

**CAREER DEVELOPMENT OF WOMEN PAPER  
ENGINEERS IN 20<sup>TH</sup> CENTURY FINLAND**

**Jyväskylä University  
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and  
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**ABSTRACT**

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<p>Abstract</p> <p>This thesis research technology management evolution in women's careers and organisational environment. This research is embedded multiple case study that consist of two cases that had multiple sub cases formed from the data of Finnish Forest Products Engineers' Association. It is about career development of women paper engineers in Finland compared to men under pairwise comparisons that uses Eisenhardt's case study methods. First case is 20 pairs from 1930 to 1959 and second case consists of 29 pairs from 1980 to 1984. Through these, career development is looked from several aspects to form results of their career development. Cases are compared against each other to see results of change between them. Change in social environment of Finland with women's careers and lives as well as environmental change if forest industry sets interesting base for the change aspect of the research.</p> <p>Position and importance of Forest industry in Finland sets interesting looking point to engineering research that differs from mainly used IT engineer research. Engineering is a masculine career that previous research has stated to affect negatively to women and their career development. This is due to them being outside of the masculine norm. Aim of this research is to see does masculine career have an effect to women's careers compared to men and does their careers follow Career Development theories.</p> <p>This research shows that women face glass ceilings and leaking pipelines in their career which is not seen in men's careers. There is some change between cases with moving from glass ceilings to leaking pipeline. While previous followed theories of women's careers, lateral career development in one company was mostly undetected which did not follow CD theories. In the second case this was due to changes in the environment of the forest industry. In the first case it could be due to change of the engineering profession and start of increase of the engineer's value. Differences between women and men's careers were detected: men got higher positions compared to women and had more career development.</p>	
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<p><b>Tiivistelmä</b></p> <p>Tämän pro gradun aiheena on teknologia johtamisen evoluutio naisten urissa ja organisaationaalisessa ympäristössä. Tämä tutkimus on monitapauksinen tutkimus. Siihen sisältyy kaksi tapausta, joissa parit muodostavat useampia alatapauksia. Ne ovat muodostettu Suomen paperi-insinöörien yhdistyksen tiedoista. Tutkimuksen tarkoituksena on tutkia naispaperi-insinöörien urakehitystä ja verrata sitä miehiin käyttämällä parivertailua Eisenhardt:n tapaustutkimus menetelmiä käyttäen. Ensimmäinen tapaus sisältää kaksikymmentä paria vuosilta 1930–1959 ja toinen tapaus sisältää kaksikymmentäyhdeksän paria vuosilta 1980–1984. Urakehitystä tutkitaan näiden tapausten kautta käyttäen eri aspekteja tulosten muodostamiseen. Tapauksia verrataan myös keskenään nähdäkseen mahdollisia ajallisia vaikutuksia ja muutoksia tapausten välillä. Muutos Suomen ja naisten urien sosiaalisessa ympäristössä sekä metsäalan muutos asettavat mielenkiintoisen pohjan muutoksen tutkimiselle.</p> <p>Metsäteollisuuden asema ja tärkeys Suomessa antaa mielenkiintoisen näkökulma tutkia insinöörien urakehitystä, joka eroaa usein käytetystä IT insinöörien näkökulmasta. Insinööriys on maskuliininen ura, jossa aikaisempi tutkimus ilmaisee vaikuttavan negatiivisesti naisiin ja heidän urakehitykseensä. Tämä johtuu heidän asemastaan maskuliinisten normien ulkopuolella. Tämän tutkimuksen tarkoitus on selvittää vaikuttaako maskuliininen ura naisten urakehitykseen suhteessa miehiin ja seuraavatko molempien sukupuolten urat urakehitykseen liittyviä teorioita.</p> <p>Tutkimus osoittaa, että naiset kohtaavat lasikattoja ja vuotavia putkia urallaan, joita miehet eivät kohtaa. Tapauksien välillä on muutoksia; siirrytään lasikatoista vuotaviin putkiin. Vaikka yllä olevat termit ovat teorioiden mukaisia, urakehityksen kohdalla vaaka-suoraa kehitystä saman yrityksen sisällä ei yleisesti havaittu ja näin ollen urakehityksen teorit eivät pitäneet tässä tutkimuksessa paikkaansa. Toisessa tapauksessa asia selittyy metsäalan muutoksilla ja ensimmäisessä tapauksessa insinööriyden kehittymisellä ja sen arvon nousemisella. Tutkimuksessa havaittiin eroja naisten ja miesten urien välillä. Miehet yltivät korkeampiin asemiin ja heillä oli enemmän urakehitystä suhteessa naisiin.</p>	
Asiasanat Urakehitys, insinööriys, paperi insinööri, maskuliininen ura	
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# 1 INTRODUCTION

Topic of this research is the technology management evolution in women's careers and organisational environment in the 20<sup>th</sup> century Finland. This is researched through the career development (CD) of women paper engineers compared to men to find out if the masculine career choice effects women's careers, does women face to find out possible gender (in)equalities and structures in a highly masculine industry. As well as look for the possible change and development between different time periods. Data for this research is from Finnish Forest Products Engineers' Association (FFPEA, Suomen paperi-insinöörien yhdistys). It was founded in 1914 in Helsinki, Finland to support paper engineers' benefits and to gathered them together in a brotherly club to boost team spirit and share knowledge. What the association did not think was paper engineer could be other than men, so they never write a rule to exclude women members. And even as today some think that women in technology is an oddball as a concept.<sup>1</sup> Engineering field is described to be male-dominated masculine field, where those out of the norm are in most cases effected by it. Women in the data are pioneers in their field which makes CD challenging. This is interesting viewpoint to look deeper in this research.

This research is embedded multiple case study that consist of two cases that had multiple sub cases.<sup>2</sup> First case is from 1930 to 1959 and consist of 20 pairs. Second case is from 1980 to 1984 and consists of 29 pairs. Data limits the consisting of pairs. First women joined FFPA in 1930 and the twentieth in in 1956. Next women to join was in 1961. The natural stop was to end the first case in 1959 due to the start of societal change in Finland. Structures of society started to change from agrarian to manufacturing based and urbanization started as well as attitudes and societies structures changed which would have affected the data and results in a way that would not make it consistent. The second time frame is chosen to be in the 1980's to create enough time between the cases to see if there is some change between them and to still be able to track the career development within the second case. Time frame of 1980 to 1984 was chosen for to have about similar cases by size for not to have uneven cases under comparisons. When forming the comparison pairs idea is to find people with same education background. Then chosen by their joining year and age. If perfect match was not possible, compromises were made depending on the case. The cap in age and joining year was tried to keep as minimum as possible so the careers would be as long with both pairs, and this would not be as main variable. Collected data is from FFPA member registers that is based on members self-reporting; therefore, information is not perfect, someone could have knowingly left out information.

Eisenhardt's case study methods are used as part of the research to build theories from the cases and test the data to create accurate testable theory that is

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<sup>1</sup> Komulainen 2014, pp. 15, 30–31; Bairoh and Putila 2021, p. 599

<sup>2</sup> Yin 2014, p. 57



interesting as part of the deductive process of the research. Pairwise comparison is used to figure out the differences between women and men's career development. In this research pairwise comparison is used instead of just comparison because it is more fruitful to compare pairs of men and women than as individuals. Pair or pairwise comparisons are rarely used in business studies and are more common in social and political studies.<sup>3</sup> The result from the analysis is used to find if it was only gender that affected women's career development or if there were other explanations too. Key variables that are studied are length of the career, career position and its change, number of employers and changes for international assignments. Comparisons are analysed by using cross-tabulation to detect variables and their effects to career development in engineers career development. Cross-tabulations are more quantitative method that is used in qualitative research to identify differences in the data and create clear results.

Career development (CD) is described to be about individual's career achievements and goals. There are multiple theorizations on career development, but they are not without problems. The main problem is that they are based on research of men's careers and thus excluding the experiences of women. CD models do not fit for women whose careers are more complex. Originally career models are linear implementing continuous rise inside the company.<sup>4</sup> What makes women's careers more complex is the balance between work and family life; women even today take care of most of the domestic work. However, like men, women want to have succeed both in work and family life, satisfaction and success in work is related to their whole life. Achieving both is hard due to organizational realities as research has shown that sometimes women must choose between their career and having children.<sup>5</sup> Women often opt-out from organizations or change field due to complex reasons; they do not have same opportunities, get same changes for mentoring, their job is boring, have unreasonable working hours or there is no change for achievement. Describing this problem are the glass ceiling, the glass wall, the sticky floor, and leaking pipeline which describe the invisible barriers that women face.<sup>6</sup>

Engineering is described to be male-dominated field according to researchers. In engineering women face barriers that are often higher than in other fields. This is due to that career paths are gendered. Women have to self-lead their careers by adapting and surviving in hostile environment that did not offer support.<sup>7</sup> Masculine norm is said to be significant barrier for equality that sets barriers to women while it creates privileged position to men. In fields like these

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<sup>3</sup> Tarrow 2010, pp. 234, 246; Gibbert and Ruigrok 2010, p. 711; Yin 2014, pp. xix, xx

<sup>4</sup> Schmeer and Reitman 1995, p. 290; Sullivan and Arthur 2006, p. 32; Hite and McDonald 2008, p. 5; Sullivan and Mainiero 2008, pp. 33–34; O'Neil, Hopkins, and Bilimoria 2008, pp. 730–731

<sup>5</sup> De Vries 2008, p. 202; Sullivan and Mainiero 2008, pp. 33–34; O'Neil, Hopkins, and Bilimoria 2008, pp. 730–731; Kraaykamp 2012, p. 313; Schultheiss 2021, p. 2

<sup>6</sup> Sullivan and Mainiero 2008, pp. 33, 34, 40; O'Neil, Hopkins, and Bilimoria 2008, pp. 732, 733, 735; Wille et al. 2018, p. 221; Schultheiss 2021, p. 3

<sup>7</sup> Cardador and Hill 2018, p. 95; Naukkarinen and Bairoh 2021, p. 1; Bairoh and Putila 2021, pp. 596, 598, 600

women felt in most cases isolation, loneliness, biases, and gender discrimination.<sup>8</sup> Women have to adapt and adjust to fit in. In male-dominated fields women felt more important to be successful and they must work harder to prove themselves. Men in the field can see women as less capable of doing their job, their work is seen less important and often question their belonging in the field. Their work is not mostly recognised. Organizations have problems to keep women due to them leaving the field in large numbers.<sup>9</sup>

In Finland, labour markets are strongly divided to women's and men's work as well women choosing STEM field is low. Women's work has had some what a negative association in the history with a general assumption on men providing for the family. This changed due to 1980's new more liberal ideology of women's work. Urbanization and industrialization started to create more work opportunities to unmarried women; they started to work in offices, shops, institutions and as teachers at the beginning of the 20<sup>th</sup> century. In the 1960's and 1970's the second wave feminism in Finland created associations to support women's right to work in Finland.<sup>10</sup> University studies were for a long time open only to people from upper social classes, and this was the case especially for women. Education and schooling were expensive therefore families invested in boy's education because girls can get along without education. Women were men to be wives and did not need higher education.<sup>11</sup> Students social background started to change in the beginning of the 20<sup>th</sup> century. Universities turned from elite schools to general people's schools and broadening of the university network started in 1960's and continuing till 1970's when higher education opportunities were broadened to cover whole country.<sup>12</sup> Social change between the cases sets the second case after the second wave of feminism in an interesting position to look for changes that the second wave have possibly created. Higher education among all people, not just women, have become more usual. Therefore, having higher education is not that special an unreachable as it was before. Change in the environment of women's work and education created more opportunities to women.

Women entered universities in Finland at the end of 19<sup>th</sup> century with special permission and 1901 women got equal right to study in universities. Women studied mostly medicine, business or to become teachers because these were the careers, they have opportunity to achieve and get. Still relation to population, Finland had most women university students in Europe. Technical studies did not tempted women in the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup>

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<sup>8</sup> Greenfeld, Greiner, and Wood 1980; Silfver et al. 2021, pp. 1–2; Bairoh and Putila 2021, pp. 596, 598, 600

<sup>9</sup> Logel et al. 2009, p. 1089; Hatmaker 2012, p. 123; Engström 2018, p. 241; Khilji and Pumroy 2018, p. 1043; Fernando, Cohen, and Duberley 2019, p. 10; Bairoh and Putila 2021, pp. 606–607

<sup>10</sup> Markkola 2000, p. 117; Häkkinen and Rahikainen 2001; Rahikainen 2001, pp. 18, 19–24; Pohls 2013, pp. 19–20, 76–77; Puro and Lundell-Reinilä 2020, pp. 148, 150

<sup>11</sup> Fredriksson 1966, p. 96; Puro and Lundell-Reinilä 2020, pp. 32–35, 43

<sup>12</sup> Kivinen and Rinne 1996, p. 84; Kivinen, Hedman, and Kaipainen 2007, pp. 237, 244–245; Puro and Lundell-Reinilä 2020, pp. 32–35, 43

century as well as getting in was hard for women.<sup>13</sup> After the 1930's depression, demand for engineers increased and valuation of the profession got higher. Number of engineering student stayed low until 1930's. Appearance of women technical students started in 1920's when students from secondary school emerged to universities. Women that wanted to start to study engineering or in STEM field did not face strict obstacles that were aimed straight to limit women in the field though time to time limitations for women were discussed.<sup>14</sup> Therefore first generation of women engineers are interesting research topic for their pioneer position. Position was rare and breaking prejudices could have been hard. Broadening of the education opportunities offered women a change to get a job and leave the expected role of the housewife. At first only few work posts were offered or seen fit to women and married women were discriminated and fired even until 1970's by some companies.<sup>15</sup>

From the 19<sup>th</sup> century to the end of the 20<sup>th</sup> century, forest industry has had a strong place on Finnish economy and industry in Finland due to the fact that forests are one of the Finland's biggest natural resources and about 70% of the land area are forests.<sup>16</sup> Because of the strong presence of paper industry in Finland, researching paper engineers is interesting view. Beginning of the industrialization was slow, and Finland was behind Western European countries. Beginning of the 20<sup>th</sup> century Finland was still an agrarian society. Until the end of the 1930's about 80 % of the population lived in the countryside where opportunities for employment were not versatile and there was not enough work for all; industry become major employer after first world war and beginning of the 20<sup>th</sup> century. Finland's economic structure changed rapidly during the 20<sup>th</sup> century from industrial to service community and urbanization started in late 1950's.<sup>17</sup> As well the field changes through the time frame of the study affecting the employees in the field.

Topic of this research is relevant today. Most CD studies have been centered around IT engineers, ignoring thus paper engineers.<sup>18</sup> Additionally, research on engineer CD is typically ahistorical. Therefore, this research is quite unique and will produce new information on historical development of women's careers in engineering. Most of the studies are centered in Anglo-American view and Nordic point of view is rarely researched in general research of the field. Some Nordic researchers have done research on Nordic view and the effects of the Nordic legislation and society to career development and connecting family and work life. It has drastic positive affects when comparing to Anglo-American

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<sup>13</sup> Kaarninen 2011, pp. 412–413; Pohls 2013, p. 19; Puro and Lundell-Reinilä 2020, pp. 38–39, 53–54, 56, 126

<sup>14</sup> Michelsen 1994, pp. 46–47, 50; Nykänen 2007a, p. Nykänen 2007a, pp. 41, 254–255, 260–261, 293; Häikiö 2015, p. 69

<sup>15</sup> Pohls 2013, pp. 19–20, 76–77

<sup>16</sup> Eloranta and Ojala 2018, p. 163; Haapala and Lloyd 2018, p. 26

<sup>17</sup> Myllyntaus 1992, pp. 42, 45, 47; Haapala and Lloyd 2018, pp. 23–24; Nykänen 2018

<sup>18</sup> Holth, Almasri, and Gonäs 2013; Holth 2014; Paloheimo 2015; Holth, Bergman, and MacKenzie 2017; Naukkarinen and Bairoh 2021

view.<sup>19</sup> Engineering as a field has tried to change towards more equal field for all but still gender discrimination is said to be found and problems are still to be seen. This study tries to look at deeper in the time of environmental change in women's work from more uncommon to achieving more equal position among men in workplaces. Changes in the field of engineering and forest industry could affect careers as well as career development and how these changes could have some affects to it.

Intention of this thesis is to find out is there any differences between men's and women's career development through 20<sup>th</sup> century in paper engineering field. Career choice and field is described to be masculine and male-dominated that normally has negative effect to women creating glass ceilings on women's career development. In order to find out if this is true and how it affects wone's career, the following questions are investigated:

1. What kind of differences there were in career development between women and men's careers?
2. How does masculine career effect women's career development?
3. Why do the differences arise between cases when comparing women and men's career development?

This thesis clarifies these questions in following chapters by first discussing previous research in the field of women's careers and career development and then searching engineer's careers. The third chapter is explaining the research context of Finnish society, women's education and education development as well as engineering education development. History of women's labour in Finland is elucidated. Fourth chapter explains the data and methodology of this research and after these results are opened and explained.

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<sup>19</sup> For example Holth 2014; Holth, Bergman, and MacKenzie 2017; Naukkarinen and Bairoh 2021; Bairoh and Putila 2021

## 2 LITERATURE REVIEW

### 2.1 Women's Careers and Career Development

Career development (CD) is about individual's career planning by using and advancing their skills working towards their personal goals with organization's supporting and offering opportunities. This should ideally be a collaborative process. Idea of managing own careers have risen and the role of "boundaryless career" has developed. These careers are outside traditional linear model and are more autonomous being outside of the structured system by being more flexible. Career research looks lifelong work experience, the work opportunities and the structure as well as relationship between careers and life outside of the work.<sup>20</sup> Women's careers are described to be different to men. Career development models were created by studying men's work therefore they do not fit for women whose careers are more complex.<sup>21</sup> Gender discrimination sets barriers to women's CD. Professional women have to be their own agents to steer through career barriers. Women actively participate their career decision; they are not passive or submissive as management literature often supposes them to be.<sup>22</sup>

Originally career models are linear implementing continuous rise inside the company achieving rewards in stable organizational structures that offer job security to loyalty. The linear model was popularized in 1950's and 1960's based on cultural roles where men are breadwinners and women took care of the household. These models are irrelevant today due to the change in family structures but still often used. Mid-1970's and early 1980's women were the first to try to combine family and work life.<sup>23</sup> Organizational and societal factors do also have an effect to difference between women's and men's careers. O'Neil et al. (2008) describe women's careers to be more like zigzags that could be portrayed as snakes while men's as ladders. Choices that women make regarding their careers are seen atypical or unfavourable since they do not follow the norm of full-time and non-stop employment.<sup>24</sup>

De Vries (2008) states that career models are based on one breadwinner in the family; women take care of the household and children providing care while men worked and focused on their careers. Idea of the model was to separate women from work, which implemented capitalist patriarchy according to Edvinsson and Edvinsson (2017). This model has strong roots in society, women

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<sup>20</sup> Arthur and Rousseau 2001; Hite and McDonald 2008, p. 5; Akkermans et al. 2021, p. 9; Murphy and Tosti-Kharas 2021, p. 1

<sup>21</sup> Schneer and Reitman 1995, p. 290; Sullivan and Arthur 2006, p. 32; O'Neil, Hopkins, and Bilimoria 2008, p. 727

<sup>22</sup>Khilji and Pumroy 2018, pp. 1032-1033

<sup>23</sup>Auster and Ekstein 2005, p. 4; Sullivan and Baruch 2009, p. 1542

<sup>24</sup> O'Neil, Hopkins, and Bilimoria 2008, pp. 727, 731; Khilji and Pumroy 2018, p. 1034

even today take care of most of the domestic work. The domestic work is systematically undervalued, and women most likely stay dependent on the breadwinner if they do not work.<sup>25</sup> Women, like men, want to have success both in work and family life, satisfaction and success in work is related to their whole life. Achieving both is hard due to organizational realities. Women are balancing with multiple roles which is supported but not rewarded organizationally. Still in some cases women have to choose between their career and having children. Women stay childless to be able to succeed in their work but even they do experienced work-life conflict having to take extra duties because they do not have children thus becoming more consumed in their work.<sup>26</sup>

According to Sullivan and Mainiero (2008) there is a lack of understanding in HRD for a need to have balanced work and family life, because models look for men's careers where family life is taken care of. In USA companies that offer opportunities for balancing family life with work have no value to the employees. Employees can be discriminated if they use these programs. Government itself does not offer many policies and employees with organizations provide rules and opportunities. In many European countries national policies dictates how to combine work and family life for example offering family leave options and arrangement of childcare.<sup>27</sup> Holth et al. (2017) states that in Nordic countries that are known for gender equality, both men and women are having difficulties to balance work and family life. Double emancipation is encouraging women to work and men to take active role in home as challenging gender norms, while traditional man's career models are used. That has led men to struggle with their stereotypical roles and expectations while being active at home. If choosing one or the other, they have felt failure and guilt. These ideologies have mostly affected men by having more egalitarian views of gender roles. Both men and women created coping strategies to have both roles. In Nordic countries, women left from demanding jobs while men still stayed with support of their spouses which indicates that women still have most of the responsibilities at home. Nordics differ from other systems by providing cheap and available high-class child and family-care continuum that helps both parents to work whereas in USA lack of available care systems leads women to so called mommy track and stay home.<sup>28</sup>

