Diverging Paths - Career Aspirations, Choices and Consequences for Men and Women Working in Technology in Finland

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1 INTRODUCTION

The underrepresentation of women in the fields of science, engineering, technology and mathematics (STEM) has been studied extensively in recent decades. Various researchers have established that sustainable improvements in women's position in science and technology are achieved only through changes in institutional and organisational practice (e.g. Lee & Faulkner, 2010; Pourrat, 2005). Nonetheless, "*Engineering has proved remarkably resistant to gender change, in spite of three decades of public and private sector backed efforts in many countries to improve the representation of women in its ranks*" (Lee & Faulkner, 2010: 90).

In Finland, technology remains a male-dominated field. Despite campaigns aimed at increasing the number of women, they are still a minority within engineering and other technology fields, comprising now 25 percent of all M. Sc. Engineering graduates (cf. 19 % in 2002). Moreover, there is evident gender segregation between various fields of technology (e.g. see Fig. 1 for study programmes of TEK members by gender).

International (e.g. US, UK) research suggests that women are less likely than men to pursue STEM careers, and more likely to drop out from STEM careers at all stages. This so called Leaky Pipeline metaphor indicates that women are opting out of STEM fields either by considering other choices or failing to progress through to the different stages of the pipeline (e.g. Appianing & Van Eck, 2015). The extent of the Leaky Pipeline phenomenon has not been widely studied in Finland so far.

However, the Leaky Pipeline metaphor may lead to an oversimplified understanding of gender dynamics in technology, since it assumes that all women experience the same pressures and respond to them in fairly similar ways (Alegria & Branch, 2015; see also Kvasny et al., 2009). Moreover, differences within various fields of technology (e.g. telecommunications, electrical engineering, life sciences) are seldom considered.

Research concerning women working in technology/STEM has been scarce in Finland overall. Some studies have seeked to analyse the continuous underrepresentation of women in engineering or ICT (e.g. Paloheimo, 2015; Bairoh, 2011; Hiltunen, 2009; Teräs, 2005). However, hardly any studies have analysed women working in technology as compared to men.

In this paper, I will describe and analyse gender differences among men and women working in technology. My research question is: **How do career paths of women and men holding MSc. Engineering degrees in Finland differ?** In order to study individual career paths, longitudinal data would be required. Since this kind of data is currently not available, I have used recent cross-sectional data, derived from different data sets available to TEK.

2 DATA AND METHODS

TEK is the largest organisation for academic engineers and architects in Finland, with 73,000 members. Members also include physicists, mathematicians, IT specialists and students. In addition to labour market issues, TEK actively participates in the development of engineering education and further professional development.

In order to support its operations, TEK conducts various kinds of surveys, obtains data from relevant 3rd parties, and cooperates with research partners such as universities. Based on its research activities, TEK has access to extensive and unique data covering both students and professionals in the field of technology. The data used in this paper is derived from three cross-sectional data sets: TEK Labour Market Survey 2015, TEK Graduate Feedback Survey 2015, and TEK Professional Development Survey 2016.

The annual *Labour Market Survey* focuses on the employment relationships and salaries of TEK members. Latest survey was conducted in October-November 2015 with approximately 10 900 respondents (response rate 28 %) of which 22 % were women. The annual *Graduate Feedback Survey* is directed at newly graduated M.Sc. engineers and architects (not only TEK members), conducted in co-operation with universities. In 2015, 1 914 graduates responded (response rate 72 %); 27 % were women. The respondents are, on average, 25-27 years old. The *Professional Development Survey* is a targeted biannual survey. In 2016, respondents represented TEK members born in 1963, 1973 and 1983. Approximately 550 persons responded (response rate 20 %); 26 % were women.

In this paper, I will present percentage shares and crosstabs to compare men and women of different age groups. Factor analysis is used pertaining to one data set.

3 FINDINGS

a. Degrees and Study Programmes

Degrees held by men and women working in technology differ somewhat. Among TEK Labour Market Survey respondents in 2015, 81 % of men hold MSc. degrees in Engineering whereas 72 % of women do so; women more often hold other degrees (please see Table 1.)

