)

Children change career tracks and priorities for women

The key factor that had impacted on the career experiences of this group of men and women was whether or not the women had had children. All except one of the women who had graduated in 2000 had children and had taken time out of the workforce. The time out of the workforce varied. Some of the women had up to three children and were working part-time. All of the women observed that the arrival of children had changed their priorities. They still wanted to work and to contribute to society through their work but their children were now their first priority. Most of these women had taken at least six months out of the workforce and then spent some time working part-time.

Jenny, for example, has two children and is currently on parental leave. She works on contract in a project management role. Jenny has never worked directly as a chemical engineer but instead moved directly into consultancy. She has extensive project management experience and now contracts to a utility company. She made it clear, however, that if she did not have children she would not be contracting. Although it is well paid ($90 an hour), as a contractor you "*get no training, no career progression and no mentoring*". She also acknowledged she is working below her level of capability but as she put it, her children come first. The company she works for has been very flexible in terms of return dates and willingness to have her work flexibly but career progression opportunities are limited and any training she wants to do will have to be paid for by her.

Laura has three children and is working part-time while also studying for an MBA. She thinks she will eventually move into management which interests her more than the technical side of engineering. Her view is that working part-time limits your career progression. According to Laura, being an associate or partner is simply not possible the way work is currently structured if you work part-time. Laura's husband, who is also an engineer, took a year off to look after the children. After this he wanted to move into structural engineering but he didn't feel he could ask to work part-time.

Heather, a chemical and process engineer based overseas and on leave from her job following the birth of her second child, acknowledged that the part-time role she returned to after the birth of her first child was at a lower level than the level she had worked at prior to having children. Heather's primary interest was in securing a part-time role so she could be there to look after her children. The company she works for does not embrace flexible ways of working and she feels lucky to have a part-time role. She does not see herself working full-time again until her children are at school. Heather says she was never terribly ambitious but rather, always wanted to do the best she could in the jobs she had. *"Having a career doesn't bother me at all. I just wanted to be proud of what I was doing."*

Employers can make a difference to career tracks

What happens on return to work appears to depend very much on the employer. All of the women interviewed felt their employers had been very flexible in terms of allowing them to return when they were ready and to work shorter hours. Lisa, who had a management role before leaving to have her first child, has been told she can come back whenever she is ready. Although she will not be able to retain her present role on a part-time basis, her manager is willing to hand over some of his workload when she returns because he recognises her value to the company.

Bridget, a civil engineer based in Christchurch with three children under five, went back to work almost immediately after having her third daughter because of the Canterbury earthquake and her feeling that she was needed. If it hadn't been for the earthquake she would have taken more of a break. As she is part of a structural engineering company she and her husband started, she can do most of her work from home.

Having children does not appear to affect men's careers but flexibility is still important

The men interviewed had not had career breaks. Paul, for example, who is based overseas, had come over as a mature student to New Zealand on a scholarship, to undertake a Masters in Science Engineering. He has subsequently completed an MBA, returned to his home country and is working in the Life Sciences Industry. He has two children, and his wife has stayed at home to look after the children.

James has moved into a management role, following career experience with large and small companies both in New Zealand and overseas. He, too, has a young child and his wife has taken the time out of the workforce to look after the child and currently works part-time. James noted that the company he works for is reasonably flexible and, as a manager, he is happy to let his staff take time out for school-based events or work from home if the children are sick. He could not, however, do his current job on a part-time basis, although he does regularly leave early to pick up his child from kindergarten.

Overseas experience is common

Most of the interviewees who had graduated around 2000 had had a number of jobs in the ten years since they had graduated. They now ranged in age from 33 to 51 and almost all had had some overseas career experience. The overseas career experiences were prompted by the desire to travel and work (the opportunity to travel was one of the reasons a number of interviewees had chosen engineering in the first place).