There is in most cases a difference in work/nonwork balance, mentoring and work outcomes between men and women.<sup>29</sup> In mid-career, women are worried about balancing their life and make decision regarding of the need around

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<sup>25</sup>Warren, Rowlingson, and Whyley 2001, p. 467; De Vries 2008, p. 202; Sullivan and Mainiero 2008, pp. 33-34; Edvinsson and Edvinsson 2017, p. 169; O'Connor, O'Hagan, and Gray 2018, p. 325

<sup>26</sup> O'Neil, Hopkins, and Bilimoria 2008, pp. 730-731; Kraaykamp 2012, p. 313; Schultheiss 2021, p. 2

<sup>27</sup> Sullivan and Mainiero 2008, p. 34; O'Neil, Hopkins, and Bilimoria 2008, p. 731; Schultheiss 2021, p. 2; van Hek and van der Lippe 2022, pp. 14-15

<sup>28</sup> Paloheimo 2015, pp. 19-20; Holth, Bergman, and MacKenzie 2017, pp. 234-235

<sup>29</sup> Sullivan and Arthur 2006, p. 26

them which could mean taking opportunities that offer flexibility over their ambitions and meaningful experiences. In later career they feel of not achieving what they wanted and disappointed due to being flexible to taking care of other's needs. Decisions regarding women's career is not just about paid work.<sup>30</sup> Taking care of family responsibilities cause women to have more career interruptions than men. Interruptions impacted negatively mid-career managers in both women's and men's careers. Women are expected to be less committed to their careers and more on family according to O'Neil et al. (2008).<sup>31</sup> Social status and position among individual characteristics affects attitudes towards gender roles but in all women support more equal gender roles while women who stay at home and parents support more traditional roles. Women with higher education support more equal roles but among men the effect of higher education is not seen in their attitudes. Environment and the countries social aspects affect gender roles in countries that are more equal towards women in work life and leadership positions according to van Mensvoort et al. (2021). Women leaders are more likely to support initiatives regarding work-family issues.<sup>32</sup>

Women often opt-out from organizations or change field due to complex reasons. Not just for experienced sexual harassment, discrimination or taking care of family. Mostly they do not have same opportunities, get same changes for mentoring, their job is boring, have unreasonable working hours or there is no change for achievement. These women either change fields or become entrepreneurs offering balanced work and opportunities for other women.<sup>33</sup> Women take steps one at the time and try to find interesting work that they love and offer challenges. They do not necessarily aim for top management jobs.<sup>34</sup> If organizations want women to stay, they need to offer authenticity. For employees it is important that their values are align with organization's mission and they might leave if values are mismatched. Organizations in most cases need to offer channels to report unethical behavior and harassment, so women feel safe and have opportunity be heard when facing problems if they face one. As well organization need to offer opportunities to balance employee's life and recognize everyone's contribution by going beyond what is legally demanded. Schultheiss (2021) mentions that even tough organizations are benefiting to having programs that offer balancing acts to employees, they are hesitant to do changes.<sup>35</sup>

Women in most cases face obstacles and barriers in their career that avert them to proceed in their careers. Many researchers<sup>36</sup> mention terms to describe

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<sup>30</sup> Sullivan and Mainiero 2008, pp. 36–37; O'Neil, Hopkins, and Bilimoria 2008, p. 729

<sup>31</sup> Schneer and Reitman 1995, p. 292; O'Neil, Hopkins, and Bilimoria 2008, p. 735

<sup>32</sup> Kraaykamp 2012, pp. 311, 323; van Mensvoort et al. 2021, pp. 794–796; van Hek and van der Lippe 2022, p. 15

<sup>33</sup> Sullivan and Mainiero 2008, pp. 33, 40; O'Neil, Hopkins, and Bilimoria 2008, pp. 732, 735; Schultheiss 2021, p. 3

<sup>34</sup> Schultheiss 2021, pp. 1, 3

<sup>35</sup> Auster and Ekstein 2005, pp. 6, 8, 18, 20; Sullivan and Mainiero 2008, pp. 38, 40, 41; O'Neil, Hopkins, and Bilimoria 2008, p. 732

<sup>36</sup> For example Sullivan and Mainiero 2008; Wille et al. 2018; van Mensvoort et al. 2021

this problem are the glass ceiling, the glass wall, the sticky floor, and leaking pipeline which describe the invisible barriers that women face. These are most often created by organizations and men's attitudes towards women whose place is not in top management and need for change is not founded. Traditional gender roles still have strong base in organizations which creates these barriers to women when they are described to be too emotional, passive, and not fitting to be managers according to Wille et al. (2018). Even women do not use their position to change the systematic behaviour but mostly women stay in lower managerial positions were creating the change due to having more regulating is hard.<sup>37</sup> Sometimes it is easier for women to accept organisations gender norms and hierarchy to get promotion and keep their own positions. Men often feel that they do not benefit gender equality and see that as a threat to their own positions creating more competition. Stereotypical masculine traits are still connected to good managers rather than feminine straits. O'Neil et al. describes this to be connected to "think manager, think male" thinking which is promoting the ideal to work for men rather than for women.<sup>38</sup> Contrary to this Schultheiss presents "think crisis, think women" where women are more communicative and warmer what are good in crisis. Women have to accept riskier positions to gain leadership positions. These situations do not end well for women; they either fail or when succeed to resolving the crisis, men force them out and replace them in calmer situations.<sup>39</sup>

It is seen that when women do follow the more masculine managerial style, they are seen to be acting against their gender role and norms and could face sanctions.<sup>40</sup> In masculine culture, women to be able to succeed they must act outside of their gender norms and be different, but it could create negative effects as well. Strong women are in most cases seen intimidating, arrogant and over all seen in a negative light while men are seen as strong leaders, but if they differ from their norm, they are described to be weak.<sup>41</sup>

The top management positions are harder for women to reach; they stay at junior or middle management while men mostly are encouraged and supported to reach out to top management while men are heavily overrepresented in top management. They describe that work offers social contacts but not visible career development opportunities which lead to them feel less satisfied.<sup>42</sup> On the other hand women are described to be more risk averse which stops them to

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<sup>37</sup> Sullivan and Mainiero 2008, p. 34; O'Neil, Hopkins, and Bilimoria 2008, p. 735; Wille et al. 2018, p. 221; Schultheiss 2021, pp. 3, 9; van Mensvoort et al. 2021, p. 794; van Hek and van der Lippe 2022, p. 5

<sup>38</sup> O'Neil, Hopkins, and Bilimoria 2008, p. 735; Kulich et al. 2011, p. 305; Powell and Butterfield 2015, p. 29; van Mensvoort et al. 2021, pp. 794; 797

<sup>39</sup> Schultheiss 2021, p. 5

<sup>40</sup> Dezsö and Ross 2012, p. 1076; Wille et al. 2018, p. 222; van Hek and van der Lippe 2022, p. 5

<sup>41</sup> Powell and Butterfield 2015, p. 29; O'Connor, O'Hagan, and Gray 2018, pp. 318-319; Wille et al. 2018, p. 222; Schultheiss 2021, p. 5

<sup>42</sup> O'Neil, Hopkins, and Bilimoria 2008, pp. 733-734; Schultheiss 2021, p. 1; van Mensvoort et al. 2021, p. 794



reach for performance-based contracts and managerial roles to avoid failure. Men are often more confident, which could be overconfidence, and take more risks especially in traditional male domains like finance.<sup>43</sup> Paradoxically it is noted that women create networks, share responsibilities, and help others to develop which are seen feminine traits and positive to organizations but seen negative when women do this and positive when men managers are doing the same. Women rarely get appropriate recognition for their actions to strengthen the organization.<sup>44</sup> Women focus on connections, and they are described to be stronger network builders than men. Women have networks with other women and to gain social support. Men have even more than women same-sex networks that tend to lead segregated networks in organizations that leave women out of important connections and conversations.<sup>45</sup> Mostly men managers do participate more in homogeneous networks which is why they are less exposed to women leadership and are more against equality in gender roles. This on the other hand makes women to support traditional gender roles to avoid negative social comparisons.<sup>46</sup> Managers do likely befriend and mentor people that are same gender, but they do not benefit having managers that are same gender. Women benefit having women in managerial roles in their organization creating more opportunities for other women to get promoted.<sup>47</sup>

Schneer and Reitman (1995) present that discrimination towards women is also seen when their managerial performance is evaluated more negatively through bias behaviour where men see other men more positively and expect men to be more competent than women in management. Men managers do see men as ingroup and women as outgroup that strengthens the bias against women creating unfavourable attitudes towards them. In some cases, performance of women CEO is evaluated more carefully when men's performance is seen the source of good or bad. Men are more rewarded but also more punished compared to women CEO's.<sup>48</sup> Women are seen to be less influential leaders and are not offered leadership roles in team tasks either.<sup>49</sup> Having women in management increases diversity and widens strategy, they also bring unique expertise and perspectives which could help companies and their performance, but the benefit of diversity is usually unseen. Companies tend to hire women when they are under external pressure to do so. Then women are seen more as symbolic tokens to show diversity and do not have real power.<sup>50</sup> This is not seen just in management, discrimination and glass ceilings are also visible in academia and

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<sup>43</sup> Kulich et al. 2011, p. 315

<sup>44</sup> O'Neil, Hopkins, and Bilimoria 2008, p. 734

<sup>45</sup> Sullivan and Mainiero 2008, p. 37; O'Neil, Hopkins, and Bilimoria 2008, p. 733

<sup>46</sup> van Mensvoort et al. 2021, p. 797

<sup>47</sup> van Hek and van der Lippe 2022, pp. 3-4, 11

<sup>48</sup> Schneer and Reitman 1995, p. 291; Kulich et al. 2011, pp. 305-306, 314; Wille et al. 2018, p. 222; Knippen, Shen, and Zhu 2019, pp. 1124, 1126

<sup>49</sup> Kulich et al. 2011, p. 314

<sup>50</sup> Dezsö and Ross 2012, pp. 1073, 1076-1077; Knippen, Shen, and Zhu 2019, pp. 1126-1128; Triana, Richard, and Su 2019, pp. 1683, 1689; van Hek and van der Lippe 2022, p. 3

especially in STEM. Projects has been made to ensure equal funding but as same that in management, men are evaluated more positively than women in most of academic settings.<sup>51</sup>

To this day many organizations are male-dominated even after the ranks of women have risen steadily for several decades. Women are described to face sexual harassment and discrimination in male-dominated spaces, and they are not always taken for notice and issues are not dealt with even when most successful organizations are the ones that encourage the women and develop their talent.<sup>52</sup> Schneer and Reitman says that men compare themselves to men and women to men as well while women feel more pressure to prove themselves.<sup>53</sup> Due to discrimination women managers are more likely to advocate policies to better organization and have initiatives against discrimination. These could affect earning gap between genders, better equality in the organization with more effort in recruiting and promoting women. Fortunately, some change in the culture is happening and leaderships stereotypes are changing to be more inclusive and understanding<sup>54</sup>

Among women lower employment rates, earning less, working fewer hours, being at lower managerial levels than men and working in poorly paid sectors is more usual but they still felt satisfied in their careers. Zou (2015) states that many women work part-time, which is base for the satisfaction created by the flexibility that working part-time offers. Women are also in disadvantaged position in labor markets which makes them to be more grateful than men which leads to women to make a best of bad situations according to Zou. Number of men working part-time is staying low and has not increased.<sup>55</sup> Especially in stock options women do not get same amounts than men which indicates that their managerial input is not valued as much and the gap in earning increases when rising to top management. Some women felt in mid-career to be successful but later felt betrayed for not getting same rewards as men due to hitting glass ceilings and facing discrimination that still tend to exist.<sup>56</sup> Men due to change their job more likely if they are not satisfied to their salary while women have more restrictions created by glass ceilings and having no options and bargaining power. Companies are more likely to offer compensations to men managers to retain them and women are more likely opting out. In countries that have expensive childcare have negative affects to women's wages when women look after children<sup>57</sup>

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<sup>51</sup> O'Connor, O'Hagan, and Gray 2018, p. 325; Bol, de Vaan, and van de Rijt 2022, pp. 1–2

<sup>52</sup> Sullivan and Arthur 2006, p. 26; Sullivan and Mainiero 2008, p. 33; O'Neil, Hopkins, and Bilimoria 2008, p. 727; Bol, de Vaan, and van de Rijt 2022, p. 2

<sup>53</sup> Schneer and Reitman 1995, pp. 293, 244

<sup>54</sup> Wille et al. 2018, p. 223; van Hek and van der Lippe 2022, p. 4

<sup>55</sup> Warren, Rowlingson, and Whyley 2001, pp. 472, 466; O'Neil, Hopkins, and Bilimoria 2008, p. 735; Kraaykamp 2012, p. 309; Zou 2015, pp. 3, 5; van Hek and van der Lippe 2022, p. 2

<sup>56</sup> Schneer and Reitman 1995, pp. 292–293, 295, 308, 310, 311; Auster and Ekstein 2005, p. 5; O'Neil, Hopkins, and Bilimoria 2008, p. 735; Kulich et al. 2011, p. 313

<sup>57</sup> Warren, Rowlingson, and Whyley 2001, pp. 466–467; Kulich et al. 2011, pp. 315, 317

What is behind all this is gender roles and norms. They are reinforced by certain acts of the manner of speech, gestures and postures that are culturally gendered. This is also related to hegemonic masculinity which is dominant position of the certain male class related to male majority and to all women. Five values of the western man ideal are power, strength, success, emotional control, and heterosexuality. Even if majority men do not fulfil the claim of the hegemonic masculinity, they do support it and perform the role of the ideal men because it guarantees or at least promises power to them. Women can also support hegemony by adapting to societies' strict expectations and values.<sup>58</sup> Lastly Iris Marion Young lists five dimensions of subdue: Economic exploitation, socio-economic replacement, lack of autonomy and power related to work, cultural imperialism, and systematic violence.<sup>59</sup>

Gender research started in 1980's in Finland and approaches work life's phenomena through two perspectives. Firstly, it looks societies genderized structures and gives information men's and women's different stations and situations in work life. It reveals differences and inequality among men and women. Secondly it analyses societies dominant genderizing cultural practices and how gender and sexuality are seen in the workplace.<sup>60</sup>

## 2.2 Careers in Engineering

Perry et al. (2016) mentions that engineers are more committed to their profession than organizations. To create commitment to organizations, there must be good fit among engineers and organizations. For engineers to be successful in their career they need to be valued, informed, needed and in the right place. Career paths in engineering are related to experiences in work and profession.<sup>61</sup> If employees are dissatisfied with their job and work conditions, they are going to go elsewhere, mobility in the field is high according to Fouad et al. (2016).<sup>62</sup> Women's faced barriers in engineering are often higher than in other fields, due to lack of career paths and effects of gendered norms. Cardador and Hill (2018) states that career paths are gendered, and most organizations are not concerned for that. Women have to self-lead their careers by adapting and surviving in hostile environment that did not offer support. They generally must make hard choices between family and work life and in both cases disappointment and regret was visible. Khilji and Pumroy (2018) mentions that to combine family and work, spousal support was critical for professional growth. In 21<sup>st</sup> century men

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<sup>58</sup> Kantola 2010, p. 83; Rossi 2010, pp. 26-27

<sup>59</sup> Kantola 2010, pp. 82-83; Valovirta 2010, pp. 92-105

<sup>60</sup> Korvajärvi 2010, p. 185; Lempiäinen 2010, p. 274

<sup>61</sup> Perry, Hunter, and Currall 2016, pp. 1247, 1251; Cardador and Hill 2018, p. 97

<sup>62</sup> Fouad et al. 2016, p. 82

have started to take more parental role among engineers as well which has created little equality in engineering careers.<sup>63</sup>

Engineering is described to be male-dominated field according to researchers. Engineering is described to be men's profession with connection to technology. Masculinity is in most cases part of the identity and norms of engineers. Masculine norm is said to be significant barrier for equality that sets barriers to women what men do not face. Masculine culture in the field usually creates privileged position to men. In fields like these women felt in most cases isolation, loneliness, biases, gender discrimination and no support. Powell and Butterfield (2015) describe these to be micro-aggression that women face in the field.<sup>64</sup> Engineering is said to be one of the sex-segregated field in many countries. The masculine norm is not just disadvantageous to women, it is also to men that are not white heterosexuals; they are not seen as part of the norm and are marginalised in many cases as well. Masculine norm is related to high competition which most women do not profit. Engineers are known for their "work hard, play hard" culture that does not fit to women.<sup>65</sup> Discrimination often causes women not to develop in their career and get managerial posts as men does. Women are also given less valued jobs that are seen to be more suitable for them like being assistants or cleaner. These non-technical jobs do not develop their competence and ratify traditional division of labour. This takes women away from technological core aspects of the work which led to feeling of their technological skills declining. Women are often elated to their social skills and men usually with more technical skills.<sup>66</sup> Slowly the image of engineering is changing to be more heterogenous, and sexism is decreasing but still there.<sup>67</sup>

Women often have to navigate and adjust in engineering because woman in technology is seen in most cases as oddball and not part of the norm. They might see themselves different in relation to men and other women in the field. Khilji and Pumroy found that having a tough skin was important for survival. To feel belonging women sometimes try to position as "one of the boys" or try to be against other women and favour men, which is called queen bee syndrome by Fernando et al. (2019). This does not challenge the masculine norms in the field and create change. Some choose to emphasise their femininity and challenge the

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<sup>63</sup> Holth and Mellström 2011, p. 324; Holth, Almasri, and Gonäs 2013, p. 523; Holth 2014, p. 108; Cardador and Hill 2018, p. 95; Khilji and Pumroy 2018, pp. 1035, 1041–1042, 1044, 1046; Ummu Sakinah et al. 2020, p. 248

<sup>64</sup> Greenfeld, Greiner, and Wood 1980, p. 294; Singh et al. 2013, p. 283; Powell and Butterfield 2015, pp. 81, 90; Fouad et al. 2016, p. 81; Naukkarinen and Bairoh 2021, p. 1; Silfver et al. 2021, pp. 1–2; Bairoh and Putila 2021, pp. 596, 598, 600

<sup>65</sup> Gill et al. 2008, p. 400; Singh et al. 2013, p. 281; Paloheimo 2015, p. 16; Khilji and Pumroy 2018, p. 1035; Fernando, Cohen, and Duberley 2019, p. 8; Bairoh and Putila 2021, pp. 598–599

<sup>66</sup> Holth 2014, p. 105; Holth, Bergman, and MacKenzie 2017, pp. 235, 241; Bairoh and Putila 2021, pp. 606–607

<sup>67</sup> Logel et al. 2009, p. 1089; Holth and Mellström 2011, p. 318; Hatmaker 2012, p. 141; Silfver et al. 2021, pp. 1–2

norms.<sup>68</sup> Those that try to be more like men are some cases penalised for not being womanly enough, paradox that hinders women who try to fit in. If women want to be shown as effective leader, they try to adapt more to masculine norm.<sup>69</sup> Bairoh and Putila (2021) describe that dissolution of the masculine norm in the field has created feelings of discrimination among men when their privileged position has been lost. They see equality as favouring women especially when organizations try to reach equality. Women are seen as threats in the field taking away men's rights for example making sexist jokes. As well the favouritism is letting incompetent women to get jobs. They state also that true change cannot happen if equality is seen as favouritism.<sup>70</sup> they as well found that in Finland, women report more discrimination in all fields than men but more in male-dominated fields. Typical discrimination in Finnish workplaces is favouritism, type of employment contract, sex and age.<sup>71</sup>

It has been noted that women leave engineering in large numbers, about half of the graduated women engineers leave the field and organizations have problems to keep women employees. Women leave engineering more than in other male-dominated fields, for example law, business and medicine. Departure is explained by the gendered career paths that appear as hostile climate, lack of confidence among women and lack of technical interest.<sup>72</sup> If women leave the field, departure creates a loss for both, organizations and leaving women.<sup>73</sup> Women to stay, organizations have to support their employees and offer opportunities to combine work and family life. Women who stayed showed more occupational commitment. Those that felt supported, felt more obligated to stay.<sup>74</sup> Lack of support for women is often justified that they will leave to have babies and therefore do not need support. Some managers actively try to limit women's career development. Countries that do not offer proper family leave, women work part-time, and most cases cannot get managerial roles that are for full-time workers.<sup>75</sup>

In male-dominated fields women felt more important to be successful and they have to work harder to prove themselves. Men in the field can see women as less capable of doing their job, their work is seen less important and often question their belonging in the field. Women's careers have less expectations than men's careers. Women do not get recognised and have no access to the power in organizations in most cases.<sup>76</sup> Fernando et al. states that women are

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<sup>68</sup> McGregor et al. 2017, p. 3; Engström 2018, p. 241; Khilji and Pumroy 2018, p. 1043; Fernando, Cohen, and Duberley 2019, p. 10; Silfver et al. 2021, p. 3; Bairoh and Putila 2021, p. 599

<sup>69</sup> Fernando, Cohen, and Duberley 2019, p. 10

<sup>70</sup> Silfver et al. 2021, p. 3; Bairoh and Putila 2021, pp. 595, 606, 608, 610, 612