Table 1. Degrees of TEK members. Source: TEK Labour Market Survey, 2015.

	Men (n=8522)	Women (n=2456)
M.Sc. Eng	81 %	72 %
M.Sc. Arch.	1 %	7 %
M. Phil.	5 %	8 %
Post-grad.	9 %	11 %
Other	3 %	2 %

The study programmes of TEK members (those with M.Sc. Eng. degree) are illustrated in Fig. 1 as percentage shares of men and women. 19 % of men have studied mechanical engineering, compared to 6 % of women. Most common programmes for men are Mechanical and Electrical Engineering and Information Technology. Women's TOP3 consists of Industrial and Chemical Engineering and Building Technology. The preferred programmes of women and men thus clearly differ. Only some current programmes (such as Chemical Engineering and Information Networks) have a balanced (approx. 50/50) gender ratio (cf. Paloheimo, 2015).

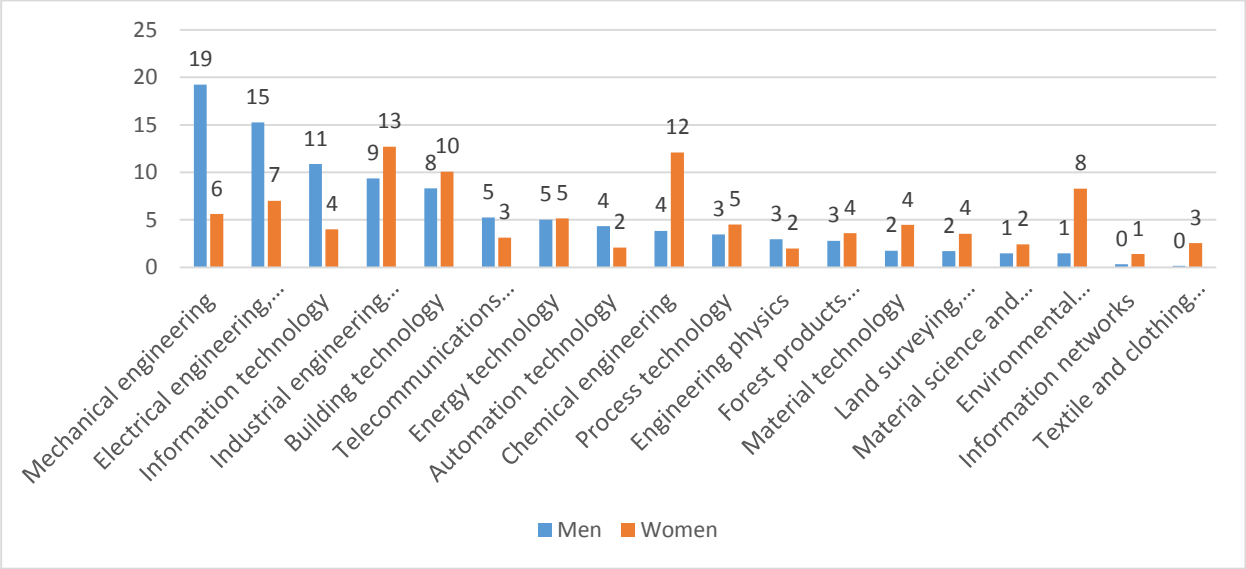

Fig. 1. Study field by gender (% of women and men holding MSc. Eng/Technology; >20 persons). Source: TEK Labour Market Survey, 2015.

b. Labour Market Situation and Employment Sector

At the time of graduation, the labour market situation of men and women is fairly similar. According to Graduate Feedback Survey 2015, close to 60 percent of both men and women are currently in employment, less than 7 percent continue their studies, and 27 percent are seeking employment (please see table 2).

Table 2. Labour market situation of recent M.Sc. Eng/Arch. graduates. Source: TEK Graduate Feedback Survey 2015.