A number of the interviewees had gone travelling with partners and ended up working overseas, while others had transferred overseas with a company. The major engineering consulting companies in New Zealand are global and offer overseas transfers. Salaries earned overseas were almost always higher than in New Zealand. Lisa, who had worked in Canada, commented that although the salaries were similar there, Canadian policy is more generous to women when they take maternity leave and the tax system is also more favourable, allowing couples to split their income and therefore pay a lower tax rate.

Most of those who were interviewed had subsequently returned to New Zealand, many for family reasons. Several of the women had already started a family when they returned or said that they intended to do so.

Decisions to remain overseas are affected by relationships and work opportunities

The interviewees who were still overseas were there because of their partners and work opportunities. Naomi, a specialist in high rise buildings, said she was unlikely to return to New Zealand because there are simply not the job opportunities for her there. Heather, who lives in Australia and is currently on parental leave, also thought it was unlikely she and her family would return to New Zealand in the near future because her husband can get better paid work in Australia.

Workplace culture

Survey respondents were asked what factors in their workplace environment were most important in terms of their current job.

Interesting and challenging work, career progression and workplace culture matter

Interesting and challenging work, career progression and the team people worked with were ranked as the three most important factors by both men and women. Women who had graduated around 2000 identified flexible working hours as more important than career progression, while men who had graduated in 2000 ranked it almost as important as career progression. For men and women who had graduated around 2005, training opportunities were more important than workplace flexibility, while for men workplace flexibility was more important than career progression.

Some comments about the importance of workplace culture include:
"I have found the most important thing for job satisfaction is the work environment. If you have a crappy job in a good environment then you are still generally happy. But if the work environment is crap then it's hard to be motivated to work hard." (Female)

"The main reason I have stayed within the company I have is the culture of the people. Very loyal staff and supportive management". (Male, in first job)

"In general, when considering the employment experiences of others I studied with, I tend to value work-life balance and how much I enjoy my work, being at work and the people I work with, over how much I get paid. That being said, I strongly believe that I am underpaid, and that engineers in general are underpaid and undervalued here in New Zealand. I would not blame anyone for seeking employment overseas, as the remuneration package is far better." (Male)

"Found it very important to tell the people who need to know, i.e your boss and boss's boss what you want to do in order to get where you want to be". (Male)

Mentoring is valued by employees

Survey respondents were asked whether they had a mentor in the workplace. Thirty one percent of men and women indicated they had a mentor. Of the respondents who indicated they did not have a mentor, 65 percent of women and 59 percent of men indicated they would like a mentor. Most of the men and women interviewed had mentors early on in their careers and mentioned how helpful it was to have someone helping you with your career. Amanda, who is working in Perth, said the company she worked for had always ensured she had a mentor and she was looking forward to mentoring a younger graduate herself.

Several of the women interviewed also mentioned that having a woman ahead of them who had taken parental leave had helped make it easier for them to negotiate their terms of return to work.

Most workplaces offer some form of flexibility

Most survey respondents indicated some form of flexibility was available in their workplace (see Table three). Women in the earlier group of graduates were more likely to have access to working from home than men and women in the more recent graduate group. A number of women who were older graduates and had children indicated that workplace flexibility was essential in enabling them to do their job.

Table three: types of workplace flexibility offered to employees (survey respondents)

Type of flexibility	Women (2000) (%)	Women (2005) (%)	Men (2000) (%)	Men (2005) (%)
Start and finish times	100	98	96.2	90.1
Working from home	72.2	57.1	57.8	50.7
Leave without pay	61.1	57.1	38.5	54.9
Time in lieu	38.9	38.8	38.5	47.9

Flexible work is widely available but not used at all levels

It was evident as a result of interviewing the 21 participants there is significant variation in workplace practices and attitudes to flexible work in businesses. The large consulting companies appear to be flexible in so far as both men and women are able to choose their start and finish times, work longer or shorter days and work part-time. There is, however, a trade-off. Management roles are designated full-time roles.