<sup>71</sup> Bairoh and Putila 2021, p. 596

<sup>72</sup> Singh et al. 2013, p. 281; Fouad et al. 2016, pp. 79–80; Cardador and Hill 2018, pp. 95, 96

<sup>73</sup> Singh et al. 2013, p. 283

<sup>74</sup> Singh et al. 2013, p. 285; Fouad et al. 2016, p. 90; Cardador and Hill 2018, p. 96

<sup>75</sup> McGregor et al. 2017, p. 8

<sup>76</sup> Greenfeld, Greiner, and Wood 1980, p. 302; Paloheimo 2015, p. 14; McGregor et al. 2017, p. 8; Fernando, Cohen, and Duberley 2019, p. 6; Bairoh and Putila 2021, pp. 596–597, 608

struggling as being overly visible as women and sexual objects or invisible as competent engineers in their work. While women do actively better themselves and increase their competence, this is not sufficient to fulfil the goals in their careers because their competence is usually not seen and building relationships is hard. Men do not have the problem with creditability in their work.<sup>77</sup> Women mostly interact with men in engineering for being minorities in the field, some of the interactions could have negative effects for women's performance due to sexism. This could cause identity and stereotype threat which undermines their performance.<sup>78</sup>

Women in the technological field have harder time to be employed than men after graduation and they had fewer permanent jobs than men in Finland. Women have more unemployment periods, and more and longer family leave periods states Naukkarinen and Bairoh (2021). One reason behind this is high labour costs of women due to having family. There are suggestions that the labour costs of having children should be divided between both parents or covered by the society.<sup>79</sup> Combining family life and engineering is problematic and hard regardless of the national context.<sup>80</sup> Pay gap between women and men is clearly visible in engineering and in many countries, change during the years for better has not happened. Employees who start at the same time, men get better pay than women after some years. Gender pay discrimination is part of the norms in the field. So called riskier jobs that offer higher pay are not given to women in most cases. This creates gendered wages.<sup>81</sup>

Women gravitating towards STEM field is small compared to men. In Finland it is one of the lowest in OECD countries and in Nordics. This is validated on that women are not interested about maths or science. Women feel that they cannot manage the subjects as well as men but in reality, they are in the same level or better. Lack of confidence mainly lowers women's interest to apply to STEM fields. Women gravitate toward biological sciences, but other STEM fields are lacking women.<sup>82</sup> Choosing to start engineering is more straight forward to men than women, women take time to choose STEM fields as their major. Women do not apply if they have doubts of their academic success. Support of their family and surroundings is important aspect. They discontinue their studies more often than men even if their study success is good. Finding engineering identity is hard which affects the dropping out.<sup>83</sup> Finnish universities are segmented to women's (education and liberal arts) and male segments (STEM) which is connected to women's jobs being low paid and not respected while men's jobs are

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<sup>77</sup> Fernando, Cohen, and Duberley 2019, pp. 1-2, 6-7; Bairoh and Putila 2021, p. 606

<sup>78</sup> Logel et al. 2009, pp. 1089, 1100; Hatmaker 2012, p. 123

<sup>79</sup> Vuorinen-Lampila 2016, pp. 296-297, 303; Naukkarinen and Bairoh 2021, p. 6

<sup>80</sup> Naukkarinen and Bairoh 2021, p. 5

<sup>81</sup> McGregor et al. 2017, p. 13; Ummu Sakinah et al. 2020, p. 244

<sup>82</sup> Paloheimo 2015, pp. 14, 19; Wegemer and Eccles 2019, pp. 28-29; Naukkarinen and Bairoh 2021, p. 178; Bairoh and Putila 2021, p. 596

<sup>83</sup> Paloheimo 2015, pp. 14-15, 27-28; Engström 2018, p. 240; Naukkarinen and Bairoh 2021, p. 188; Silfver et al. 2021, p. 2

high paid. Fields that are dominated by men are unlikely to be chosen for education by women. Culture during the studies shape engineers' values and norms from the beginning.<sup>84</sup> High status that engineering degree provides is not important to women as to men who want to become leaders and be successful.<sup>85</sup>

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<sup>84</sup> Gill et al. 2008, p. 392; Paloheimo 2015, pp. 21–22; Naukkarinen and Bairoh 2021, p. 3

<sup>85</sup> Engström 2018, pp. 241, 250

### 3 RESEARCH CONTEXT

#### 3.1 Industrialization in Finland

Finland was behind in development compared to other Western European countries before its industrialization. Industrialization started in Finland at the end of 19<sup>th</sup> century, and it happened through the development of the forest industry.<sup>86</sup> At the time Finland was in great need for economic change due to fast increase in population and opportunities for gaining an income were low. Even though Finnish industry increased fast at the end of 19<sup>th</sup> century, industry became major employer after first world war and beginning of 20<sup>th</sup> century Finland was still an agrarian society. Until the end of 1930's about 80 % of the population lived in the countryside where opportunities for employment were low and industry could not offer enough employment to all. At the end of 1930's industrial areas were developed around the areas where they are now. Industrial areas developed around transport connections and close to energy reserves that were situated close to waterways, railroad network and coastal areas.<sup>87</sup>

One of the biggest natural resources of Finland is its forests; about 70 % of the Finland's land area is forest land. Forestry was a major secondary income to agricultural community by creating opportunities for work for farmers during wintertime, when their farms had less work to be done. Forestry and forest industry became backbone for economic development in Finland, for many years about 80 % of export income was from forest industry and fifth of the GDP until 1950's. Sawmill and paper industries became one of the largest industries in the country and stayed at that until the end of the 20<sup>th</sup> century.<sup>88</sup> Forest industry has faced many structural changes through the years for what is the most important produce. In 1600's to 1830's tar was the most important produce, in 1840' to 1950's saw wood products, in 1950's to 1960's chemical pulp and from 1970's onwards it has been paper. It also created cluster around it with other industries; shipping business, machine shops and designing services.<sup>89</sup>

Wars effected a lot on Finnish paper industry and economy. First and second world wars almost caused Finland's economy to collapse and cut the country off from international connections. All the country's human and material resources were committed to the war effort which effects lasted until 1952 in the machine industry. Due to losing the war Finland lost parts of its Eastern border to Russia; about the tenth of the forest area and fourth of the pulp production

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<sup>86</sup> Myllyntaus 1992, pp. 37, 39, 40–41; Rahikainen 1992, pp. 21–22; Eloranta and Ojala 2018, p. 142; Haapala and Lloyd 2018, pp. 23, 26; Koivuniemi 2018, p. 213

<sup>87</sup> Myllyntaus 1992, pp. 39, 42; Haapala and Lloyd 2018, p. 24; Koivuniemi 2018, p. 215; Nykänen 2018

<sup>88</sup> Myllyntaus 1992, p. 43; Haapala and Lloyd 2018, p. 26; Laine 2019, pp. 131, 132

<sup>89</sup> Eloranta and Ojala 2018, p. 163; Koivuniemi 2018, p. 215



capacity was lost behind the new border. Finland did not face other losses or faced major issues compared to other European countries.<sup>90</sup> Russia demanded Finland to pay war reparations, which was mainly done by delivering goods and products, with the beginning of the Cold War forced Finland to modernize and expand its machine-making industry. In 1952 Finland had paid its war reparations and the Korean war caused a boom in the industry with the rising international demand for pulp and paper until the end of the war. Then again, the Finnish paper industry fell behind its international competitors.<sup>91</sup> The problem in the economy was fixed by devaluating the Finnish Mark by 30% and dismantling the regulations of foreign trade in 1957. This created a new era of investment in the Finnish paper industry in 1960's. There was a need for bettering the quality of the products which created research and development programs to improve the quality of the products. Finland also joined EFTA and other trade associations to improve its trade. By the end of 20<sup>th</sup> century there were many multinational Finnish operators in the forest industry. Industrialization created more work opportunities to women and engineers in general. Engineers became an important part of developing forest industry and their appreciation increased.<sup>92</sup>

### 3.2 Society and Women's Labour in Finland

Women's work and livelihood has been researched in Finland through the women's movement. First wave happened in the end of 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century and the second in 1960's to 1970's. In the first wave, women's right to work, wages and working conditions was researched and in the second wave how women managed in labour markets and how problems with combining work and family were solved. The second wave started relatively late in Finland compared to other Nordic countries that started the conversation in the 1950's.<sup>93</sup> The Evangelical Lutheran Church of Finland's ideology has been for a long-time strong influencer on norms and roles of the people in Finnish culture, likewise other local religions had affected culture and norms around the world. It appointed the norms for the role of women to be in the home taking care of the house and the children while men worked which was the ideology of the ideal woman like in many other cultures at the time. These expectations and assumptions go far beyond biological requirements.<sup>94</sup> There have been a negative association in the history to women's work. Even up till 1960's general opinion was that men have to work to gain money for the family until 1980's women finally get to work outside of their homes and not be under men's jurisdiction.

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<sup>90</sup> Myllyntaus 1992, p. 49; Koivuniemi 2018, p. 222; Nykänen 2018

<sup>91</sup> Nykänen 2018

<sup>92</sup> Myllyntaus 1992, pp. 46, 48–49; Eloranta and Ojala 2018, p. 163; Koivuniemi 2018, p. 222; Nykänen 2018

<sup>93</sup> Eskola 1968, p. 11; Häkkinen and Rahikainen 2001, p. 7

<sup>94</sup> Liljeström 1966, p. 14; Rotkirch 1968, p. 159; Markkola 2000, pp. 113–116

This related to new more liberal ideology of women's work.<sup>95</sup> Still in 19<sup>th</sup> century most of the people lived in countryside that had men's and women's work but mainly the work was done together and in general women participated to farm work more than in other European countries. In countryside women could do small additional work to support the family for example knitting. Many of the unmarried women worked in their family's farm or if they had education they worked as governess. Some worked as maids in other's farms.<sup>96</sup>

Urbanization and industrialization started to create more work opportunities to unmarried women; they started to work in offices, shops, institutions and as teachers. In 1864 new law reform liberated unmarried women from men's guardianship after they turned 25 years. The new marriage laws of 1889 and 1929 gave married women more liberties from their husband's jurisdiction.<sup>97</sup> At the end of 19<sup>th</sup> century labour markets were under quick reform in Finland. They were mostly unregulated, and women's and men's work were not yet got established. Industry become the second largest employer for women after farming and most of the women's work was low paid and did not need education. Mainly the work was for unmarried women; fitting job for married women was mostly sewer.<sup>98</sup>

Broadening of the education opportunities created women a chance for career even though the main reason for women's education was to raise the girls to be mistresses of their husband's household. If women were educated, creating a career was hard and seen unnecessary because of the norm and assumption that they will stay at home once they get married. Women were not taken into all posts; they were discriminated in the work markets. Women were free to take on the lower posts like governess, to the middle posts' women must apply to get liberation from their sex and still their qualification in their post was restricted. Women were not allowed to take on the highest posts that used jurisdiction.<sup>99</sup> It was expected that women who worked stayed unmarried or quit their jobs when they get married. It was thought that work of the government official did not suit for married women. Some companies fired women when they got married, for example Oy Alko Ab (Provider of alcohol products, Finnish government owned monopoly) it was forbidden to hire married women by the jurisdiction of the Justice of the Supreme Administrative court and Yhdistyneet Paperitehtaat (United Papermills, predecessor of current UPM) had same kind of practice until 1970's. In the beginning of the 20<sup>th</sup> century women started to live for themselves without the family and its obligations.<sup>100</sup>

Urbanization accelerated in Finland in 1950's when people started to move from the countryside to the growing cities which changed structures and daily

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<sup>95</sup> Häkkinen and Rahikainen 2001, p. 8

<sup>96</sup> Rahikainen 2001, pp. 18, 19-24

<sup>97</sup> Markkola 2000, p. 117; Rahikainen 2001, pp. 18, 19-24

<sup>98</sup> Rahikainen 2001, pp. 24-25, 26-27, 29

<sup>99</sup> Pohls 2013, pp. 76-77

<sup>100</sup> Walden and Karreinen 1971, p. 219; Hakkarainen 1993, pp. 69-71; Pohls 2013, pp. 19-20, 76-77

life. Family size started to decrease in the beginning of the 20<sup>th</sup> century which enabled women to work and have more opportunities; they were able to be more independent. It was beneficial to limit the number of children while child mortality decreased, life expectancy increased. Having less children give opportunity to offer them more and better education.<sup>101</sup> Still, it was expected that women would follow the norm to become a housewife when they get married after the model from USA, which was ideal from 1920's to 1950's, but women found work and opportunities from the growing welfare state. Norm of the stay-at-home mom never became a norm in Finland like in Central Europe. Even in Sweden the housewife era was stronger as placing between 1930's to 1979 with the crescendo in 1950's. Women in lower classes have to work, men alone were not able to provide for the family. They worked in low paid and odd jobs; not creating career.<sup>102</sup> Behind the ideal of women staying in home was the depression in 1930's where rivalry for the work was high and women were left out. During the second world war women started to do the men's jobs when they were fighting which was after seen problematic and their jobs were given to men that came back from the war. At this time working women were blamed to be running away from homes because their duty was to be at home. Their efforts in labour markets were diminished by stating that women do not get promotions or have progress in their career because they do not want power.<sup>103</sup>

In the 1950's forecasts of the labour force, married working women were seen as temporary and exceptional phenomenon which did not turn out to be the case. In 1950 35 % of the married women were working and in 1960 the number was 45 %. In 1960's the number of academically educated women were high enough to start demand change because they were not content to be stay-at-home moms or unmarried.<sup>104</sup> Many different associations were created to support women's right to work. Committee was founded to reflect equality question. 1960's and 1970's second wave feminism was successful; idea and ideology of equality was set on as apart of public administration and politics. The role-thinking was strongly related to the division of labour with the ambition at the time was to eliminate that aspect and to aim more equal grounds. This included the relations between work and family as well as parenthood and home which are important to research on how the actions at home give opportunities to working life. This research gives an opportunity to understand role sift between the different roles. What helped women to be able to work in Finland were generalization of childcare, contraception, and internationalization.<sup>105</sup> In 1986 law was set to discriminate gender discrimination which became punishable by law and in

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<sup>101</sup> Edvinsson and Edvinsson 2017, pp. 169, 172, 173

<sup>102</sup> Edvinsson and Edvinsson 2017, pp. 169, 172, 173

<sup>103</sup> Boethius 1966, p. 46; Kantola 2010, p. 80; Pohls 2013, p. 77; Puro and Lundell-Reinilä 2020

<sup>104</sup> Pohls 2013, pp. 127-128

<sup>105</sup> Eskola 1968, pp. 12-13; Korvajärvi 2010, p. 184; Rossi 2010, p. 26; Pohls 2013, pp. 127-128; Puro and Lundell-Reinilä 2020, pp. 124, 148, 150

1980's the women of the younger generations were in the same level with their education status than men.

Education in Finland has enabled societal gender equality and women's emancipation, nevertheless highly educated women still felt that gender is causing damage to their career.<sup>106</sup> This created the countermove where men were afraid that they will lose their position of power and how their own roles changed regarding rights and duties. Conservative men were afraid that women and womanity would change to be neutral. The change had negative affect to the image of stay-at-home moms and those who wanted to stay home experienced the change as negative thing.<sup>107</sup> The countermove stated that children will be left alone and not taken care of while women steal men's jobs. They doubted working women's family's happiness and their motives, created questions and misunderstandings. They stated that changing of the gender roles will take freedom to choose, society structure will be reversed, the conversation about gender roles is fake and everyone will be put to the kolkhozes. Someone also stated that women's problems should stay as women's problems.<sup>108</sup> In their opinion work for women was too heavy, dirty, and exhausting. If women and men worked together it would cause problems with discipline as well as it was too expensive to build two separate changing rooms and facilities for both genders. They argument that women did not fit to be leaders for their social skills; they come workplaces to flirt or be passive. Society would waste recourses on women's education because they would not have a need for it as a housewife. Women were more often away from work when they were sick, or they would eventually become pregnant and need a leave from work or they did not come back.<sup>109</sup>

### **3.3 Development of Higher Education of Women and Engineering Education in Finland**

#### **3.3.1 General Development in Education**

Finland started to reform its schooling system in 1866 but the law for compulsory education was passed relatively late in 1921 and it was fully carried out after WWII. Large age groups gave pressure to schooling system, new schools were established in large numbers between 1950's to 1970's and the system was standardized. Education was not valued among the people in the countryside until 1960's when it was seen as a way to better life. Most of them did not have afford to educate their children because schools were not located near.<sup>110</sup>

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<sup>106</sup> Korvajärvi 2010, p. 187; Naskali 2010, p. 281; Pohls 2013, pp. 127-128; Puro and Lundell-Reinilä 2020, pp. 124, 148, 150

<sup>107</sup> Eskola 1968, p. 30

<sup>108</sup> Eskola 1968, p. 31; Turunen 1968, p. 39

<sup>109</sup> Baude 1966, pp. 64, 68, 72; Liljeström 1966, p. 25

<sup>110</sup> Kivinen and Rinne 1996, pp. 81-82

In the end of 19<sup>th</sup> century, women's movement started to plead their case on gender equality and better education for girls and women. Changes were made and women had more opportunities in education when reforms took place in secondary and grammar school teaching which led to that at the beginning of the 20<sup>th</sup> century 50% of the pupils were girls.<sup>111</sup> Until that the girls that aimed to university was hard and unclear path. Girls were not first allowed to same schools as boys and schools for girls aimed to rise girls as wife's and taking care of their households and did not prepare them for any occupation. Teaching was all-round education and studies were seen physically heavy for girls as well as they were seen as slowly developing and weak. Too much education was seen to be harmful for their roles as women and their calling as mothers and wives. Girls' Schools normally had grades from 1 to 4 and lasted seven years where the last grade was for those that wanted to become teachers. About the age of fifteen girls had reached the highest level in that was possible.<sup>112</sup>

If women wanted to get into university, they have to apply as a private student in boys' gymnasium and do matriculation exam. First mixed-secondary school was founded in 1880's first in Swedish and later ones in Finnish. These schools created the equal path to universities for boys and girls. Mixed schools were also great to smaller cities where it was hard to have separate schools for both sexes with small resources. Many mixed schools were not supported by the government and girl gymnasiums were not endorsed until 1915 when they were allowed to become girl gymnasiums that aimed to teach students to get into universities and were very significant education offerors in 1920's and 1930's. Renewing the school system for girls was seen necessary because of the need for earning possibilities for middle class unmarried women but still university level education was not guarantee for employment.<sup>113</sup>

First university opened its doors for women in Switzerland in 1860's and first women doctor graduated in 1868. In Finland women were first allowed to monitor the lectures of medicine 1871 onwards, participation to all lectures were not allowed and they could not enrol to university. They also have to apply dispensation from their sex to be allowed to study until 1901 when women got equal right to study in universities. Tough applying for the dispensation had been more of a formality from the 1890's onwards and only two women were denied for the dispensation during its stand. This was probably affected by the student riots in Saint Petersburg in 1970's which is why no women applied to university between 1870-1899. One opportunity that was open for women was to become teacher

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<sup>111</sup> Naskali 2010, p. 381; Buchardt et al. 2013, p. 16; Pohls 2013, pp. 76-77

<sup>112</sup> Leino-Kaukiainen and Heikkinen 2011; Strömberg 2011, p. 121; Pohls 2013, pp. 76-77; Kaarninen 2015a, pp. 26-27; Puro and Lundell-Reinilä 2020, pp. 23-24, 32-35

<sup>113</sup> Kaarninen 2011, p. 408; Leino-Kaukiainen and Heikkinen 2011, pp. 26-27; Strömberg 2011, pp. 134, 139; Kaarninen 2015a, p. 163; Puro and Lundell-Reinilä 2020, pp. 38-39

and study in teacher's seminar in Jyväskylä which was founded in 1863.<sup>114</sup> In Finland women's university studies were more common than in Sweden and with relation to population Finland had the most women university students in whole Europe. Between 1870–1901 about 700 women registered to universities in Finland and in Sweden between 1870–1899 about 200 women registered. Women who studied in universities were from upper social classes because education and schooling were expensive. In many families they did not have funds to educate multiple children. Normally families invested to boy's education because girls can get along without education.<sup>115</sup>

After the change of the schooling system, first wave of women university students was between 1885 to 1900 and at the same time students in universities increased rapidly. In generally started the conversation of about flood of student and especially women in the university which started the talk about restricting women's entry to university. Many thought that women did not do as well in their studies as men and thus they could not manage their studies in universities. And it was also unsettling that women started to gravitate towards male-dominated areas.<sup>116</sup>

In 19<sup>th</sup> century, Finland had only one university that was situated in Turku until the city burned in 1828 and university moved to Helsinki and renamed as Imperial Alexander's University in Finland (Keisarillinen Aleksaterin-Yliopisto Suomessa) which was renamed as University of Helsinki in 1919 (Helsingin Yliopisto). University did not teach technical and business studies which created the Helsinki University of Technology in 1849 and Helsinki Higher School of Business in 1911.<sup>117</sup> At the beginning of the 20<sup>th</sup> century when number of Finnish students increased significantly, desire for first Finnish university was rising. After several territorial disputes about the location of the university it was decided to establish it to Turku in 1920.<sup>118</sup> At the end of 19<sup>th</sup> century to beginning of the 20<sup>th</sup> century the students social background was changing when schools leading to university were not only for the children of the upper social classes. Higher education turned from elite only universities to general people's universities when large age groups came to the schooling system. Broadening of the university network started in 1960's and continuing till 1970's when higher education opportunities were broadened to cover whole country.<sup>119</sup>