	Men	**Women**
Work contract (not graduate studies)	60,6 %	58,5 %
Seeking for a job	26,9 %	27,3 %
Continuing as full-time graduate student	6,5 %	6,6 %
Something else	6,0 %	7,5 %

The situation changes quickly after this, as table 3 illustrates. In the age group of 25-34 years, 79 % of women and 92 % men are in full-time employment whereas 7 % of women but only 1 % of men are on maternity, parental or other leave. In the next age group (35-44 years) 4 % of women are on maternity or other leave, as compared to less than 1 per cent of men. Finnish women usually have children rather late and often stay out of work at least 10-12 months per child. Additionally, it is possible to stay out of work - but still be employed - until the child is 3 years, and also do part-time work until the child reaches school-age (7 years). Although these opportunities are also available to fathers, it is typically mothers who stay at home when the child or children are small. On the other hand, part-time work is not common, unlike in some other European countries.

Table 3. Labour market situation of TEK members by age group. Source: TEK Labour Market Survey, 2015.

	Full-time emplyment		**Part-time employment**		**Maternity or other leave**		**Unemployed**		**Other**	
	men	*women*	*men*	*women*	*men*	*women*	*men*	*women*	*men*	*women*
25-34 years	92,3%	79,2%	1,0%	4,0%	,9%	7,2%	4,0%	4,9%	1,8%	4,6%
35-44 years	92,7%	81,2%	1,3%	7,6%	,8%	4,2%	3,2%	3,9%	2,0%	3,1%
45-54 years	90,1%	86,0%	1,2%	3,0%	,1%	0,0%	6,9%	7,8%	1,8%	3,2%
55-64 years	80,4%	76,9%	2,7%	3,4%	0,0%	0,0%	11,6%	13,4%	5,3%	6,2%
Total	n=7484	n=1969	n=117	n=116	n=43	n=96	n=467	n=151	n=210	n=101
	89,9%	**80,9%**	**1,4%**	**4,8%**	**,5%**	**3,9%**	**5,6%**	**6,2%**	**2,5%**	**4,2%**

Table 3 also highlights that the employment situation is more challenging for women: they are more often unemployed than men. This finding coincides with other data available to TEK (please see Figure 2). As Figure 2 shows, the unemployment rate of women has been consistently higher than that of men.

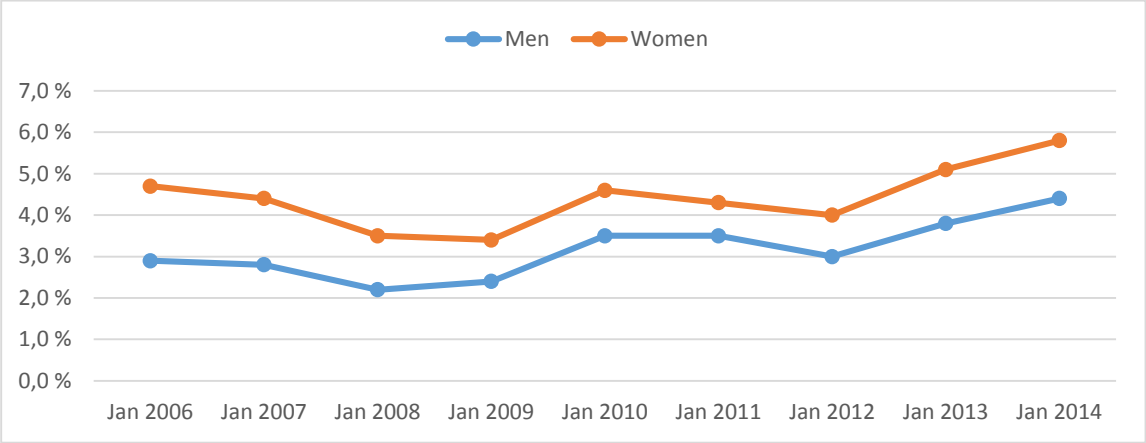

Fig. 2. Unemployment rate by gender (those holding M.Sc. Eng/Technology). Source: Statistics Finland, Ministry of Employment and the Economy, TEK.