Flexible start and finish times, working shorter hours and, to a lesser degree, working from home were all commonly available but shorter hours tended to be more widely used by women as opposed to being used by all workers. There was little evidence of workers at management level working flexibly and there was a definite perception among the interviewees that working long hours is necessary in order to progress to management positions.

Engineering companies are male dominated at management level and this was considered to impact on employment practices

In general, senior management positions in engineering organisations are dominated by men. Some respondents considered that this had impacted on workplace practices. It was evident that some of the firms had not really had to consider issues such as parental leave and subsequent return to work practices. There was a feeling from the participants that employers were changing because there was a greater cohort of women engineers coming through, particularly in the chemical and process area. The company John worked for in Adelaide, for example, had this year recruited equal numbers of male and female engineers as part of their graduate recruitment programme.

The lack of women in senior management roles was perceived, in some cases, to be affecting the performance of the company. Denise works for a company in Auckland which has grown over the past ten years to more than 100 employees with overseas offices. She noted that her company's managers are all engineers and all men, and that they are possibly better at the technical side of engineering than management. She also felt that the performance of the company and the quality of its products was being adversely affected by its lack of systems. This observation is further supported by a study[4] which found that emerging businesses tended to have flat structures and few systems and processes, an outcome that may impact on a company's ability to grow.

Employees can buy shares in companies they work for

Salaries are hard to compare because a number of the engineering companies provide the opportunity for employees to buy shares in the company once they have been with the company for a number of years. Tony, a computer systems engineer has been with the same (medium sized) company for five years and receives half of his pay as a retainer, paid regardless of project hours. The other half of his salary is based on project hours. Profits are shared based on the hours employees have worked. In addition, employees can buy into the company if they have been there for at least a year.

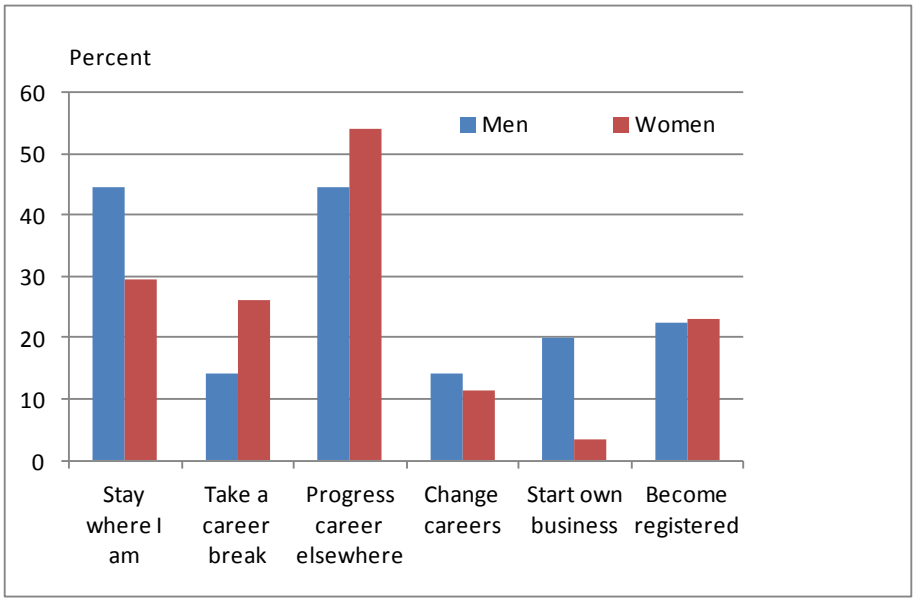
[4] Kesting, S., Lin, J., and Pringle, J. *Identifying Emerging Industries*. AUT, Gender and Diversity Research Group, June 2010.