In Finnish universities women studied mostly medicine, business or to become teachers because these were the careers, they have opportunity to achieve

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<sup>114</sup> Kaarninen 2011, pp. 412–413; Leino-Kaukiainen and Heikkinen 2011, pp. 26–27; Engman 2015, p. 17; Hakosalo 2015, pp. 25–26; Kaarninen 2015a, p. 162; Puro and Lundell-Reinilä 2020, pp. 21, 28

<sup>115</sup> Fredriksson 1966, p. 96; Kaarninen 2011, pp. 412–413; Puro and Lundell-Reinilä 2020, pp. 32–35, 43

<sup>116</sup> Kaarninen 2011, pp. 421–422; 2015b, p. 37; 2015a, pp. 162, 163, 180; Puro and Lundell-Reinilä 2020, pp. 23, 109, 112

<sup>117</sup> Leino-Kaukiainen and Heikkinen 2011, pp. 28–29

<sup>118</sup> Strömberg 2011, pp. 129–140

<sup>119</sup> Kivinen and Rinne 1992, p. 84; Kivinen, Hedman, and Kaipainen 2007, pp. 237, 244–245

and get. For example, women did not study law because they were not offered careers with jurisdiction which was seen unsuitable for women. Also, technical studies did not tempt women in the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century.<sup>120</sup> The law, medicine and technology remained for a long time as male-dominated fields because long established entrance examinations which decreased the number of women applicants. One of the reasons where prejudices that women have to face, especially in Helsinki School of Technology where engineering had a strong male label and where women were seen as non-professionals that have come to seek husbands from lecture halls. Many thought that there is no place for women engineers or leaders, and they do not get jobs. That is why gender roles effected for a long time to the choices in choosing the field of study.<sup>121</sup>

### 3.3.2 Engineering Education in Finland

In Finland, there was three universities of technology which were Helsinki University of Technology (Teknillinen Korkeakoulu, HUT), Tampere University of Technology (Tampereen Teknillinen Korkeakoulu, TUT) and Lappeenranta University of Technology (Lappeenrannan Teknillinen Korkeakoulu, LUT).<sup>122</sup> First technological university was HUT that was founded in 1849 and worked in different forms and names until 2009 when the Aalto university was founded. Aalto combined three different universities into one which included HUT, Helsinki School of Economics and University of Art and Design Helsinki.<sup>123</sup> TUT was first a part of HUT as its branch location in 1965 but it was made to its own university from 1972 onwards. It merged with University of Tampere in 2019.<sup>124</sup> LUT was founded 1969 and it is still operating with a branch in Lahti. As an addition to these, a major engineering educational establishment is University of Oulu's technological faculty that was originally founded in 1959. The faculty does not have separate history of the faculty, so it is not used as a part of the evolution of engineering education part, but their Technological student's association does have its own history that is used as a part of the engineering student's association's history.<sup>125</sup> There is also technological students and teaching in University of Turku (1922) and Åbo Akademi (1919), but they do not have histories that could be used as part of this research. Along with the former is University of Vaasa (1968) but it started to offer engineering studies only in 1990's along with HUT so it is not relevant to this research.

Engineers were not valued until 1940's; only after the 1930's depression, need for engineers increased. After the second world war their value increased

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<sup>120</sup> Pohls 2013, p. 19; Puro and Lundell-Reinilä 2020, pp. 38–39, 53–54, 56, 126

<sup>121</sup> Liljeström 1966, p. 22; Pohls 2013, pp. 76–77; Puro and Lundell-Reinilä 2020, pp. 38–39, 53–54, 56, 126

<sup>122</sup> Michelsen 1994; Nykänen 2007a; 2007b; Häikiö 2015

<sup>123</sup> Nykänen 2007a, pp. 7, 13, 154–155

<sup>124</sup> Nykänen 2007a, pp. 7, 13, 154–155; Häikiö 2015

<sup>125</sup> Michelsen 1994

but their education was still lacking. At this point only one establishment offered proper education for engineers and number of engineering student stayed low until 1930's. Contents of engineering education and number of engineering students was regulated by Ministry of Trade and Economic Affairs.<sup>126</sup> Engineers increase in value led to changes in university education policy and new engineering education establishments were opened. Therefore, institution or college level engineering teaching facilities were created to offer more engineering education in 1940's. These institutions were later transformed to universities of applied sciences and aimed to offer more basic engineering studies in bachelor's level compared to universities of technology that offers master's level studies.<sup>127</sup> In 1960's more engineering institutions and universities were opened to respond in the need of technological professionals and new universities of technology were established to Tampere and Lappeenranta which led to decrease of applicants in HUT and increase in TUT and LUT.<sup>128</sup> Engineers experienced social rise in 1970's but still in next decades there was a need for more students in engineering education and number continued to increase. Engineers were employed quickly after graduating but the small numbers of engineering students created need for skilled engineers.<sup>129</sup>

Women got equal rights to study in 1896 but there were still quite few women students at the beginning of 1900's. First woman graduated from STEM field as architect in 1890 and after that, women came steadily to STEM and engineering fields. The biggest problem at the time among women that had higher education was that they dropped out from the studies and work because they started a family. On the other hand, if women did not start a family and put their work life as a priority, they were looked down.<sup>130</sup> In 1905 there were 14 women students which was 3% of all students and number increased steadily. In 1917 there were 29 women students which was still about 3% of all students, but among architect student's women were consisting of 39% of the students. In 1930's women students covered about 11,5% of all students. During the second world war the number of women increased to 26% of all students because most men were in war and decreased back to between 6 to 8% after the war and stayed there until 1970's when it increased to 18–19% and in 1990's to 22%.<sup>131</sup>

Appearance of women technical students started in 1920's when students from secondary school emerged to universities. Women that wanted to start to study engineering or in STEM field did not face strict obstacles that were aimed straight to limit women in the field. Women in many cases encountered negative general opinion towards women technological students and many times they did not possess required basic education. Women started to study generally more in

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<sup>126</sup> Michelsen 1994, pp. 46–47, 50; Häikiö 2015, p. 69

<sup>127</sup> Hyvönen 2013, pp. 37–39; Mäki 2013, p. 11

<sup>128</sup> Michelsen 1994, pp. 46–47, 50; Häikiö 2015, p. 69

<sup>129</sup> Michelsen 1994, pp. 46–47, 50; Häikiö 2015, pp. 224, 226

<sup>130</sup> Hanski 1997, pp. 268–269; Nykänen 2007a, pp. 41, 259–261

<sup>131</sup> Hanski 1997, pp. 268–269; Nykänen 2007a, pp. 41, 259–261



1920's and in 1930's women students percentage increased heavily in universities. There were some arguments that women should move to fields that fit them more physically and characteristically because engineering is too dirty and physically demanding.<sup>132</sup> Women studied in architecture, chemistry and in mechanical engineering. Architecture was the most popular one among women students from the 1880's onwards. Architecture was seen as an artform and thus seen more suitable for women. In 1930's 37 women studied architecture, four in chemistry department, one in mechanical engineering and one in land surveying department. In that time HUT concluded 743 students which had 43 women.<sup>133</sup> In Finnish universities as whole had at the time 5530 and on that was 2144 women. That created a conversation that in universities should create quota restriction to women students with a special attention to architectural department that had too many women. In the 1930's it was harder to get in in HUT than to University of Helsinki which was seen a more suitable place to women to study.<sup>134</sup>

During the war time in 1940's the teachers board of HUT expressed the problem of women students and restricting their intake again, especially in the department of architecture, two times. In the first handling of the subject, it was dismissed after some professors expressed that it could be against the law and the rules of HUT. In the second handling the school suffered student loss where most of the male students were in front and women tried to help in war effort but still to increase the number of women students, duty to work for women to cover not being in the front was suggested.<sup>135</sup> There were more openings than new students that started their studies and only in traditionally departments that had more women students had more applicants than could be taken in. This created the problem for some where relative proportion of women increased too high. Students' union was not prepared for this, and they wanted broader student body, which meant more men. In the front, studies were not the most important thing, and many did not forward their studies. And at the time women's right to study was still seen unnecessary which had negative aspect on women's studies.<sup>136</sup> After the war HUT faced increased applicant numbers and decided to arrange entrance courses to eliminate students by clarifying their starting level and pick out the students. This decreased the activity of the women applicants but still in 1945's entrance course had over ten women and half of the graduates of the 1947 architect course were women.<sup>137</sup>

The number of students in universities increase rapidly in 1960's and was more than three times more than before the war in all universities. In 1960's women in higher education and in engineering were already a more common

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<sup>132</sup> Nykänen 2007a, pp. 41, 254–255, 260–261

<sup>133</sup> Hanski 1997, pp. 268–269; Nykänen 2007a, pp. 259–261

<sup>134</sup> Nykänen 2007a, pp. 254–255, 260–261

<sup>135</sup> Nykänen 2007a, pp. 41, 289, 293

<sup>136</sup> Nykänen 2007a, pp. 41, 256–257, 314, 318

<sup>137</sup> Nykänen 2007b, pp. 42, 48

thing and problems with educating women was not that obvious than it was before. Therefore, women engineering students were not a big of issue which is why these problems are not mentioned in other histories of universities of technology like it was mentioned in HUT history.<sup>138</sup> But in Tampere, Engineering student's union was worried about women's transforming to work life in 1975. They thought about restricting the universities intake of women students and placing them for more women suitable fields like textile industry. This was argued for that industry only needed few women engineers yearly because people do not want women to be their leaders and managers. Also, women were seen as not suitable for management roles without few exceptions. Universities did not want to educate women to become unemployed, but Engineering student's union eventually did not support this, and the conversation was over. This worry was baseless because already in 1950's only 10% of the women did not end up working in the field and the women outside of the workforce were housewives.<sup>139</sup>

In Finland women are completing engineer studies relatively low, 19%, when in Central and Southern Europe the same number is about 30%. Male dominance in the engineering is seen to be against equality.<sup>140</sup> Many studies have aimed to solve the problem and get more women to the field. This manifest in the marketing and in the popular culture. TINA initiative was created to tackle the problem from the beginning. It supported girls in comprehensive schools and encouraged them to apply in STEM field and give them more practical experience.<sup>141</sup> University Education Politics have tried to meddle with this problem from 1980's onwards by increasing initiatives that aims increasing the number of women students in engineering. Women in engineering feel that they are facing some discrimination in their studies, however they are mostly content of the atmosphere in universities and the sex ratio of the students. Women feel that the problem is more in internships and transforming to work life which is seen less equal between women and men employees. There are also big issues combining work and family life especially among women engineers but still in the industry they are in better position than women in other industry. In engineering women have more regular contracts and face less unemployment.<sup>142</sup> HUT started to do changes to support women in the beginning of 21<sup>st</sup> century. They participated to European Social Fund's initiative, which intention was to develop the culture and to notice different needs and physical aspects of women. Program of Bioinformatics technology was created to attract more women to the field. HUT offered more support to students and women which started to advance men's studies as well at the same time.<sup>143</sup>

Problems in engineer education are more wide-ranging than just based on sex. One of the ways to answer this issue of discontinued studies was to invest in

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<sup>138</sup> Michelsen 1994; Nykänen 2007b, pp. 180, 199; Häikiö 2015

<sup>139</sup> Vilander, ed. 1992, p. 24; Nykänen 2007a, pp. 256-257

<sup>140</sup> Vilander, ed. 1992, p. 24; Korvajärvi 2010, p. 197

<sup>141</sup> Korhonen-Yrjänheikki 2004, p. 62; Nykänen 2007b, pp. 332-333

<sup>142</sup> Korhonen-Yrjänheikki 2004, pp. 63-64; Nykänen 2007b, p. 332

<sup>143</sup> Nykänen 2007b, p. 332

the dual model between universities and universities of applied sciences that were created in 1990's in Finland.<sup>144</sup> Though many problems rise when teaching and education differed a lot compared to other subjects in universities of applied sciences and standards of the education was seen too low compared to universities that offered master's degrees, universities of applied sciences aims mostly to the Bachelors degrees. Master's degree in engineering aims to educate experts in engineering, readiness to continuous learning and scientific advanced studies to get doctoral degree.<sup>145</sup>

### 3.3.3 Technological Student's Associations and Women Students

Oldest technological student's association was founded by students from HUT. First associations were established after 1850's. Women were seen as problem among men students in technological student's associations like in any other male-dominated field but still women were actively participating in the association regardless of their small percentage of all the students. In 1930's number of women increased among engineering students even if it still was manly world. The great revolution of the women's visibility happened in 1932 when women students edited a whole number of the technological student's paper.<sup>146</sup>

Women were not first accepted, and they tried to adjust themselves by trying to be more maculing and be one of the men. Men tried to repel them away to places they thought will fit women more which were universities. What made it even harder for women to participate was that the activities in technological student's association were not seen proper for women for its nature of rumbustious actions and drinking. Tough arriving of the women and their number increasing changed the culture; it calmed down and got more diverse. Women created their own clubs and sport teams, men did not take women to their teams as well, to support women engineering students and aimed to equality between men and women.<sup>147</sup> For a long time in technological student's association women students were not in equal position with men. They were accepted to be part of the association but did not get into clubs they had or no entry to committees (first woman got a place in a committee in 1920's) and for a long-time woman only place was to be the hostess in the clubs, for example the first and only woman in wood processing guild where they had here as hostess still after the second world war.<sup>148</sup>

In 1930's number of women increased among engineering students even if it still was manly world. They were not first accepted, and they tried to adjust

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<sup>144</sup> Korhonen-Yrjänheikki 2004, p. 46

<sup>145</sup> Korhonen-Yrjänheikki 2004, pp. 46–47, 56; Nykänen 2007a, pp. 261, 270–271, 273

<sup>146</sup> Hanski 1997, pp. 96, 268–269; Nykänen 2007a, pp. 260–261, 291

<sup>147</sup> Hanski 1997, pp. 268–269; Nykänen 2007a, pp. 260–261

<sup>148</sup> Hanski 1997, pp. 115–116, 268–269, 272

themselves by trying to be more maculing and be one of the men. Men tried to repel them away to places they thought will fit women more which were universities. During the war women got more power in the association when men were at war. Taking care of association were in the hands of women, war invalids, those who were off from the front and men who served in Helsinki. During this time women got into association bord for the first time. Still women students did not just continue their studies, they participated in the war effort by working as a part of Lotta Svärd organization<sup>149, 150</sup> In war time in association some aspects got more equal, but women also lost their rights. Women's room in an association house was given to soldiers, and after the war women lost their housing in associations student housing to former soldiers and refugees from Karjala (area that was lost to Russia during the war). They hoped that after losing their housing, women would not come back to their studies. women answered this by creating a fundraising to refugees. After the war situation got mostly to the point that it was before war and some points even worse.<sup>151</sup>

After the 1960's and 1970's when percentage of women students rose and it got more usual, women's role in associating got more equal to men. When LUT was founded in 1969 there were only one women student, but she got straight into associations bord and in the 1970's more women were taken to the bord. In the 1980's in Oulu and HUT had their first associations bords woman presidents.<sup>152</sup> In the technological student's associations different kind of women clubs and initiatives were created to make association more women friendly and support women students, first ones were established in Helsinki in 1930's. Teekkarinaiset club (Technological Women Student's Club) was created to women students in 1986 in LUT to strengthen the bonds between students and graduated engineers. One of the men students commented the club that it does not have clear view where the club aims and that can be seen characteristics to its creators. Most of these clubs ended operating in LUT at the end of 1990's or in early 2000's because they were seen unnecessary because the atmosphere towards women and equality was changed better.<sup>153</sup>

Tough in HUT at the same time Teekkaritytöt club (Technological Girl Student's Club) was reactivated and more support was created to women and help them to be better off with their studies. Research noticed that women have relatively less practical experience. Initiative was created to support girls in comprehensive school to learnt practical technical skills and it was noticed that supporting female-friendly aspects also affect positively of men students learning results. They also started to arrange girl excursion to create networks among students and graduated people in the work life. The idea was to share experiences and transfer the silent knowledge.<sup>154</sup>

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<sup>149</sup> Nevala-Nurmi 2012

<sup>150</sup> Hanski 1997, pp. 107, 131, 156, 160, 162, 234, 269; Nykänen 2007a, pp. 261, 291

<sup>151</sup> Hanski 1997, pp. 107, 131, 156, 160, 162, 234; Nykänen 2007a, pp. 261, 291

<sup>152</sup> Hanski 1997, p. 269; Valta 1999, pp. 16, 19, 21; Saarela 2010, p. 89

<sup>153</sup> Valta 1999, p. 72; Nykänen 2007a, pp. 261, 270–271, 273

<sup>154</sup> Nykänen 2007b, pp. 332–333

Women engineering students were quite seldom mentioned in all of the histories. Mostly they were mentioned in Hanski's (1997) book but also in that history women get a one short chapter and few mentions when there have been clear problems in attitudes and in equality between men and women students in associations. They did not accept women and were sometimes hostile towards women and did not see them as fitting in the industry. As a remark, although Hanski is covering the HUT's student associators, Nykänen (2007a, 2007b) is doing more detailed work to cover women in technological student's association.<sup>155</sup> There has been and still is issues that are connected to women engineering students and women in STEM field and these issues are relatively easily dismissed and unrecognized.

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<sup>155</sup> Vilander, ed. 1992, p. 24; Hanski 1997, pp. 269–273; Nykänen 2007a; 2007b; Saarela 2010, pp. 16, 19, 21, 72

## 4 DATA AND METHODOLOGY

### 4.1 Finnish Forest Products Engineers' Association

Finnish Forest Products Engineers' Association (FFPEA, Suomen paperi-insinööri-yhdistys) was founded in Helsinki on 12<sup>th</sup> of April 1914 to support paper engineers' benefits and to gather them together in a brotherly club to boost team spirit and share knowledge. Association was founded by small group, about ten men. The rules of the association were made to be strict where only certain people with certain profession and those that have already worked for some time were accepted as members so the comradely spirit would stay the same. Student were not allowed and most of the members were elderly or already retired gentlemen. They wanted that the association would be exclusive.<sup>156</sup> Association did not write a rule about joining of women members because to them it was obvious that paper engineers are men. They did not want women/ladies/dates to be a part of the dinners after official meetings or their summer trips. These women discriminating practise was normal in the early years and did cause conversations. At the summer trip of 1917 and by yearly meeting women were allowed but participation was low. Eventually rules were made to exclude women altogether out of the association's activities. According to Komulainen (2014) this was extraordinary at the time and association wanted to keep its actions related to their profession. At the time women had a strong role in the norms of participating social activities but the new forms of socialising allowed women to be left out when topic was related to profession or hobbies.<sup>157</sup>

As their goal, paper engineers wanted to better the conditions of the factory workers, but the Finnish civil war<sup>158</sup> caused scars among the different social classes. Engineers were stuck between the workers and the owners even if they wanted to stay neutral. In principle they were whites and were included in the cruelties of the war when some of them were killed. This created negative approach to reds and socialist who they no longer wanted to be part of their association which led to ending the process better the workers conditions and attentions of the association were moved towards evolution of engineering education.<sup>159</sup> After the first world war and civil war, Finland faced engineer shortage when foreign engineers left Finland due to the wars. A lot of work was available until the 1930's depression that caused unemployment until at the end of 1930's

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<sup>156</sup> Alho 1966, pp. 13–15; Komulainen 2014, pp. 15, 30–31, 108

<sup>157</sup> Alho 1966, p. 29; Komulainen 2014, pp. 31–33

<sup>158</sup> Finnish civil war lasted from January to till May in 1918, it was a war of the social classes-Finnish reds were socialist that concluded workers and farmers who did not own their land. Finnish whites were mostly the owning class with more wealth. The whites won with the help of Germany. More information for example Tepora, Roselius, and Aapo Roselius 2014

<sup>159</sup> Komulainen 2014, pp. 55–62

demand of paper increased rapidly due to exports which repaired the employment situation. At the beginning of the 20<sup>th</sup> century amount of technology increased in the industry which raised the engineers in the top management and in the 1930's about 40% of the CEO's were engineers. Value of the educated and professional engineers increased. Paper engineers were mostly wealthy and prosperous.<sup>160</sup>

FFPA's number of members increased slowly. Between the wars memberships increased steadily and at the beginning of the 1920's association had 111 members and at the end of 1920's there were 195 members (Figures 1 and 2). At the time when number of the members increased profession titles widened as well. Widening of the membership base caused problems when they wanted to comradesly atmosphere to survive, and they reinforced in events like summer trips and associations birthday celebrations. In 1933 the association rules were changed so that the members that change profession could stay as members and again in 1940's rules were changed to that all persons who worked with pulp were allowed to join as members. Defining the member base was hard and partly strictly exclusionary because they did not want to increase membership base rapidly. The reason behind this was the valuation of their profession and the membership of the FFPA.<sup>161</sup> The rules of the membership were again under the consideration in 1956-1957, 1961 and again in 1970's when membership base was broadened gradually, and the rules were a lot stricter than other affiliate organization abroad. Women joining the association caused friction among its members. In the first history of the FFPA Alho (1966) mentions that some members expressed their dissatisfaction to the situation where women engineers who worked as librarians in some companies could join as members but at the same time men who work as energy departments of the large pulp and paper companies cannot join.<sup>162</sup> In 1950's and after the popularity of the paper engineering among students started to decrease which was noted in the association. They tried to make it better and modernize the education to make it more popular, but the effect was low.<sup>163</sup>