Moreover, men more often obtain permanent job contracts. At the time of graduation, 60 % of men have permanent contracts and 35 % have fixed-term or temporary contracts, whereas the corresponding figures for women are 55 % and 43 % (please see Table 4). Men are also more often entrepreneurs, as Table 4 illustrates.

Table 4. Type of employment of recent M.Sc. Eng/Arch. graduates. Source: TEK Graduate Feedback Survey 2015.

	Men	**Women**
I have a permanent contract	60,0 %	55,3 %
I have a fixed-term / temporary contract	35,3 %	42,7 %
I am an entrepreneur / self-employed	3,9 %	1,4 %
I have a personal scholarship or grant	0,8 %	0,7 %

The difference in permanent vs. temporary job contracts seems to persist over time: in the age group of 25-34 years, 10 % of men but up to 18 % of women have temporary contracts, and still 7-8 % of women in the age groups of 35-44 years and 45-54 years have such contracts (please see Table 5).

Table 5. Percentage share of respondents with temporary (fixed-term) work contracts by gender and age group. Source: TEK Labour Market Survey, 2015.

	Men	**Women**
25-34 years	10 %	18 %
35-44 years	2 %	8 %
45-54 years	3 %	7 %
55-64 years	3 %	2 %

Why should we be concerned about this? Because recent research underlines that temporary employment relationships are connected to precarious career prospects; including lower salary, less influence at the workplace, and more career instability (Ojala & al., 2015). According to Ojala et al. (2015), young women are far more likely than men to have temporary employment relationships. It is noteworthy that also in the field of technology, women more often than men find themselves in less promising employment situations.

The higher percentage share of temporary contracts for women is partly explained by the sector of their employee. Women with M.Sc. Eng. degrees are more often employed in universities and municipalities than men with corresponding degrees (please see Fig. 3), and these sectors are known to offer temporary work contracts more often than e.g. the industrial sector.

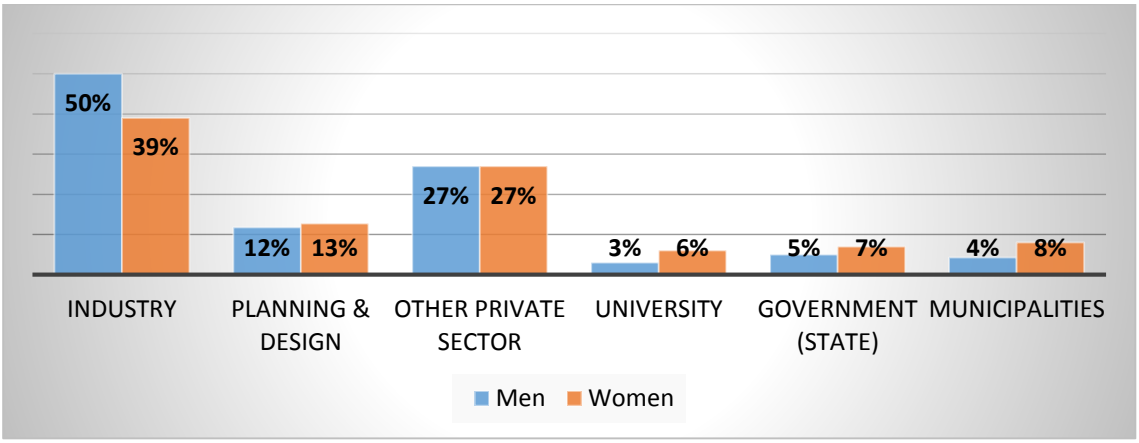

Fig. 3. Employment sector by gender (those holding M.Sc. Eng/Technology). Source: TEK Labour Market Survey, 2015.

c. Position and Salary

Table 6 indicates that at the time of graduation, women are somewhat less likely than men to hold Management or Middle Management positions. This difference persists and even accentuates (please see Fig. 4 and Table 7). For example, among 45-54 year olds, 22 % of men but only 12 % women have positions in management.

Please note that Fig. 4 and Table 7 only cover persons employed by others, i.e. entrepreneurs are excluded.