A number of the men and women who graduated in 2000 have shares in the company they work for. Bridget, who started her own company with her husband six years ago, owns five percent of the shares while her husband and another director own 80 percent of the shares, with the third director owning 15 percent. They are open to selling shares to other employees in the future. The larger consulting companies offer shares to their employees once they have been there for five or six years and several of the men and women interviewed own shares in these companies.

The career intentions of men and women show some differences

The survey asked respondents about career intentions over the next five years (see Figure three). Gender differences were evident.

Figure three: career intentions for men and women over the next five years (all respondents)



Women were more likely to be intending to progress their careers elsewhere or intending to take a career break. Men were more likely than women to have intentions of starting their own business. One of the male respondents made the following comment which may explain why more men and women did not state the intention to start their own business over the next five years:

"*There is little information available about starting your own business as a graduate, and there are reasons to recommend it, and recommend against it. I enjoyed several years where I had great flexibility, employed another person and learned a wide range of business skills that have proven useful in jobs since. I recommend graduates be given more information about this option*."

It was not fully clear why women were more likely than men to intend to progress their career elsewhere. Some of the comments made by participants suggest there may still be some issues in terms of male attitudes towards women in areas that have previously been the domain of men. From the interviews the most common reason people in the younger age group were planning to leave their job related to plans to travel and work overseas. Of the women we interviewed career intentions were impacted by the age of their children and whether they were currently working. One woman who was on parental leave, for example, did not plan to return to her previous place of employment because she did not like the workplace culture.

Conclusion

The aim of this research was to understand what motivates men and women to study engineering and whether there are differences between men's and women's experiences of engineering as a career.

Summary of findings

Some key findings that arise from the results of the survey include:

- Career opportunities and parental influence were the most important influencers for both men and women in terms of their motivations for choosing to study engineering.
- Career advice and guidance could be better for both men and women, but particularly women, as less information about engineering appears to be provided to girls at school.
- Visits to schools by engineers seem to be effective at encouraging people to choose engineering as a study option.
- The women surveyed did not generally perceive gender to be a barrier to career progression, although at the same time some women spoke about instances where they experienced gendered attitudes.
- Women were more likely than men to specialise in chemical and material, or biomedical engineering, and men were more likely than women to specialise in mechanical, electrical and electronic, software and computer systems, or mechantronic engineering. This may explain some of the pay differences between men and women.
- Women were more likely than men to be earning between $30,000 and $60,000; and men were more likely than women to be earning more than $120,000. Pay differences vary by speciality (in civil engineering similar proportions of men and women earn more than $120,000, whereas in chemical and process engineering men were much more likely to earn more than $120,000).
- There is significant variation in firms in terms of workplace practices and attitudes towards flexible work. The ability to work part-time appears to be widely available, but the trade-off is that being part-time limits career progression (promotion is often connected to hours worked in engineering firms). This is one of the reasons why having children has more of an impact on the career progression of women than of men. Males tend to dominate senior management roles in engineering organisations.
- Employers can make a difference to career tracks for women who have had career breaks to have children, and are returning to work part-time, by considering alternative pathways for career progression.

Men and women had similar motivations for choosing to study engineering

Few differences were found between men and women regarding their reasons for choosing to study engineering. The survey revealed that engineering was chosen by a large number of graduates because of the career opportunities offered and as a result of parental influence. Parental influence was important for both men and women. Although women had fewer parental role models (more men had parents who had experience of engineering), where parents were encouraging of engineering as a pathway this had an impact on both men and women. Men and women were fairly similarly motivated by income earning potential and career opportunities. Proportionally more men than women were concerned about career opportunities, and more women than men were seeking to 'make a difference'.

Interestingly, women were more likely than men to be influenced by a teacher, although for both women and men the influence of teachers and careers guidance were reasonably low. Careers guidance, in particular, appears to be a lottery for both men and women – all of the interviewees said they wanted to study something that allowed them to use their maths and science skills (which they all saw themselves as being good at). However, there was a lack of good careers advice on the pathways into career opportunities in fields using maths and science. For girls, in particular, engineering was rarely mentioned as a career possibility; girls who were seen as "bright" were more likely to be encouraged into medicine or law. This resulted in women being less likely than men to know about engineering as a career option, and for some it led to them entering engineering studies later on, although not directly from school.