First women joined the FFPA in 1930's and started to participate in the action's activities. This was continuum to the increase of the women students in engineering in 1920's. Even though most of the women graduated as architects from HUT, the first women in FFPA become pioneers and role models. The first history of the association gives women members a quite negative picture and do not mention the first women members at all even though it was revolutionary at the time when there were only a few women engineers, the field was male-dominated and the associations rules where strict and every member needed several referees. As well in the 1930's the strict rules about dates were finally solved and

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<sup>160</sup> Alho 1966, p. 46; Komulainen 2014, pp. 65, 68, 71, 101, 104

<sup>161</sup> Alho 1966, p. 47; Komulainen 2014, pp. 100-101, 128-130, 142-145, 213-215, 218

<sup>162</sup> Alho 1966, pp. 87-88

<sup>163</sup> Alho 1966, pp. 87-88; Komulainen 2014, pp. 100-101, 128-130, 142-145, 213-215, 218

women were allowed to participate as dates. Excursions to women were arranged while men toured the factories. Women took part more actively to associations actions in 1960's and 1970's onwards.<sup>164</sup> Fear of women was still present in the association in the 1970's; number of women kept rising after the field had been for a long time so male-dominated. Women formed in the end of the 1970's about 40% of the field. Prejudices alone were not the only reason for the fear of women, many were worried about the unemployment of the women. Many discontinued their studies in the end of the 1970's and the beginning of the 1980's because of the unemployment caused by financial and economic problems at the time.<sup>165</sup>

Masculinity in the forest industry could not be changed in a moment, but the attitudes towards women changed as their number get increasing in 1980's when about 8% of the engineers were women (Figure 2). Women took a stronger stand in associations actions: first woman was accepted as a part of Finland's technical associations board in 1981, and same in FFPA couple of years later. FFPA founded women division at the middle of 1990's but its activity subsided at the beginning of the 2000's, professionalism without gender limits has rase in general opinion. In 1999 first women, Pirkko Molkentin-Matilainen, was chosen as managing director of the FFPA. Under her management, the increase of the women continued and in 2013 about 20% were women in FFPA.<sup>166</sup>

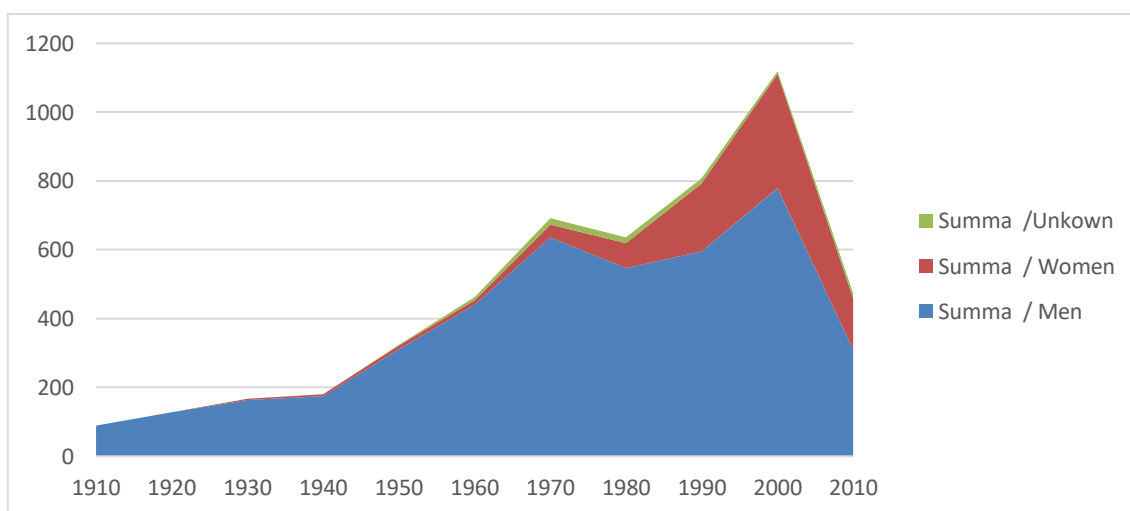


Figure 1 FFPA Members Joined Yearly

Source: The FFPA registers

<sup>164</sup> Alho 1966, pp. 47, 75; Komulainen 2014, pp. 94–97, 183, 185

<sup>165</sup> Komulainen 2014, pp. 216–217

<sup>166</sup> Komulainen 2014, pp. 216–217



In 1980's FFPA encountered member crisis, number of the members had decreased and there was a challenge to find voluntary members to become managing director, which was unheard of in the history of the association. Last women's lunch was held in 1986 for the member's wives when only two attended. Mode of operation and the base of the membership fee were changed with the broadening of the membership base in the 1980's and 1990's. Joining of the women and student members broadened member base. 130 students joined the association straightaway (Figure 2). This changed the association from the rule of older generation to the younger generation. In the 1990's association women members achieved high accomplishments when working as a part of the VTT's group which got the first prize from the Ministry of the Environment.<sup>167</sup>

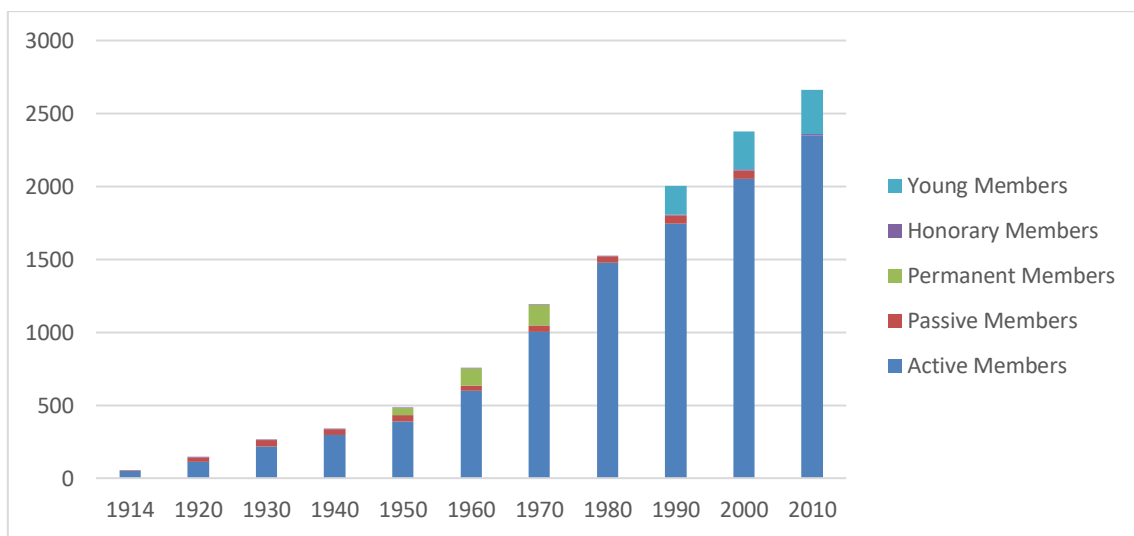


Figure 2 Number of FFPA Members.

Source: The FFPA registers

## 4.2 FFPA Data

As a data for this research materials that are used had been gathered from registers of Finnish Forest Products Engineers' Association (FFPEA). This register informs all members of FFPEA with information of their education, workplace and station, date of birth and when they joined to the association between years 1914–2022. This gives the information for the pair comparisons. Add to this FFPEA's other archive material are used: minutes of the executive committee of FFPEA, protocols of the association, some marketing materials and interviews made by FFPEA. Data for studying three histories of university of technology and from four student associations are used. Add to that some autobiographies will be

<sup>167</sup> Komulainen 2014, pp. 187, 213–215, 218–221

used. All of these are used to get a full picture of what it was like to be women engineer and how their careers developed.

Main data of this research is FFPEA's register of its members. There is 821 women in data (could include some doubles if joined several times or changed their name) and first 20 women that appeared in FFPEA's members for pair comparisons are picked (Table 1). The first twenty women are chosen because it felt natural on the restrictions created by the data. First women joined the association in 1930 which created the starting point for the timeline of the study. The 20<sup>th</sup> women joined in 1957 and the next one joined 1960 (Table 1). That seemed as a natural ending for the timeline of the first comparison because without it, the timeline would start to be too wide and Finland as a society started to change rapidly and extensively in 1950's and onwards. Therefore, it was not reasonable to widen the first timeline and to made it shorter would have limited the comparison data to be lower. First ten women joined between 1930 to 1949 and that would have been quite narrow data for comparisons (Table 1). Data for joining is not perfect. Some people have joined several times throughout years and decades, possible doubles are tried to be avoided, but some could still appear in the data as well some women are there possible several times after changing their last name through marriage. Explanations for several joining's and re-joining's are that in the early days of the association, there were no permanent memberships which could have caused some member to drop. As well as changing workplace that was not part of the approved occupations by the association and changing mind on being a member. Unknown cases are ones where gender was not able to be determined because member only informed their initials.

Table 1 FFPA Members Joined on Decade

Decade	Men	Women	Unknown	Total in decade
1910	89	0	1	90
1920	128	0	1	129
1930	164	3	1	168
1940	174	7	0	181
1950	311	10	2	323
1960	440	13	10	463
1970	636	37	19	692
1980	546	74	16	636
1990	595	197	15	807
2000	779	332	8	1119
2010	311	148	15	474
<b>Total</b>	<b>4173</b>	<b>821</b>	<b>88</b>	<b>5077</b>

Source: The FFPA registers

Table 2 Number of FFPA Members

Year	Active Mem- bers	Passive Members	Permanent Members	Honorary Members	Young Mem- bers	Total
1914	51	3	0	0	0	54
1920	110	32	0	1	0	142
1930	217	42	0	1	0	260
1940	298	38	0	4	0	340
1950	389	42	49	3	0	483
1960	599	37	115	3	0	693
1970	1004	42	140	5	0	1191
1980	1476	45	0	4	0	1525
1990	1744	56	0	6	199	2005
2000	2051	60	0	6	261	2378
2010	2349	0	0	9	302	2660

Source: The FFPA registers

For selected women a man pair has been picked, from the same data. The aim was to find as similar pair as possible as too excessive differences may lead to too many variables.<sup>168</sup> As second time period for comparison, 1980's is chosen as there is enough time for possible development between the periods and people in the data have full or almost full careers. In the 1980's, 74 women joined to the association. Women from first five years of the decade will be chosen for comparisons, which is 29 women. Choosing the men will be done same as with the earlier data.

For most of the women, there were several comparable men candidates with similar background. Of them, the candidates were picked randomly. If similar enough pair was not found, as similar as possible was chosen. In deciding pairs for comparison, the main aim was to find people with same educational

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<sup>168</sup> Tarrow 2010, p. 234

background, after this the joining year to the association and age were given priority. If perfect match was not possible, compromises were made depending on the case. The cap in age and joining year was tried to keep as minimum as possible so the careers would be as long with both pairs, and this would not be as main variable. The pair matching and mismatch are shown in Table 3. Nearly two thirds of the pairs are perfectly matched. Rest of the cases compromised with one or two variables. In most cases with age, 35%, and joining year, 14%. Only 4% compromised with education background which was caused by the fact that there were not enough members in the early years, which caused more mismatch between pairs. In some cases, compromise was not possible due to creating too many variables, therefore two men are used two times in pair comparisons. Full pair comparisons are presented in the Appendix 1 and 2.

Table 3 Comparison Match

Comparison Match with Pair	Number	%
Matches perfectly	29	59%
No match in some area	20	41%
Age Difference (under 5 years)	17	35%
Difference with joining year	7	14%
Difference in education	2	4%
<b>Total</b>	<b>49</b>	<b>100%</b>

Source: The FFPA registers

The registers of FFPEA were originally in book format listing name, education, working place and position, some personal information (for example, address, later email and phone number). Some also added their picture, but it was not mandatory. Members themselves were responsible for the information that ended up in the registers. Register books were made about two to four per every decade starting from 1927. Last one that is available is from 2022. Pictures were first time added in 1937 to make co-operation with other Nordic associations easier.<sup>169</sup> From these register books three different Excel lists were formed. The first list has all the members with their names, date of birth, education, graduation year and year when they joined to association. At this point to join, one had to be already working somewhere to be able to join. In the second list is listed every member's job places and sometimes job positions with starting and ending years were listed. Some of the members did not mention their job positions and it was not mandatory. This could have meant that they did not want to tell their position

<sup>169</sup> Komulainen 2014, p. 94

because it was not high enough compared to others or that their position did not change equally with colleagues, in other words, they were not promoted. In the last list was listed all the women and changes in their information, such as the change of last name changed due to possible marriage, was listed. The first list is used to choose my pairs by looking their entry year and graduation year to be close. Due to this at first their jobs or career development it is not known and therefore it made the research more objective without biases.

Most of the FFPA members were Engineers with master's degree or higher (about 65–70%), Rest were engineers with bachelor's degree (about 16–23%) or with bachelor's degree or higher in science, chemistry or physics (about 7–8%). Some have other degrees, that were not classified in the material, or they did not mention their degree (about 2–5%) (Table 4). In table 4 DI means Master's in engineering, TL is licentiate of technology and TT is doctor of technology. Engineer is bachelor in engineering. FK, FM, FL and Ft are science degrees from bachelors to doctor. Table four shows that most of the members have masters in engineering which can be seen in the data of the research.

Table 4 Degree Structure of FFPA Members 1955–1979

	1955	% of 1955	1960	% of 1960	1965	% of 1965	1970	% of 1970	1975	% of 1975	1979	% of 1979
<b>DI, TL, TT</b>	366	70,7 %	485	70,9 %	594	70,9 %	686	69,0 %	819	67,0 %	842	66,4 %
<b>Engineer</b>	84	16,2 %	116	17,6 %	145	17,3 %	196	19,7 %	285	23,2 %	298	23,5 %
<b>FK, FM, FL, FT</b>	41	7,9%	54	7,9%	71	8,5%	80	8,1%	96	7,8%	98	7,7%
<b>Other degree</b>	14	2,7%	18	2,6	19	2,2%	26	2,6%	19	1,5%	21	1,7%
<b>No mention</b>	13	2,5%	11	1,6%	9	1,1%	6	0,6%	7	0,5%	9	0,7%
<b>Total</b>	518	100 %	684	100 %	628	100 %	994	100 %	1226	100 %	1268	100 %

Source: The FFPA archives

When using persons as a research object, it is important to think about how to do ethical research. Research ethics covers research subject and respectful handling of the researched persons. They are not looked only for as individuals; they main aim is to look the subjects as a whole and them as a part of the phenomenon. Lidman et al. (2017) mentions in their article collection that as a part of the new way to look research ethicality is that people from the past should be respected, avoid scandalising the subject and acknowledge the feelings of the readers. Research ethicality is not anymore just sincerity and demonstrating most objectively the portrayal of what has happened.<sup>170</sup> This research is aimed to be done as objectively as possible presenting researched persons as presentation of their own group of people, not as individuals.

Women's agency as research subjects has been coming more usual in all research areas. Gender studies in social sciences have been pioneers in the research of women, femininity and gender studies that bring up different views and data that is some cases is unfamiliar in other fields. Gender studies mix different methods to get the view of the researched person recognising differences and dissimilarities. Therefore, views and methods of gender studies fits among other fields of research, not just in social studies.<sup>171</sup> In gender studies and fields around, the term of intersectionality has become important. In intersectionality gender, age, ethnical background, social class and sexual orientation affects individual's experiences and place in society. This helps researchers to look deeper on what effects the experiences of different people and genders.<sup>172</sup> This is important in this research as well when looking different aspects that could affect career development among women and men.

As a supplementary material, this study FFPA's archive materials were searched through. Archive materials included minutes of the board, studies, teaching materials, structure of FFPA members and interviews. The interviews that had six former noteworthy members of the FFPA interviewed in 2012 and 2013. One of them was woman and rest of the five were men. Interviews did not have same structure; interviewer posed the questions related to the person's history. As the information obtained from the FFPA registers was quite limited and did not offer any useful insights, other source materials are used too. This supporting material gives the study more background information of the aspects that are behind the data and can affect the results. These sources also help to explain the results. Histories of student associations and engineering schools are used in the context chapter to give more background to education of the engineers and general atmosphere among engineers.

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<sup>170</sup> Lidman et al., eds. 2017

<sup>171</sup> Reinharz and Davidman 1992, pp. 197, 243, 252; Hannikainen 2018

<sup>172</sup> Hannikainen 2018

### 4.3 Pairwise Comparisons as Case Study

This study is embedded multiple case study; two cases are selected to compare the cases to find either similar or contrasting results when comparing the cases from 1930-1950's to 1980's. These two cases have multiple sub-units of analysis, that are the pairs (Figure 3) The selected cases emerged from the data and the theory behind the research.<sup>173</sup> The amount of, or lack of, data created the first case and theory suspects that the time view will change the norms and attitudes where there should be change between the cases, therefore the second case of 1980's was chosen. Cases are established of individuals from FFPA data and compared between each other's and between the cases.<sup>174</sup>

Some of the ground-breaking studies in the field have been done through case studies. It has also been highlighted that the importance of case studies is increasing.<sup>175</sup> Eisenhardt's case study methods are used as part of the research to build theories from the cases and test the data to create accurate testable theory that is interesting as part of the deductive process of the research.<sup>176</sup> Previous research has proven that the case study methodology is valuable for the study of career development among men and women. In this research CD is researched through masculine context of the engineering field. Something that must be taken into account is different cultures, which create differencing aspects and base for the study. It is important to note that this study does not use grounded theory building to use strong empirical grounding as the central of the research.<sup>177</sup>

Figure 3 Embedded multiple case study frame

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<sup>173</sup> Yin 2014, p. 57

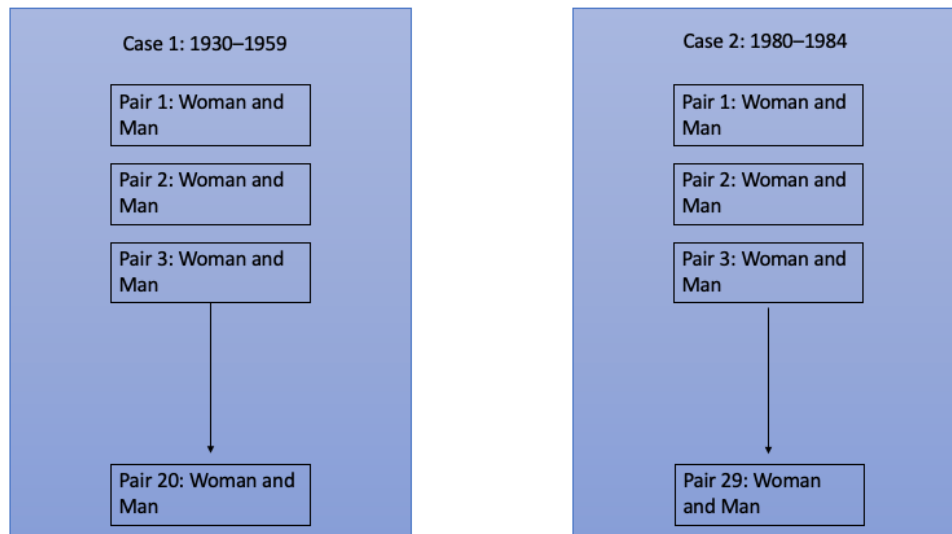
<sup>174</sup> Yin 2014, p. 34

<sup>175</sup> Gibbert and Ruigrok 2010, p. 711; Yin 2014, pp. xix, xx

<sup>176</sup> Eisenhardt and Graebner 2007, pp. 25-26; Gibbert and Ruigrok 2010, p. 732

<sup>177</sup> Eisenhardt and Graebner 2007, pp. 26-27, 30

## Case Study of Engineer Career Development



As it is typical to case study methodology, this research leans on data triangulation, that is, it combines different data sources, for example archive materials, interviews etc. as it is done in this study as well. In this study, most of the used evidence is qualitative. Two cases with 20 and 29 pairs in them is a large enough sample to draw conclusions and small enough to conduct in depth research. Sampling in this study is based on cultural and social aspects, not for statistical requirements. Cases themselves are not chosen randomly but systematically choosing the first ones in the data limited by the timeline aspects.<sup>178</sup> Cross analysis of the data reveals patterns allowing data analysis from many perspectives and to create a well-considered set of actions by using different data collection strategies and data sources. When looking at patterns, the risk of doing information-processing biases is huge, therefore it is important to remember not to jump on conclusions from small data and do generalizations and using subjective judgements. In pattern matching the goal is to find predicted patterns or find ones that are found in previous research but in different context.<sup>179</sup> This study tries to find patterns in career development and see if the gender affects the results and if cultural and normative changes have an effect on the results.