Table 6. Position of recent M.Sc. Eng/Arch. graduates. Source: TEK Graduate Feedback Survey 2015.

	Men	Women
Management	3 %	2 %
Middle mgmt	7 %	4 %
Expert	77 %	74 %
Entrepreneur	3 %	2 %
Other	11 %	18 %

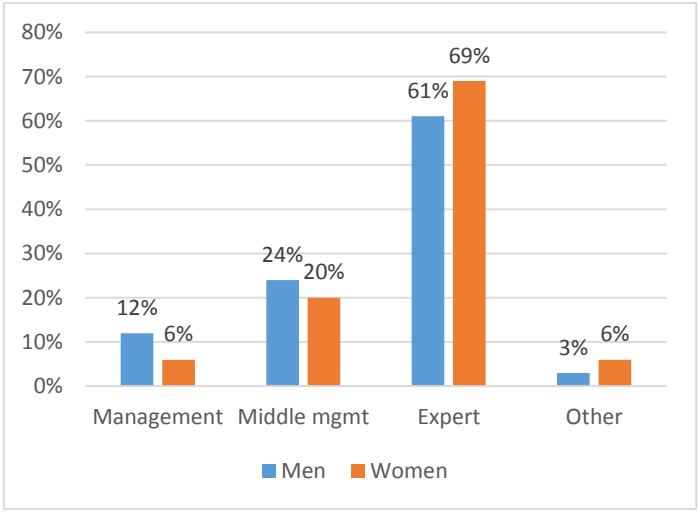

Fig. 4. Position by gender. Source: TEK Labour Market Survey, 2015.

Table 7. Position by gender and age group. Source: TEK Labour Market Survey, 2015

	Management		Middle Management		Expert		Other	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
25-34 years	2%	1%	18%	12%	75%	79%	5%	9%
35-44 years	12%	6%	28%	25%	59%	66%	2%	3%
45-54 years	22%	12%	29%	30%	48%	52%	1%	5%
55-64 years	21%	17%	25%	19%	52%	62%	2%	1%

Obviously, this difference in positions is reflected in the salaries of men and women. TEK does not, in general, study wage differences by gender in detail, but some results have been published. Table 8 contains the median salary by position for men and women, as well as the percentage of women's salary divided by men's salary, so called "weuro" (in Finnish, "neuro") which was introduced in a campaign for equal salaries by Akava in spring 2016.

Table 8. Median salary by gender and position (including "weuro").
Source: TEK Labour Market Survey, 2015

Full-time employment, median salary (€/month)

	Women	**Men**	**"Weuro"***
Top Management	7520	8980	84 %
Management	6873	7435	92 %
Higher middle mgmt	5225	5520	95 %
Lower middle mgmt	4635	4770	97 %
Very demanding expert duties	5020	5300	95 %
Demanding expert duties	4165	4420	94 %
Expert duties	3681	3800	97 %
Other	3200	3583	89 %
All	**4269**	**4840**	**88 %**

*Weuro = percentage of women's salary divided by men's salary

Table 8 illustrates that the median salaries of women working in technology are lower than those of men (cf. Paloheimo, 2015) although in expert positions and middle management positions, they are fairly close to equal (97 %). Nonetheless, there is remarkable discrepancy in the salaries of those working in management and particularly in top management positions; women in these positions only earn 84 % of what men in similar positions obtain.

d. Career Aspirations

In Professional Development Survey 2016, the respondents were asked to rate how important they consider certain statements reflecting career expectations. Factor analysis was conducted, and the following four groups emerged (please see Table 9.)