The research suggests that visits from engineering graduates can positively influence student career choices and that visits to school classrooms are likely to be more effective than the information on websites in influencing women's choice of career.

Differences between genders in choice of engineering specialisation and pay

Women were more likely than men to specialise in chemical and material, or biomedical engineering, and men were more likely than women to specialise in mechanical, electrical and electronic, software and computer systems, or mechantronic engineering. This was perceived by survey participants as being about preferences (as there was no particular emphasis on any one area in the general first year of engineering degrees).

Salaries between the specialisation areas within engineering vary considerably and this may contribute to the differential between pay for men and women in engineering as a whole. The survey showed that men appeared to be better paid than women: 33 percent of the women graduating in 2000 earned more than $120,000 (compared with 46 percent of men), and only 3 percent of the women graduating in 2005 earned more than $120,000, compared with 22 percent of male 2005 graduates. Starting salaries do not seem to vary by gender, although of those that did negotiate their starting salary (a minority) most were men.

Gender not perceived to be a barrier

The research showed that most women do not perceive gender to be a barrier in relation either to their career opportunities or progression in the engineering profession. Few differences between men and women's experiences of their first five years of work were reported by those surveyed. All of the women surveyed felt they had the same or better career opportunities than their male counterparts. Although some instances of negative attitudes towards female engineers were reported, on the other hand, some women felt they had an advantage in the engineering workforce. It is interesting to note here that at the time of the survey only 71 percent of the women surveyed were still working in engineering, compared with 82 percent of men. Some women stated this was because they did not enjoy engineering. Workplace culture seemed to be connected to the retention of women in engineering jobs, as some female respondents commented that they had left jobs due to being unhappy with the workplace culture.

Impact of career breaks and part-time work

The careers of men and women do appear to diverge, however, at the point at which women start families. Women are far more likely to take time out of the workforce when they have children, and to go back on a part-time basis (and in addition they often go back to work of a different focus, e.g. project management rather than working as an engineer). All of the women interviewed except for one took breaks from work when they had children, whereas the men interviewed had not had career breaks.

Part-time work was seen by some to limit career progression, as many engineering firms connect hours worked to career progression. The way the profession is currently structured means that women's career progression may be limited by working part-time, as the path to senior roles is linked to full-time work and often long hours. This is reflected by a predominance of men in senior management roles in engineering organisations.

Next steps

A number of the findings from the survey and the individual interviews suggest the range of advice available at school on career options could be improved. It seems clear that lack of information, particularly about engineering as an option for women, may be affecting the study choices of students. There was some evidence that there was more information about engineering for the men and women who entered engineering in the early 2000s. However, there is clearly more that could be done to broaden the information available to students, not only about possible career paths but also about the potential income they can expect to earn in those careers.

The women who participated in this study had excellent career experience by the time they had children, and they are out of the workforce for short time periods. Employers could consider alternative pathways of career progression for women once they return to work so that periods of part-time work do not hinder career progression in the longer term.

Companies could also consider how workplaces can better support a changing workforce. Changes to workplace culture, including addressing the expectation of long hours as a pathway to management positions, are likely to improve the diversity of engineering businesses through retaining the skills of women.

There were examples of employers who had introduced flexible work practices. A useful next step would be to interview some engineering firms to see what strategies they have in place to both attract and retain women and how effective these policies have been in increasing the numbers of women in senior management. For example URS, an engineering consultancy firm that employs 300 staff, won the EEO Trust Work Life Awards in 2011 for its innovative approaches to flexible work. Work and life provisions are an inherent part of the company's culture and career progression is not affected by working part-time. It would be interesting to compare the effectiveness of this kind of working environment with other engineering firms.