Case studies research many events. Creating a conceptual background with an event history analysis provides noticing patterns in the process data. Complex theories and narratives drawn from process data is not valued over simple theories with good explanations. The goal is to gain understanding of organizational phenomena which in this case is career development.<sup>180</sup> In case

<sup>178</sup> Eisenhardt 1989, pp. 534-537; Langley 1999, p. 695; Gibbert and Ruigrok 2010, p. 714; Yin 2014, pp. 45-47

<sup>179</sup> Eisenhardt 1989, p. 540; Langley 1999, p. 692; Gibbert and Ruigrok 2010, p. 712, 713, 714; Yin 2014, pp. 45-47

<sup>180</sup> Langley 1999, pp. 692, 695



studies showing validity is important when it cannot be proven quantitatively. This is done by creating a clear chain of evidence to show how the study is made starting from the theory building and data collecting to final conclusions. Transparency is created by precise documentation, clear research procedures and creating database.<sup>181</sup>

In this research pairwise comparison is used instead of just comparison because it is more fruitful to compare pairs of men and women than analysing them just as individuals. Pairs for the research are formed to have similar age, status and education and to see where it leads them, as well as to find out if there are differences in their careers and look where similarities or differences could come.<sup>182</sup> Pairwise comparison is the most ideal way to make comparisons between subjects from the data in this research for its capability to make profound analysis of the data. In this method it is ideal to choose most similar subjects under the comparison so the situation can be controlled as much as possible. The factors outside of the controlled comparisons are seen as interpreting factors, as in my case it is sex of the compared subjects.<sup>183</sup>

Common for comparative analysis is that it often leads to generalizations, theories and looking for regularisations.<sup>184</sup> Especially when there is fewer data that is the base for the comparisons, this could create a pitfall that has to be avoided. It is important that in these cases researcher do not go straight to conclusions from the small data and do not note that there could be other explanations behind the results as well. Same results are not necessarily happening in other research that use same methods and same kind of data. The end results are compared with prior research and seen if they align with that.<sup>185</sup> Though it is important to remember that there is no one right way to use comparisons as the method.

Pair or pairwise comparisons are rarely used in business studies and are more common in social and political studies.<sup>186</sup> In business studies, paired comparisons are typically used as a co-method in analysing variables before or after. Normally data for comparisons is gathered from surveys and it is analysing different opinions and outcomes of the surveys are analysed.<sup>187</sup> In this study the pair comparisons are first made using the data from FFPEA's materials. The results are used to find out if the only meaningful variable is gender of the attendees or if there are other explanations too. This study focuses on researching the length of the career, career position and its change, number of employers and changes for international assignments. Comparisons are analysed by using cross-tabulation to detect variables and their effects to career development in engineers career development. Cross-tabulations is a part of quantitative methodology, but

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<sup>181</sup> Gibbert and Ruigrok 2010, pp. 713, 718

<sup>182</sup> Tarrow 2010, pp. 234, 246

<sup>183</sup> Tarrow 2010, pp. 234, 246

<sup>184</sup> Kekkonen 2008, pp. 33, 34

<sup>185</sup> Kekkonen 2008, pp. 33, 34

<sup>186</sup> Tarrow 2010, pp. 234, 246

<sup>187</sup> Zewotir 1999; Hammond 2001; Kappia, Dainty, and Price 2005; Mridula and Sakeer 2020

which is also used in qualitative research in order to identify differences in the data and to create clear results which might not be achieved just by analysing data without cross-tabulations.<sup>188</sup>

As mentioned before, social sciences are known for using and mixing multiple methods like comparative data as part of the research methods creating wider understanding of the phenomenon. Methods of social sciences can be utilized when looking through gender related phenomenon. Comparative methods are mixed with case study methods creating useful tool to analyse individuals and networks. In HRM studies comparative analysis uses more interviews rather than cases.<sup>189</sup>

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<sup>188</sup> Igbaria and Baroudi 1995

<sup>189</sup> Lange, 2012; Mahoney & Thelen, 2015, 5; Brewster et al., 1996.

## 5 RESULTS

### 5.1 Comparing Women and Men Engineers' Career Development

From all cases cross-tabulation are formed to reach comparisons results between pairs in the cases. Cross-tabulations are made on to measure career length, highest career level, career development, international assignments and number of employers. This makes possible to compare different career aspects between the pairs, women and men and between the cases to see similarities and differences to form results on paper engineer's career development through time. Cross-tabulations are helping to spot the results from the qualitative data that could be missed if not concluded numerically. Case sizes differ from the first cases 20 pairs to second cases 29 pairs, but they are still close enough to make comparisons between cases.

#### 5.1.1 Case 1: 1930–1959

From formed twenty pairs career development is researched and measured through cross-tabulations. Career length, development, highest career level, number of employers and number of international assignments are looked to form results. First case's twenty pair's careers lasted mostly from 30 to 39 years (35% of the women and 45% of the men) (Table 6). Women's career length showed more variation than men's careers; 30% of the women had careers that were under 20 years but had more careers that were longer than 40 years than men (20% > 15%). Most of the men had careers between 20 to 39 years (75%) and most of the women had careers between 20 to 49 years (55%).

Table 5 Career Length

	Women	% of W	Men	% of M	Total	% of total
<b>Under 10 years</b>	2	10%	1	5%	3	8%
<b>10-19 years</b>	4	20%	1	5%	5	13%
<b>20-29 years</b>	3	15%	6	30%	9	22%
<b>30-39 years</b>	7	35%	9	45%	16	40%
<b>40-49 years</b>	4	20%	3	15%	7	17%

N	20	100%	20	100%	40	100%
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In the first case, the biggest problem is that many women (40%) and some men (20%) do not report their work positions, only their workplaces (Table 7). This makes analysing CD hard. In Table 7 category one is assistants, secretaries, librarians etc. In level 2 are different research roles, consultants and engineers and in level three are senior, special or other kind of more senior titled researchers. Level four is lower or middle leadership roles for example head of research, project managers, head of laboratory etc. Level five and six are top management; level 5 is for CTO's, CMO's, vice presidents etc. and level six are CEO's and presidents. Women higher, Men higher and Equal between pairs in Table 7 are describing, which one of the pairs was more successful when compared to each other and equal situation describes their having same highest work level. Under and over 10 years describes how long it took to reach the top position in their career. If positions are only some were mentioned, cases were undefined.

None of the women works at the end in the higher positions and work in categories 1, 2 and 4 while men only work at the end of their careers in categories 4 to 6 and only work in different level leadership positions. None of them work in level 1-3 careers in the end. Although it could be that especially men that do not have progress in their career do not inform their career position and same could be with women as well, the category 4 among women is highest achieved reported class (30%). The effects of glass ceiling could be seen in the case even when women have the same educational background and are highly educated. Among the pairs, draw between the pairs was most common, tough it most cases was resulted from both not reporting their career positions (Table 7). Otherwise, men were more successful in their career compared to women, out of 20 pairs 9 men were in higher positions than women, in nine cases pairs work positions were equal compared to each other. In the length of the career development the unreporting is showing strongly. Career development took men longer time, but this is due to their higher positions and women making only to lowest managerial roles.

Table 6 Highest Career Level

	Women	% of W	Men	% of M	Total	% of total
<b>0</b>	8	40%	6	20%	14	35%
<b>1</b>	2	10%	0	0%	2	5%
<b>2</b>	4	20%	0	0%	4	10%
<b>3</b>	0	0%	0	0%	0	0%
<b>4</b>	6	30%	8	40%	14	35%
<b>5</b>	0	0%	2	10%	2	5%
<b>6</b>	0	0%	4	20%	4	10%
<b>Women higher</b>	2	10%	2	10%	4	10%
<b>Men higher</b>	9	45%	9	45%	18	45%
<b>Equal between pairs</b>	9	45%	9	45%	18	45%
<b>Under 10 Years</b>	3	15%	5	25%	8	20%
<b>Over 10 Years</b>	5	25%	10	50%	15	38%
<b>Undefined</b>	12	60%	5	25%	17	42%
<b>N</b>	20	100%	20	100%	40	100%

Table 8 describes career development in levels of how many career levels each progressed during their career. 0 describes no progress or if someone did not report any work positions. In the table, yes situations describe lateral CD and no more horizontal careers, or they did not have promotions or have demotions which are also reported numerically below. Most of the women (70%) did not have any progress in their career. Some did not proceed but mostly due to not reporting their posts. Otherwise, women promoted two or three levels in their career (20% of the women). Among men were more variation but still 45% of the men did not have CD and it was common to rise 2–3 levels among men as well. Tough only 30% of the women had CD while 55% of the men had CD but their careers did not follow the basic theories of the lateral CD (85% of the women and 75% of men). Demotions were more common among men (Table 8).

Table 7 Career Development

	<b>Women</b>	<b>% of W</b>	<b>Men</b>	<b>% of M</b>	<b>Total</b>	<b>% of total</b>
<b>0</b>	14	70%	9	45%	23	58%
<b>1</b>	1	5%	1	5%	2	5%
<b>2</b>	2	10%	4	20%	6	15%
<b>3</b>	2	10%	2	10%	4	10%
<b>4</b>	1	5%	3	15%	4	10%
<b>5</b>	0	0%	1	5%	1	3%
<b>Yes</b>	3	15%	5	25%	8	20%
<b>No</b>	17	85%	15	75%	32	80%
<b>Demotion</b>	4	20%	6	30%	10	25%
<b>N</b>	20	100%	20	100%	40	100%

Having international assignments did not have big variation between men and women. Most of them did not do any international assignments, 80% of the women and 75% of the men. Men did slightly more and those who did assignments abroad did more than one, only 5% did only one (Table 9). Most of the engineers between 1930 to 1959 had one to three workplaces during their career (63% of them all). Only 30% had one workplace in their career. It was usual to have only few employers and stay there for their most of the career (Table 10). Only few had more than 5 workplaces during their career, 3%. It was more common that women have fewer workplaces than men, though in 5 workplaces than more numbers are quite even.

Table 8 International Assignments

	<b>Women</b>	<b>% of W</b>	<b>Men</b>	<b>% of M</b>	<b>Total</b>	<b>% of total</b>
<b>0</b>	16	80%	15	75%	31	78%
<b>1</b>	1	5%	1	5%	2	5%
<b>2</b>	3	15%	2	10%	5	13%
<b>3</b>	0	0%	1	5%	1	2%
<b>4</b>	0	0%	1	5%	1	2%
<b>N</b>	20	100%	20	100%	40	100%

Table 9 Number of Employers

Employers	Women	% of W	Men	% of M	Total	% of total
1	6	30%	6	30%	12	30%
2	4	20%	0	0%	4	10%
3	3	15%	6	30%	9	23%
4	3	15%	4	20%	7	19%
5	2	10%	3	15%	5	14%
6	1	5%	0	0%	1	3%
7 or more	1	5%	1	5%	2	1%
<b>N of Employes</b>	20	100%	20	100%	40	100%

**Observation 1:** Most notably in first case is that most of the women and some men do note informed their job posts, total of 35%, 40% of the women and 20% of the men, they just do report their workplaces (Table 7). And due to this re-posting CD is hard due to not having work post that could be tracked through their careers. Therefore 70% of women in this case do not have career progress and 45% as well did not have any CD (Table 8). Behind this could be shame of not proceeding in their career like others or not having job post that they thought would be high enough. Some just do not want to share every aspect of their life.

**Observation 2:** What was interesting is that at the end of the career women worked in level 1, 2 and 4 while men worked in level 4 to 6 (Table 8). In women's case the glass ceiling is clearly visible, they only reached lower management positions. Men on the other hand only worked on different level management roles at the end of their careers and not on the lower job posts. Some of them could have but did not report that. **Observation 3:** During the first cases time period was the time for breadwinner and housewife time period. Especially men should have risen in their career and women not. In the data, women did follow that and only 15% of the women, who are highly educated and did not quit their jobs for marriage or family, had career development that matches theories of lateral career development (Table 8). In this time most of them men should have lateral CD that followed the theories while they had someone to take care of the household, only 25% of the men followed the theoretical CD. The small numbers were surprisingly slow among men while among women it was expectable.

### 5.1.2 Case 2: 1980–1984

Second case consists of 29 pairs. Same measurements are used as in the first case, so the results are comparable even though case numbers are different. Career length in the second case is in the women's dataset is that most of their careers were between 30 to 39 years, 59% of the women, and mainly women worked between 20 to 39 years, which is 80%. Women in this dataset did not have careers over 40 years (Table 11). Men have more variables in the dataset, but the results are similar with the women. Mainly of them worked between 30 to 39 years, 42%, and mostly their careers were between 20 to 39 years, 73%. One of the men worked over 40 years but still when looking the total, 17% of them all had careers under 10 years according to the data.

Table 10 Career Length

	Women	% of W	Men	% of M	Total	% of total
<b>Under 10 years</b>	5	17%	5	17%	10	17%
<b>10–19 years</b>	1	3%	2	7%	3	5%
<b>20–29 years</b>	6	21%	9	31%	15	26%
<b>30–39 years</b>	17	59%	12	42%	29	50%
<b>40–49 years</b>	0	0%	1	3%	1	2%
<b>N</b>	29	100%	29	100%	58	100

Every person in this data set reported at least one job post if not all, in most cases reporting the job post at the end of the career was more usual. Due to this making the comparisons were easier and there is more and better results. In the case two, glass ceiling is still visible as well. Most of the women, 59%, ended up on the level four job posts in their careers making to lower or middle management. Getting to the top posts was still hard, 24% of the women got to level 5 or 6, and only one woman got to level 6 (Table 12). Among men, it was most common, 31%, to end up in level 4, but it was not as common as it was among women. Most of the men's careers ended in the level 5 and 6, 49%, and 6 men ended up being CEO level jobs. In this dataset none of the studied persons ended up in level one job. In the level 2 and 3, numbers between women and men were quite similar with me being bit higher, 17% < 21%. Between the pairs, men usually had higher career level than women, which was in 41% of the cases. In 35% of the cases pairs ended up in draw between their careers and were in the same level jobs. Women's career developed faster to their top positions compared to men where 48% of the women. It took under 10 years to developed to their highest career level while men it took 62% of the cases over 10 years. Though what explains this is that men had higher career level and developing to higher takes more time (Table 12).



Table 11 Highest Career Level

	<b>Women</b>	<b>% of W</b>	<b>Men</b>	<b>% of M</b>	<b>Total</b>	<b>% of total</b>
<b>0</b>	0	0%	0	0%	0	0%
<b>1</b>	0	0%	0	0%	0	0%
<b>2</b>	3	10%	4	14%	7	12%
<b>3</b>	2	7%	2	7%	4	7%
<b>4</b>	17	59%	9	31%	26	45%
<b>5</b>	6	21%	8	27%	14	24%
<b>6</b>	1	3%	6	21%	7	12%
<b>Women higher</b>	7	24%	7	24%	14	24%
<b>Men higher</b>	12	41%	12	41%	24	41%
<b>Equal between pairs</b>	10	35%	10	35%	20	35%
<b>Under 10 Years</b>	14	48%	6	21%	20	35%
<b>Over 10 Years</b>	10	35%	18	62%	28	48%
<b>Undefined</b>	5	17%	5	17%	10	17%
<b>N</b>	29	100%	29	100%	58	100%

Women in this case raised through two levels in their career, 45% of the cases and after that most common was to rise three levels, 22% of the cases (Table 13). Among men risen through ranks has more variables than among women. Most common was to rise two levels as well with 32% of the cases and similar to women, second most common was to rise three levels, 24% of the cases. As same level to that was to not rise at all which similar 24% which is more common than among women, 17%. Rising four levels is more common among men than women, 10% > 3%. but in level 5 raises, both are in same level, 3%. Therefore rising 5 levels is quite uncommon in the dataset. Table 12 shows that among men lateral CD is

most common, 59% of the cases and among women it is as well most common but in smaller scale, 48%. Among women the number between lateral and non-lateral CD is quite the same. Notable is that among women getting demotion is more common than men, 41%>24%.

Table 12 Career Development

	Women	% of W	Men	% of M	Total	% of total
0	5	17%	7	24%	12	21%
1	3	10%	2	7%	5	9%
2	13	45%	9	32%	22	38%
3	6	22%	7	24%	13	22%
4	1	3%	3	10%	4	7%
5	1	3%	1	3%	2	3%
Yes	14	48%	17	59%	31	53%
No	15	52%	12	41%	27	47%
Demotion	12	41%	7	24%	19	33%
N	29	100%	29	100%	58	100%

Having international assignment during their career is clearly more common in men's career than among women's careers (Table 14). Among men 28% of them did one or two international assignments, more common was to do one, 21%. Among women only few did international assignments, 10% of the cases, two women did one international assignment, and one did three.

In the second case, there is a lot of variables in the numbers of employers among both men and women but mostly they had several rather than few employers. Most common for women was to work for four employers, 25% of the cases (Table 15). With men most common was to work for seven or more employers but men had more variation and number are quite even, but most men had 4 or more jobs, 73%. Even though number are quite even among men and women and compared to each other, men do change their employer more often than women, men have 5 or more jobs more often, 56%>41%.

Table 13 International Assignments

	Women	% of W	Men	% of M	Total	% of total
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0	26	90%	21	72%	47	81%
1	2	7%	6	21%	8	14%
2	0	0%	2	7%	2	3%
3	1	3%	0	0%	1	2%
N	29	100%	29	100%	58	100%

Table 14 Number of Employers

	Women	% of W	Men	% of M	Total	% of total
1	3	10%	3	10%	6	10%
2	3	10%	2	7%	5	7%
3	4	14%	3	10%	7	12%
4	7	25%	5	17%	12	22%
5	2	7%	5	17%	7	12%
6	5	17%	3	10%	8	14%
7 or more	5	17%	8	29%	13	23%
N	29	100%	29	100%	58	100%

**Observation 1:** What differed from the earlier case is that none of the persons, in the earlier case it was all women, ended in the level 1 jobs (Table 12). Clearly everyone had some kind of career development or started already from higher positions. **Observation 2:** What was notable that still between the pairs, men usually had higher career level than women, which was in 41% of the cases, only in 24% of the cases women had higher career level, the rest were draws between the pairs (Table 12). This affects to men having higher career level and developing to that higher level took more time, mostly over the years, while women it took most cases under 10 years. Women in the field do not get that much top management jobs. They could settle for less and quit trying because of the prejudices and norms of the field that creates discrimination towards them still. **Observation 3:** Among women getting demotion is more common than men, 41%>24% (Table 123). This was interesting result. Women may have harder to find same level jobs if they change jobs for some reason when men normally had same level or higher jobs if they change.

### 5.1.3 Comparing the Two Cases

In this section results of both cases are compared in order to see if there is any difference among the cases and if the change of the time period created some changes to the career development of engineers and between women and men engineers. Case number are different due to lack for data but do not differ that much that the comparing of the two cases would not be possible or be irrelevant. When comparing career length, both cases it was most common for women to work for 30 to 39 years, but in the latter case it was more usual, 59% > 35%, and the first case had more variables (Table 16). With men both cases were quite similar, mostly they varied on the end and the beginning of the scale. In the 1980's case, there was more shorter careers and in the earlier case careers were longer. This could be related to the nature and position of the association. It was more valued in the beginning of the 20<sup>th</sup> century and members wanted more to be a part of it as a status symbol. When comparing the differences and changes between two cases and then comparing men and women, results showed that between cases, results were not same when looking gender wise. Women's' careers had less variables after the change of time while men the cases had not that much changed.

Table 15 Career Length

	% of Women 1 period	% of Women 2 period	Total % of Women	% of Men 1 period	% of Men 2 period	Total % of Men	% of Total
<b>Under 10 years</b>	10%	17%	14%	5%	17%	12%	13%
<b>10-19 years</b>	20%	3%	11%	5%	7%	6%	8%
<b>20-29 years</b>	15%	21%	18%	30%	31%	31%	25%
<b>30-39 years</b>	35%	59%	49%	45%	42%	43%	46%
<b>40-49 years</b>	20%	0%	8%	15%	3%	8%	8%
<b>N</b>	100%	100%	100%	100%	100%	100%	100%

Not reporting any workplaces appeared in the first case and it was not seen in the second case. And those who stayed in the level one jobs only appearing among the first case's women (Table 17). Having level 3 job was quite rare and did not appear in the first case at all. If not counting the first case's women not reporting their job posts, in both cases most of the women end up in level 4 jobs. In the first case, none got higher than that and in latter case some women got trough but ending up as CEO is still rare. Among men in both cases level of CEO's

stayed the same, but difference could have been seen between level 4 and 5 jobs where in latter case more men were in level 5 jobs than in level 4 like before. In this case it could have been behind that more women are transferred to level 4 jobs and man for that had got more level 5 jobs or the structure of job hierarchy has changed, but this is small dataset, generalizing is not reasonable.

When comparing the pairs and their career development according to their career level, among women more women had higher career than men between the cases when comparing the latter to the first case, rising from 10% to 24%. Number is still low compared to men but there was progress towards more equal career development. At the same time men's number had stayed quite the same in over 40% but the number of equal situations had drop due to reporting better their job posts. Among women the career development time increases due to their better situation on higher job levels and getting more promotions. Among men the numbers stayed quite the same but losing the unreported cases from the data increases the number of years that careers take to develop (Table 17).