Table 9. Factor analysis of Q11. Source: TEK Professional Development Survey 2016

	Component			
	Success	Stability	Content	Meaning
my salary development is good	0,63	0,35	0,03	-0,16
my work requires responsibility	0,6	0	0,3	0,17
I have the possibility of working abroad	0,59	-0,19	0,09	0,25
my work provides me with career advancement opportunities in managerial positions	0,79	-0,01	0,16	-0,03
my livelihood is secure	0,07	0,88	0,09	-0,01
I have a stable employment relationship	0,06	0,86	0,1	0,07
I have a reasonable amount of work	-0,29	0,52	0,34	0,14
my work is interesting	0,16	0,03	0,62	0,12
my work provides me with career advancement opportunities as a specialist	-0,08	0,21	0,56	-0,01
I have opportunities for improving my professional skills	0,27	0	0,72	0,11
I can affect my work	0,22	0,11	0,69	0,1
my work is socially significant	0,04	-0,05	0,12	0,8
my work provides me with opportunities to help people	-0,04	0	0,05	0,85
people respect my work	0,17	0,21	0,12	0,69
Cronbach Alpha	.61	.71	.57	.71
Mean	2,32	3,23	2,91	2,74

Summary variables were calculated based on the factor analysis and the results were compared based on gender (as well as other background criteria). Both men and women evaluate issues in the group 'Content' most important in their career, followed by 'Stability' (see Table 10). Nonetheless, as the results illustrate, there is a significant gender difference pertaining to 'Meaning' (i.e. aspects concerning social significance of one's work and the opportunities to help others). These aspects are clearly more important to women than to men, and this difference is also statistically significant.

Table 10. Q11 by gender, means of summary variables. Source: TEK Professional Development Survey 2016

	Men (n=372)	**Women (n=134)**
Success	3,49	3,40
Stability	4,22	4,27
Content	4,40	4,49
Meaning	3,35	3,60

4 DISCUSSION

Data available to TEK suggests that women working in technology are, in general, disadvantaged compared to men. Women are less often in full-time employment and more likely to have fixed-term contracts; their unemployment rate is higher; they are less likely to progress to top management; and their salaries are lower.

Why? Perhaps the most common explanation so far has been that these are the *consequences* of women's (and men's) *choices*: choice of a particular engineering programme, choice of working in a certain sector, choice of whether to progress to more demanding tasks, etc. TEK data indicates that even within MSc. Eng. studies, women and men choose different programmes which may impact their employment prospects. However, predicting whether Mechanical or Chemical Engineering provide better prospects is hard for anybody, let alone a fresh MSc. student. Concerning sectors of employment, it is nearly impossible to say what determines the selection of an applicant for a post (previous experience, the attitude of the interviewer, chance, etc.). Furthermore, data available to TEK suggests that numerous women experience unfair treatment or discrimination e.g. concerning career advancement[i]. Therefore, blaming the women for their choices is hardly conducive to improving the situation.

Another explanation has been that men and women seek different things, i.e. their *career aspirations* differ. This seems to be partly true: TEK data shows that although job content is most important to both men and women, meaningfulness (when measured as social significance and being able to help others) is more important to women. Therefore, universities could highlight these aspects in order to attract more women (see also Paloheimo, 2015). Additionally, companies in the technology field could emphasise the social and beneficial aspects of their activities.

Lee and Faulkner (2010) argue that there is well established consensus about what kind of policies should help to correct the poor recruitment, retention, and progression of women into engineering. They stress that underlying the failure to turn good policies into good practice is a widespread lack of 'deep' organizational commitment to gender equality and consequently a lack of resources. Similar conclusions were drawn in an EU-wide study on Women in Engineering over a decade ago: *"It is not women's deficits that drive them away from engineering but rather established, patriarchal structures of teaching, and working climate, content, and context in technology fields. Therefore, higher education institutions and companies are challenged to adapt their environment and content of training, and to reflect an equal consideration of the needs of all." (Pourrat, 2005: 118).*

Based on the results presented in this paper, there is still plenty to do – for universities, companies, and all parties interested in adjusting the gender balance in technology. Employers and universities should pay attention to and attempt to avoid gender bias. As also Hatmaker (2013) suggests, a more inclusive culture is likely to influence the number of women who choose and persist in engineering.

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[i] Recent data gathered by TEK suggests that up to 30 % of women have experienced discrimination or unfair treatment. Please see more (in Finnish): https://www.tek.fi/fi/uutishuone/tutkimukset/naisten-kokema-syrjinta-tekniikan-alalla.