Table 16 Highest Career Level

	% of Women 1 period	% of Women 2 period	Total % of Women	% of Men 1 period	% of Men 2 period	Total % of Men	% of Total
<b>0</b>	40%	0%	16%	20%	0%	13%	14%
<b>1</b>	10%	0%	4%	0%	0%	0%	2%
<b>2</b>	20%	10%	15%	0%	14%	8%	11%
<b>3</b>	0%	7%	4%	0%	7%	4%	4%
<b>4</b>	30%	59%	47%	40%	31%	35%	41%
<b>5</b>	0%	21%	12%	10%	27%	20%	17%
<b>6</b>	0%	3%	2%	20%	21%	20%	11%
<b>Women higher</b>	10%	24%	18%	10%	24%	18%	18%
<b>Men higher</b>	45%	41%	43%	45%	41%	43%	43%
<b>Equal between pairs</b>	45%	35%	39%	45%	35%	39%	39%
<b>5-10 Years</b>	15%	35%	35%	25%	21%	23%	29%
<b>Over 10 Years</b>	25%	48%	30%	50%	62%	57%	44%
<b>Undefined</b>	60%	35%	35%	25%	17%	20%	27%

N	100%	17%	100%	100%	100%	100%	100%
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When looking career development through career level rises, women number develop enormously when in first case 70% of the women did not have any career development and in second case 0 level decreases to 17% which is divided to other levels and creates increase in all other levels (Table 17). Most common is to get 2 to 3 levels up in their career, 67% of all women. Among men there is same kind of change to be seen but in smaller numbers. In level 4 and 5 rises, there is small decrease between case one and two. This could be due to that in latter case engineers start from higher positions and the change in work duties where lower-level engineers do the lower jobs and master level engineers do the higher-level jobs. Men have more promotions through career levels than women in both cases. Normal lateral CD get more usual and increases from 15% to 48% but at the same time demotions among women do increase as well over time from 20% to 41%. Among men lateral CD has also risen but demotion decrease. As seen in the Table 18 normal CD is rarer among women than among men and women have more demotions.

Table 17 Career Development

	% of Women 1 period	% of Women 2 period	Total % of Women	% of Men 1 period	% of Men 2 period	Total % of Men	% of Total
0	70%	17%	39%	45%	24%	33%	36%
1	5%	10%	8%	5%	7%	6%	7%
2	10%	45%	31%	20%	32%	27%	29%
3	10%	22%	16%	10%	24%	18%	17%
4	5%	3%	4%	15%	10%	12%	8%
5	0%	3%	2%	5%	3%	4%	3%
Yes	15%	48%	35%	25%	59%	45%	40%
No	85%	52%	65%	75%	41%	55%	60%
Demotion	20%	41%	33%	30%	24%	27%	30%
N	100%	100%	100%	100%	100%	100%	100%

Among men having international assignments during their career did not change that much between cases. Number of international assignments did change between cases; in the first one man had several and in latter men only did one more often (Table 19). Between cases among women international assignments decrease over time from 20% to 10%. In numbers of international assignments

among women had same change that men, many had only one in latter case. Between the cases among women the number of employers increases. In first case 50% of the women have 1 or 2 employers and in second case it was most usual to have 4 employers during their career (Table 20). There were more variety in second case. Among men it was already in the first case more common to had multiple employers when comparing to women. In the second case, there was more variables in the numbers, but they are centres more in the end side of the scale and had seven or more employers was the most common case.

Table 18 International Assignments

	<b>% of Women 1 period</b>	<b>% of Women 2 period</b>	<b>Total % of Women</b>	<b>% of Men 1 period</b>	<b>% of Men 2 period</b>	<b>Total % of Men</b>	<b>% of Total</b>
<b>0</b>	80%	90%	86%	75%	72%	73%	80%
<b>1</b>	5%	7%	6%	5%	21%	15%	10%
<b>2</b>	15%	0%	6%	10%	7%	8%	7%
<b>3</b>	0%	3%	2%	5%	0%	2%	2%
<b>4</b>	0%	0%	0%	5%	0%	2%	1%
<b>N</b>	100%	100%	100%	100%	100%	100%	100%

Table 19 Number of Employers

	<b>% of Women 1 period</b>	<b>% of Women 2 period</b>	<b>Total % of Women</b>	<b>% of Men 1 period</b>	<b>% of Men 2 period</b>	<b>Total % of Men</b>	<b>% of Total</b>
<b>1</b>	30%	10%	19%	30%	10%	18%	18%
<b>2</b>	20%	10%	14%	0%	7%	5%	9%
<b>3</b>	15%	14%	14%	30%	10%	18%	16%
<b>4</b>	15%	25%	21%	20%	17%	18%	20%
<b>5</b>	10%	7%	8%	15%	17%	16%	13%
<b>6</b>	5%	17%	12%	0%	10%	7%	9%

7 or more	5%	17%	12%	5%	29%	18%	15%
N	100%	100%	100%	100%	100%	100%	100%

**Observation 1:** Notable for comparing the cases is that when looking career development through career level rises women developed enormously. In the first case 70% of the women did not have any career development and in second it decreases to 17% (Table 18). Most of this comes from that women are more active to report their work posts, which enables to report career development. But at the same time there were many cases in the first period where women did not have career development at all when they did report their job posts. This indicates that women had more CD in the second case. From Table 18 is seen that normal theoretical lateral CD get more usual and increases from 15% to 48%. Among men lateral CD has also risen. **Observation 2:** When looking theories of breadwinners and housewives and adding managerial research about work life and Career Development, this should be the opposite were changing of work and family responsibilities should affect negatively to CD. Though this had been in the American context but in Finland government had increased the amount of support to families which could have had effect to both genders CD. **Observation 3:** Lastly among men in both cases level of CEO's stayed the same, but difference could have been seen between level 4 and 5 jobs where the mass had transformed to level 5 jobs (Table 17). In this case could it be behind that more women are transferred to level 4 jobs and men for that had got more level 5 jobs or the structure of job hierarchy had changed, but this is small dataset, generalizing is not reasonable. Or the structures of engineering had changed where engineers with master's degree are starting their career from higher posts and engineers with bachelor's would have done the lower-level jobs.

## 5.2 Explaining Results

In this chapter observations that are made from the results above are explained more deeply. Some of the expected results were not fulfilled in this research. Firstly, this was not observed in the tables but at the time of the first case, it was expected that women would get married and have a family rather than work or they will at least quit. There was none of the observable situations in the first case that women would have left her job after getting married. 25% of the women in the first case changed their last name during their membership in the FFPA but none of them quit their jobs after that or close to the name change. Behind this could be their commitment to their career. Getting higher education was hard for women in that time period, especially in the masculine field and choosing to have career in the masculine field could mean that they were committed to continue



and not quit after all the hard work they had done to be there. This could have also mean to make hard decision to sacrifice family to succeed in their career. Researching the topic more with interviews would have been interesting but impossible in the first case. In the second case about 45% of the women got married during their membership in the FFPA based on changing their last name and one of them quit just after changing their name. There is a clear increase in women that changed their name between cases that could indicate that women did not have to choose anymore assessable childcare and family leaves for parents. These changes started in the 1960's to support working parents with their children. Finland due to changes in the society that supports families by providing inexpensive and Some of the women could have get to married as well and not changed their name or have done it before joining the FFPA, but in these cases there is no observable indicator in the data.

### 5.2.1 Women's Career Barriers

What followed the theories was visible glass ceilings and leaking pipelines that women faced in their careers. As mentioned in the previous chapters glass ceiling is an invisible barrier that stops women to get higher positions without clear reason other than based on their gender.<sup>190</sup> In the first case is a clear glass ceiling that women face, none of them get trough from level 4 onwards while men do in the data therefore glass ceiling was set on between level 4 and 5. In the second case most of the women do not get through from level 4 onwards but some get to level 5 and one to level 6, this is more of the leaking pipeline which is a situation where most do not get to higher positions but some do like in the second case.<sup>191</sup> Situation did progress for the better between cases but is still problematic compared to men who do not face these kinds of barriers. Behind this could be structural discrimination and norms towards women in masculine field that prevents them from getting to highest level jobs like mentioned earlier. Related to this could be the fact that in the data women changed their jobs less frequently than men. They could be afraid to change jobs if the work environment would change for worse or they were otherwise scared for the change. It could be harder to get new jobs or there might not be better opportunities to women, or they could not get them. Staying is therefore just easier even if they do not get promotions in their current workplace. Men in other hand most likely changed workplaces to gain new opportunities and promotions.

### 5.2.2 Career Development

The managerial theories of career development found no reinforcement in this research. Most of the paper engineer's careers were not developing laterally from the lowest position to higher positions inside the same company. The first case

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<sup>190</sup> Sullivan and Mainiero 2008, p. 34

<sup>191</sup> O'Neil, Hopkins, and Bilimoria 2008, pp. 733–734

should be ideal timeframe for the theoretical CD for men who had housewife supporting their efforts. Theoretically CD should have increased in the second case among both women and men, but in this case, the rise through the job hierarchy did not happen in the one company and mostly people did change companies to get new or better opportunities in the data. Paper industry in Finland faced many fusions, acquisitions, and mergers in the end of 20<sup>th</sup> and the beginning of the 21<sup>st</sup> century which is visible in the data. It affects the studied persons work life and career development as well. Therefore, development inside the same company was harder in the second time period due to these changes. During fusions and mergers some jobs disappeared when companies were combined. This could have negatively affected the career development of the persons in the second case. In the first case, there is no clear reason for why lateral career development did not happen. This could be due to changing structures in the field and yet ongoing development of the role of the engineer in the workplace where engineers were slowly getting to higher positions from the dirtier and more physical jobs among the machines and getting to be more on the design of the things.

### 5.2.3 Changes in the Environment

Between cases structures of ownerships, companies and work roles have changed. In the first case, companies were mostly small and local, some cases family-owned companies that transformed to national companies with local subsidiaries and in the change of the 21<sup>st</sup> century to multinational companies. Change of the ownership base created more opportunities to rise higher leadership positions. Between cases roles of the employees in established and job positions and roles become more permanent and similar between companies. This makes career development easier and more predictable. Educational background of the engineers affected to their work positions; some with master's degrees started from lower leadership positions and did not work in physical work posts. Therefore, in the data if measuring career development through level rises, rises were smaller in the second case when some started from higher posts and relatively did not rise that much compared to those that started lower.

The Finnish economy developed as well during the century. The importance of the paper industry decreased and rise of the IT sector started with the help of Nokia. Many wanted to study to be IT engineer rather than paper engineer and the field was seen unattempting study choice. Some changed careers if they could be due to uncertainty in the field created by M&A's and the decrease of the paper industry itself. Therefore, some shorter careers in the second case could be explained through the change of the field and leaving the association.

During the period between the cases the social and gender attitudes as well as norms changed. Women's education became a norm and women in work life increased, only few stayed at home. Women in masculine fields and management as well increased which made career development for women easier. The data reflects that. What mostly affected the results was that there were big gaps

in the data created by not reporting job posts especially among in the first cases women. They probably did not want to share their positions due to feeling not being in the same level as men in their careers and wanted to keep the information to themselves. This could be seen among men as none of the men in the data had highest career positions under level 4, so the ones that had did not express that and only reported their workplace. Even from the beginning of their career some could have worked in the position that was not seen as proper for highly educated engineer like librarian in the company's library or research archives and therefore, they never reported their work position.

#### **5.2.4 Limitations**

Not reporting was the biggest limitation for forming the results. In the first case, most of the calculations and comparisons were impossible to make due to not having data as a base. And due to this, making comparisons between the cases was hard as well. This affected the results a lot, especially when comparing men and women. Therefore, men's careers showed even better in the results than women. Important to member that reasons behind not reporting are only educated guesses as this kind of information could not had been found in the data as well as some other explanations as well. Data for this research is limited and the cases that are formed from it are small. Cases are not statistically made; they are chosen from the data pool which automatically effects the results. Therefore, they are not statistically generalizable. As well as the chosen cases are relatively small, in whole only 98 persons are used as base for the comparison, the results are not in any case generalizable, they are preliminary and are used to see, if the paper engineers' careers have same affects as the previous research has found. As mentioned above data is limited which creates limited number of pairs. In the first case on that time period, no more pairs could have been created. This has effects on the results and creating results. This research would be hard to do with quantitative methods due to its limits on low data and in that case, results are hard to make, and they are not reliable. Worst case results would not give any notions on the topic. Therefore, this study is done using qualitative methods and would have been hard to do any other way.

Archives of FPPA did not show anything important to material even though the association was against women and women members. Materials did not show any discussions about joining women members, only their joining was mentioned by person as was men in the beginning. When looking person of the second case that had short careers from LinkedIn, only two were able to be found. These two persons stayed in the field which indicates that they left from the association and therefore there is no information of them available in the data. Others could have done same but do not use LinkedIn and this checking is not possible with the person in the first case due to most of them being deceased.

## 6 DISCUSSION

In this master's thesis the focus was on women paper engineers career development compared to men in two cases. First case is from 1930 to 1959 consisting of 20 pairs and second case from 1980 to 1984 consisting of 29 pairs. Cases were compared through cross-tabulations to from results on career length, highest career level, career development, international assignments, and number of employers. Results show that when comparing women's careers to men's in both cases men reach higher careers compared to women. Women faced clear cases of glass ceilings and leaking pipelines. In first case, none of the women reached above level 4 jobs into higher management roles and in the second case some women got to level 5 and one to level 6 which could be described as leaking pipeline. At the same time, level 6 jobs among men stayed the same and level 5 jobs increased. This shows that it is hard for women to get promotions to higher management which could be affected by the masculine career. Women in the first case worked in roles that men did not, for example as librarians, which could be seen as understatement when having higher engineering education and their work is not seen as valued as men.

Other results were that lateral career development increased in the second case among women and men compared to first case, which was unexpected. It was expected that in the first case research subjects would rise in the same company, but many times lateral rise did not happen. In the second case lateral rise was increased when compared to first case. This result was interesting when in the time frame of the second case a lot of M&A's happened in the industry and many changed workplaces frequently. What affects the results is the context of the Nordic countries and Finland in general. Nordic countries differ from other European countries and US in many ways trough the structures of society and so on. Therefore, work life and career development are different. Engineering in general was still developing in the first case and its valuation increased after 1930's which affected the careers of engineers. In the second case the roles of engineers were established. Most of the research in the field is done in the Anglo-American perspective and thus results in Nordic context studies differ immensely due to factors on combining work and family life that offers different and mostly better opportunities to those in the Nordics.

Problem in the study was the lack of reporting the job posts which especially affected the first cases results. Most of the women did not report anything or just some of their job posts which made observing career development impossible. Some men as well in the first case did not report job post. This decreased in the second case but some in there did not report job posts or all of the job posts, but the numbers were quite low and did not matter that much in the results. In this study the data that was used in the cases were small. For the future research having larger number of research subjects would be useful for the results because as smaller data set is not useful for generalizations and bigger statistically formed

data could be more useful. Though this could be difficult and time consuming to form.

## Sources

### Source material

Suomen Paperi-insinöörien Yhdistys - Finska Pappersingeniörsföreningen R.y. (spy/fpf) - Tutkimukset Jäsenkunnan Rakenteesta; Suomen Elinkeinoelämän keskusarkisto: <http://yksa.fi/100300/143413179879100> / Referenced 17.5.2023

Taskinen, J., Sonja Karppanen, Mirva Peltomäki and Riitta Pitkänen. 2021. "Insinöörimobilitteetti". Jyväskylä School of Business and Economics. Unrealised electric data.

### References

Akkermans, J., C. I.S.G. Lee, S. Nijs, A. Mylona, and J. K. Oostrom. 2021. "Mapping Methods in Careers Research: A Review and Future Research Agenda," in *Handbook of Research Methods in Careers*, pp. 9–32.

Alho, K. 1966. *Suomen paperi-insinöörien yhdistys 1914-1964*, Helsinki.

Arthur, M. B., and D. M. Rousseau. 2001. *The Boundaryless Career: A New Employment Principle for a New Organizational Era*.

Auster, E. R., and K. L. Ekstein. 2005. "Professional Women's Mid-career Satisfaction: An Empirical Exploration of Female Engineers," *Women in Management Review* 20, pp. 4–23.

Bairoh, S., and S. Putila. 2021. "'Pätevät naiset eivät etene' vai 'naisia suositaan'?" Sukupuoleen perustuvan syrjinnän ristiriitaiset kokemukset tekniikan korkeakoulutettujen työpaikoilla," *Työelämän tutkimus* 19, pp. 595–619.

Baude, A. 1966. "Työnantajat Ja Naiset," in *Sukupuolten roolit: puheenvuoroja naisen ja miehen tasa-arvoisuudesta (Taskutieto 7)*, ed. I. Fredriksson and K. Eskola, Porvoo ; Helsinki, pp. 62–82.

Boethius, U. 1966. "Roolikysymysten Historia," in *Sukupuolten roolit: puheenvuoroja naisen ja miehen tasa-arvoisuudesta. (Taskutieto 7)*, ed. I. Fredriksson and K. Eskola, Porvoo ; Helsinki, pp. 28–49.

Bol, T., M. de Vaan, and A. van de Rijt. 2022. "Gender-Equal Funding Rates Conceal Unequal Evaluations," *Research Policy* 51, p. 104399.

Buchardt, M., P. Markkola, H. Valtonen, M. Buchardt, P. Markkola, H. Valtonen, Historian ja etnologian laitos, Department of History and Ethnology, Suomen

historia, and Finnish History. 2013. *Introduction. Education and the Making of the Nordic Welfare States.*

Cardador, M. T., and P. L. Hill. 2018. "Career Paths in Engineering Firms: Gendered Patterns and Implications," *Journal of Career Assessment* 26, pp. 95–110.

De Vries, J. 2008. *The Industrious Revolution: Consumer Behavior and the Household Economy, 1650 to the Present*, Cambridge.

Dezsö, C. L., and D. G. Ross. 2012. "Does Female Representation in Top Management Improve Firm Performance? A Panel Data Investigation," *Strategic Management Journal* 33, pp. 1072–1089.

Edvinsson, R., and T. N. Edvinsson. 2017. "Explaining the Swedish "Housewife Era" of 1930–1970: Joint Utility Maximisation or Renewed Patriarchy?," *Scandinavian Economic History Review* 65, pp. 169–188.

Eisenhardt, K. M. 1989. "Building Theories from Case Study Research," *The Academy of Management Review* 14, p. 532.

Eisenhardt, K. M., and M. E. Graebner. 2007. "Theory Building from Cases: Opportunities and Challenges," *Academy of Management Journal* 50, pp. 25–32.

Eloranta, J., and J. Ojala. 2018. "Suomi Kansainvälisessä Taloudessa," in *Suomen rakennehistoria: näkökulmia muutokseen ja jatkuvuuteen (1400-2000)*, ed. J. Eloranta, M. Hannikainen, A. Häkkinen, M. Lamberg, C. Lloyd, M. Nenonen, I. Nummela, J. Ojala, and J. Peltola, Tampere, pp. 142–169.

Engman, M. 2015. "Kemisti Lydia Sesemann – Unohdetun Tohtorin Umpikuja," in *Naisten aika: valkoinen varis ja muita oppineita naisia*, ed. R. Mäkinen and M. Engman, Helsinki, pp. 15–20.

Engström, S. 2018. "Differences and Similarities between Female Students and Male Students That Succeed within Higher Technical Education: Profiles Emerge through the Use of Cluster Analysis," *Int J Technol Des Educ* 28, pp. 239–261.

Eskola, K. 1968. "Sukupuoliroolikeskustelu Suomessa," in *Miesten maailman nurjat lait (Huutomerkki-sarja)*, ed. K. Eskola, Helsinki, pp. 11–37.

Fernando, D., L. Cohen, and J. Duberley. 2019. "Navigating Sexualised Visibility: A Study of British Women Engineers," *Journal of Vocational Behavior* 113, pp. 6–19.

Fouad, N. A., R. Singh, K. Cappaert, W. Chang, and M. Wan. 2016. "Comparison

of Women Engineers Who Persist in or Depart from Engineering," *Journal of Vocational Behavior* 92, pp. 79–93.

Fredriksson, I. 1966. "Tasa-Arvoisuuteen Kouluttaminen," in *Sukupuolten roolit: puheenvuoroja naisen ja miehen tasa-arvoisuudesta (Taskutieto 7)*, ed. I. Fredriksson and K. Eskola, Porvoo ; Helsinki, pp. 96–112.

Gibbert, M., and W. Ruigrok. 2010. "The "What" and "How" of Case Study Rigor: Three Strategies Based on Published Work," *Organizational Research Methods* 13, pp. 710–737.

Gill, J., R. Sharp, J. Mills, and S. Franzway. 2008. "I Still Wanna Be an Engineer! Women, Education and the Engineering Profession," *European Journal of Engineering Education* 33, pp. 391–402.

Greenfeld, S., L. Greiner, and M. M. Wood. 1980. "The "Feminine Mystique" in Male-Dominated Jobs: A Comparison of Attitudes and Background Factors of Women in Male-Dominated versus Female-Dominated Jobs," *Journal of Vocational Behavior* 17, pp. 291–309.

Haapala, P., and C. Lloyd. 2018. "Johdanto: Rakennehistoria Ja Historian Rakenteet," in *Suomen rakennehistoria: näkökulmia muutokseen ja jatkuvuuteen (1400-2000)*, ed. P. Haapala, J. Eloranta, M. Hannikainen, A. Häkkinen, M. Lamberg, C. Lloyd, M. Nenonen, I. Nummela, J. Ojala, and J. Peltola, Tampere, pp. 6–30.

Häikiö, M. 2015. *Hyöty ja tiede: Tampereen teknillisen yliopiston historia 1965-2015*, Helsinki.

Hakkarainen, N. 1993. *Oravanpyörässä*, Porvoo ; Helsinki ; Juva.

Häkkinen, A., and M. Rahikainen. 2001. "Naisten Yönteon Ja Toimeentulon Tutkimuksesta," in *"Työllä ei oo kukkaan rikastunna": naisten töitä ja toimeentulokeinoja 1800- ja 1900-luvulla*, ed. M. Rahikainen and T. Räsänen, Helsinki, pp. 7–16.

Hakosalo, H. 2015. "Lääkäri Rosina Heikel – Pitkänmatkanjuoksijan Yksinäisyys," in *Naisten aika: valkoinen varis ja muita oppineita naisia*, ed. R. Mäkinen and M. Engman, Helsinki, pp. 21–36.

Hammond, M. S. 2001. "Career Centers and Needs Assessments: Getting the Information You Need to Increase Your Success.," *Journal of Career Development* 27, pp. 187–197.

Hannikainen, M. O. 2018. *Menneisyyden rakentajat: teorian historiantutkimuksessa*, Helsinki.



Hanski, J. 1997. *Polin suojiin me saavumme taas: Teknillisen korkeakoulun ylioppilaskunta 125 vuotta*, Espoo.

Hatmaker, D. M. 2012. "Practicing Engineers: Professional Identity Construction through Role Configuration," *Engineering Studies* 4, pp. 121–144.

van Hek, M., and T. van der Lippe. 2022. "Why Female Employees Do Not Earn More under a Female Manager: A Mixed-Method Study," *Work, Employment and Society* 2022, p. 09500170221083971.

Hite, L., and K. McDonald. 2008. "A New Era for Career Development and HRD," *Organizational Leadership and Supervision Faculty Publications* 10, pp. 3–7.

Holth, L. 2014. "Passionate Men and Rational Women: Gender Contradictions in Engineering," *NORMA* 9, pp. 97–110.

Holth, L., A. Almasri, and L. Gonäs. 2013. "Career Patterns for IT Engineering Graduates," *Economic and Industrial Democracy* 34, pp. 519–535.

Holth, L., A. Bergman, and R. MacKenzie. 2017. "Gender, Availability and Dual Emancipation in the Swedish ICT Sector," *Work, Employment and Society* 31, pp. 230–247.

Holth, L., and U. Mellström. 2011. "Revisiting Engineering, Masculinity and Technology Studies: Old Structures with New Openings," *International Journal of Gender, Science, and Technology* 3, pp. 313–329.

Hyvönen, R. 2013. "Näin Turus," in *Insinöörikoulutusta 100 vuotta Suomessa: juh-lakirja.*, ed. R. Manninen, H. Miettinen, A. Mustonen, J. Ursinus, and L. Hietalahti, Tampere, pp. 37–39.

Igbaria, M., and J. J. Baroudi. 1995. "The Impact of Job Performance Evaluations on Career Advancem," *MIS Quarterly* 19, p. 107.

Kaarninen, M. 2011. "Oppikoulu Yhteiskunnan Rakentajana," in *Valistus ja kou-lunpenkki: kasvatus ja koulutus Suomessa 1860-luvulta 1960-luvulle.*, ed. A. Heikki-nen and P. Leino-Kaukiainen, Helsinki.

— — —. 2015a. "Valkolakin Valloittajat - Varhaiset Naisylioppilaat Ja Mitä Heitä Tuli," in *Naisten aika: valkoinen varis ja muita oppineita naisia*, ed. R. Mäkinen and M. Engman, Helsinki, pp. 161–191.

— — —. 2015b. "Maisteri Emma Irene Åström – Legenda Jo Eläessään," in *Naisten aika: valkoinen varis ja muita oppineita naisia*, ed. R. Mäkinen and M. Engman, Hel-sinki, pp. 37–55.

- Kantola, J. 2010. "Sukupuoli Ja Valta," in *Käsikirja sukupuoleen*, ed. T. Saresma, L.-M. Rossi, and T. Juvonen, Tampere, pp. 78–88.
- Kappia, J. G., A. Dainty, and A. Price. 2005. "An Assessment of Construction Craft Trainee Career Priorities through the Analytical Hierarchy Process," 2005.
- Kekkonen, J. 2008. "Vertailevan tutkimuksen haasteita," *Tieteessä tapahtuu* 2008, p. 6.
- Khilji, S. E., and K. H. Pumroy. 2018. "We Are Strong and We Are Resilient: Career Experiences of Women Engineers," *Gender Work Organ* 2018, p. gwao.12322.
- Kivinen, O., J. Hedman, and P. Kaipainen. 2007. "From Elite University to Mass Higher Education: Educational Expansion, Equality of Opportunity and Returns to University Education," *Acta Sociologica* 50, pp. 231–247.
- Kivinen, O., and R. Rinne. 1992. "Oppivelvollisuudesta Kestävään Koulutususkoon," in *Suuri muutos: suomalaisen yhteiskunnan kehityspiirteitä*, ed. E. Nurminen and M. Rahikainen, Lahti, pp. 81–87.
- — —. 1996. "Higher Education, Mobility and Inequality: The Finnish Case," *European Journal of Education* 31, pp. 289–310.
- Knippen, J. M., W. Shen, and Q. Zhu. 2019. "Limited Progress? The Effect of External Pressure for Board Gender Diversity on the Increase of Female Directors," *Strategic Management Journal* 40, pp. 1123–1150.
- Koivuniemi, J. 2018. "Tehtaiden Suomi Ja Deindustrialisaatio," in *Suomen rakennehistoria: näkökulmia muutokseen ja jatkuvuuteen (1400-2000)*, ed. P. Haapala, J. Eloranta, M. Hannikainen, A. Häkkinen, M. Lamberg, C. Lloyd, M. Nenonen, I. Nummela, J. Ojala, and J. Peltola, Tampere, pp. 210–243.
- Komulainen, A. 2014. *Paperimaailman valloittajat: Paperi-insinöörit ry 1914-2014*, Helsinki.
- Korhonen-Yrjänheikki, K. 2004. *Suomalainen teknillinen korkeakoulutus ja toimintaympäristön muutos vuoteen 2015*, Helsinki.
- Korvajärvi, P. 2010. "Sukupuolistunut Ja Sukupuolistuva Työ," in *Käsikirja sukupuoleen.*, ed. T. Saresma, L.-M. Rossi, and T. Juvonen, Tampere, pp. 183–197.
- Kraaykamp, G. 2012. "Employment Status and Family Role Attitudes: A Trend Analysis for the Netherlands," *International Sociology* 27, pp. 308–329.
- Kulich, C., G. Trojanowski, M. K. Ryan, S. Alexander Haslam, and L. D. R.

- Renneboog. 2011. "Who Gets the Carrot and Who Gets the Stick? Evidence of Gender Disparities in Executive Remuneration," *Strategic Management Journal* 32, pp. 301-321.
- Laine, J. 2019. "Metsä Talouden Ja Arvojen Risteyksessä," in *Vaurastumisen vuodet: Suomen taloushistoria teollistumisen jälkeen.*, ed. J. Laine, S. Fellman, M. Hannikainen, J. Ojala, and M. Autio, Helsinki, pp. 131-149.
- Langley, A. 1999. "Strategies for Theorizing from Process Data," *The Academy of Management Review* 24, pp. 691-710.
- Leino-Kaukiainen, P., and A. Heikkinen. 2011. "Yhteiskunta Ja Koulutus," in *Vaalistus ja koulunpenkki: kasvatus ja koulutus Suomessa 1860-luvulta 1960-luvulle.*, ed. A. Heikkinen and P. Leino-Kaukiainen, Helsinki, pp. 16-33.
- Lempiäinen, K. 2010. "Naistutkimuksen Kolme Vuosikymmentä," in *Käsikirja sukupuolee*, Tampere, pp. 274-277.
- Lidman, S., A. Koskivirta, J. Eilola, K. Vainio-Korhonen, J. Kalela, R. Välimäki, and A. Korhonen, eds. 2017. *Historiantutkimuksen etiikka*, Helsinki.
- Liljeström, R. 1966. "Sukupuolirooleista," in *Sukupuolten roolit: puheenvuoroja naisen ja miehen tasa-arvoisuudesta. (Taskutieto 7)*, ed. I. Fredriksson and K. Eskola, Porvoo ; Helsinki, pp. 13-27.
- Logel, C., G. M. Walton, S. J. Spencer, E. C. Iserman, W. von Hippel, and A. E. Bell. 2009. "Interacting with Sexist Men Triggers Social Identity Threat among Female Engineers," *Journal of Personality and Social Psychology* 96, pp. 1089-1103.
- Mäki, S. 2013. "Vaikeudet Vahvistavat Insinöörikoulutusta," in *Insinöörikoulutusta 100 vuotta Suomessa: juhlakirja*, ed. R. Manninen, H. Miettinen, A. Mustonen, J. Ursinus, and L. Hietalahti, Tampere, pp. 11-13.
- Markkola, P. 2000. "The Calling of Women: Gender, Religion and Social Reform in Finland, 1860-1920," in *Gender and vocation: women, religion and social change in the Nordic Countries 1830-1940*, ed. P. Markkola, Helsinki, pp. 113-146.
- McGregor, J., S. G. Davies, L. S. Giddings, and J. Pringle. 2017. "Pursuing Equal Pay: The Perspectives of Female Engineers and Potential Policy Interventions," *Journal of Industrial Relations* 59, pp. 3-21.
- van Mensvoort, C., G. Kraaykamp, R. Meuleman, and M. van den Brink. 2021. "A Cross-Country Comparison of Gender Traditionalism in Business Leadership: How Supportive Are Female Supervisors?," *Work, Employment and Society* 35, pp. 793-814.

- Michelsen, K.-E. 1994. *Lappeenrannan teknillinen korkeakoulu 1969-1994*, Lappeenranta.
- Mridula, N., and H. A. Sakeer. 2020. "Career Preference Assessment of Agricultural Students Using Paired Comparison Method.," *Journal of Research ANGRAU* 48, pp. 60-66.
- Murphy, W., and J. Tosti-Kharas. 2021. *Handbook of Research Methods in Careers*.
- Myllyntaus, T. 1992. "Vaaran Laelta Toimiston Nurkkaan - Taloudellinen Kehitys Ja Elämän Muodon Muutokset," in *Suuri muutos: suomalaisen yhteiskunnan kehityspiirteitä*, ed. E. Nurminen and M. Rahikainen, Lahti, pp. 35-51.
- Naskali, P. 2010. "Kasvatus, Koulutus Ja Sukupuoli," in *Käsikirja sukupuoleen*, ed. T. Saresma, L.-M. Rossi, and T. Juvonen, Tampere, pp. 277-288.
- Naukkarinen, J., and S. Bairoh. 2021. "Gender Differences in Professional Identities and Development of Engineering Skills among Early Career Engineers in Finland," *European Journal of Engineering Education* 0, pp. 1-17.
- Nevala-Nurmi, S.-L. 2012. *Perhe maanpuolustajana. Sukupuoli ja sukupolvi Lotta Svärd- ja suojeluskuntajärjestöissä 1918-1944*.
- Nykänen, P. 2007a. *Kortteli sataman laidalla: Suomen teknillinen korkeakoulu 1908-1941*, Helsinki.
- — —. 2007b. *Otaniemen yhdyskunta: Teknillinen korkeakoulu 1942-2008*, Helsinki.
- — —. 2018. "Research and Development in the Finnish Wood Processing and Paper Industry, c. 1850-1990," in *Technological Transformation in the Global Pulp and Paper Industry 1800-2018 (World Forests)*, ed. T. Särkkä, M. Gutiérrez-Poch, and M. Kuhlberg, Cham, pp. 35-64.
- O'Connor, P., C. O'Hagan, and B. Gray. 2018. "Femininities in STEM: Outsiders Within," *Work, Employment and Society* 32, pp. 312-329.
- O'Neil, D. A., M. M. Hopkins, and D. Bilimoria. 2008. "Women's Careers at the Start of the 21st Century: Patterns and Paradoxes," *J Bus Ethics* 80, pp. 727-743.
- Paloheimo, A. 2015. *Women and Higher Engineering Education - Supporting Strategies*.
- Perry, S. J., E. M. Hunter, and S. C. Currall. 2016. "Managing the Innovators: Or-

ganizational and Professional Commitment among Scientists and Engineers," *Research Policy* 45, pp. 1247–1262.

Pohls, M. 2013. *Korkeasti koulutetut naiset: Suomen Akateemisten Naisten Liiton historia*, Helsinki.

Powell, G. N., and D. A. Butterfield. 2015. "The Preference to Work for a Man or a Woman: A Matter of Sex and Gender?," *Journal of Vocational Behavior* 86, pp. 28–37.

Puro, L., and H. Lundell-Reinilä. 2020. *Lahjakkaat, sitkeät, kyvykkäät: suomalaisten naisten koulutuksen ja Konkordia-liiton historia*, Helsinki.

Rahikainen, M. 1992. "Maa Ja Kansa Ajan Virrassa," in *Suuri muutos: suomalaisen yhteiskunnan kehityspiirteitä*, ed. E. Nurminen and M. Rahikainen, Lahti, pp. 12–24.

— — —. 2001. "Naiset Näkyvät Suomessa Tekevän Vaikka Mitä," in *Työllä ei oo kukkaan rikastunna": naisten töitä ja toimeentulokeinoja 1800- ja 1900-luvulla*, ed. M. Rahikainen and T. Räisänen, Helsinki, pp. 17–35.

Reinharz, S., and L. Davidman. 1992. *Feminist Methods in Social Research*, New York.

Rossi, L.-M. 2010. "Sukupuoli Ja Seksuaalisuus, Erosta Eroihin," in *Käsikirja sukupuoleen*, ed. T. Saresma, L.-M. Rossi, and T. Juvonen, Tampere, pp. 21–38.

Rotkirch, K. 1968. "Nainen Neuvostoliitossa Ja Yhdysvalloissa – Ihanne Ja Todellisuus," in *Miesten maailman nurjat lait (Huutomerkki-sarja)*, ed. K. Eskola, Helsinki.

Saarela, L. 2010. *Aika jäynää muistot: Oulun teekkariyhdistys ry 50 vuotta*, 1. p., Oulu.

Schneer, J., and F. Reitman. 1995. "The Impact of Gender as Managerial Careers Unfold," *Journal of Vocational Behavior* 47, pp. 290–315.

Schultheiss, D. E. 2021. "Shining the Light on Women's Work, This Time Brighter: Let's Start at the Top," *Journal of Vocational Behavior* 126, p. 103558.

Silfver, E., A. J. Gonsalves, A. T. Danielsson, and M. Berge. 2021. "Gender Equality as a Resource and a Dilemma: Interpretative Repertoires in Engineering Education in Sweden," *Gender and Education* 2021, pp. 1–17.

Singh, R., N. A. Fouad, M. E. Fitzpatrick, J. P. Liu, K. J. Cappaert, and C. Figueredo. 2013. "Stemming the Tide: Predicting Women Engineers' Intentions to Leave," *Journal of Vocational Behavior* 83, pp. 281–294.

Strömberg, J. 2011. "Oppikoulun Laajentuminen Ja Yhtenäistyminen," in *Valistus ja koulunpenkki: kasvatus ja koulutus Suomessa 1860-luvulta 1960-luvulle.*, ed. A. Heikkinen and P. Leino-Kaukiainen, Helsinki, pp. 120–140.

Sullivan, S. E., and M. B. Arthur. 2006. "The Evolution of the Boundaryless Career Concept: Examining Physical and Psychological Mobility," *Journal of Vocational Behavior* 69, pp. 19–29.

Sullivan, S. E., and Y. Baruch. 2009. "Advances in Career Theory and Research: A Critical Review and Agenda for Future Exploration," *Journal of Management* 35, pp. 1542–1571.

Sullivan, S. E., and L. Mainiero. 2008. "Using the Kaleidoscope Career Model to Understand the Changing Patterns of Women's Careers: Designing HRD Programs That Attract and Retain Women," *Advances in Developing Human Resources* 10, pp. 32–49.

Tarrow, S. 2010. "The Strategy of Paired Comparison: Toward a Theory of Practice," *Comparative Political Studies* 43, pp. 230–259.

Tepora, T., A. Roselius, and Aapo Roselius. 2014. *The Finnish Civil War 1918: History, Memory, Legacy.*

Triana, M. del C., O. C. Richard, and W. Su. 2019. "Gender Diversity in Senior Management, Strategic Change, and Firm Performance: Examining the Mediating Nature of Strategic Change in High Tech Firms," *Research Policy* 48, pp. 1681–1693.

Turunen, R. 1968. "Keskustelun Perillemeno," in *Miesten maailman nurjat lait. (Huutomerkki-sarja 5)*, ed. K. Eskola, Helsinki, pp. 38–44.

Ummu Sakinah, S., C. Ridzwan, M. Ramlee, and H. Zaliza. 2020. "Career Challenges Model Among Female Engineers: PLS-SEM Analysis," *Malaysian Journal of Public Health Medicine* 20, pp. 243–250.

Valovirta, E. 2010. "Ylirajaisten Erojen Poliitiikka," in *Käsikirja sukupuoleen*, ed. T. Saresma, L.-M. Rossi, and T. Juvonen, Tampere, pp. 92–105.

Valta, R. 1999. *Mitä teekkarit eilen... 1969-1999: Lappeenrannan teknillisen korkeakoulun ylioppilaskunta 1969-1999*, Lappeenranta.

Vilander, P., ed. 1992. *Teekkarieloa Tampereella 1965-1992*, Tampere.

Vuorinen-Lampila, P. 2016. "Gender Segregation in the Employment of Higher Education Graduates," *Journal of Education and Work* 29, pp. 284–308.

- Walden, J., and T. Karreinen. 1971. *Minua sanotaan Juusoksi*, Hki.
- Warren, T., K. Rowlingson, and C. Whyley. 2001. "Female Finances: Gender Wage Gaps and Gender Assets Gaps," *Work, Employment and Society* 15, pp. 465-488.
- Wegemer, C. M., and J. S. Eccles. 2019. "Gendered STEM Career Choices: Altruistic Values, Beliefs, and Identity," *Journal of Vocational Behavior* 110, pp. 28-42.
- Wille, B., B. M. Wiernik, J. Vergauwe, A. Vrijdags, and N. Trbovic. 2018. "Personality Characteristics of Male and Female Executives: Distinct Pathways to Success?," *Journal of Vocational Behavior* 106, pp. 220-235.
- Yin, R. K. 2014. *Case Study Research: Design and Methods*, 5th edition., Los Angeles.
- Zewotir, T. 1999. "Gender Differences in Science Career Choice," 1999.
- Zou, M. 2015. "Gender, Work Orientations and Job Satisfaction," *Work, Employment and Society* 29, pp. 3-22.

## APPENDIX 1 Case 1: Pairwise Comparisons (1930–1959)

Information of the Pair	Career Development of Women	Career Development of Men	Results and Notes
<p>1.</p> <p><b>Joined:</b> 1930</p> <p><b>Education:</b> Bachelor of Science in Engineering, HUT</p> <p><b>Year of Birth:</b> W:1901: M:1902</p>	<p>1925–1938: Central Research Centre, Assistant Engineer</p> <p>1938–1963: Division Leader</p> <p>1971: Engineer's association</p>	<p>1926–1932: Forest Industry Company</p> <p>1932–1941: Forest Industry Factory</p> <p>1941–1946: Machine Shop and Steel Foundry, Division Leader</p> <p>1946–1968: Forest Industry Factory, CEO</p>	<p>Careers are developing as same until woman's development stops in lower management and men's develop to higher management. Careers are as long. Woman has less workplaces.</p>
<p>2.</p> <p><b>Joined:</b> 1936</p> <p><b>Education:</b> W: Master of Science (Chemistry), HU M: Bachelor of Science, HU</p> <p><b>Year of Birth:</b> W:1909: M:1903</p>	<p>1932–1937: Forest Industry Company's Laboratory, Biochemist</p> <p>1937–1942: Forest Industry Company's Laboratory, Laboratory Leader</p> <p>1942–1944: Consumer packaging Manufacturer</p> <p>1944–1948: Food Processing Industry's Company, Main Chemist</p>	<p>1930–1938: Central Research Centre, Assistant</p> <p>1938–1968: Division Leader</p>	<p>Woman has more workplaces, man has only one. Career development looks about the same, except woman's work history is short, only 16 years, man's 38 years.</p>
<p>3.</p> <p><b>Joined:</b> 1939</p> <p><b>Education:</b> Master of Science in Engineering, HUT</p> <p><b>Year of Birth:</b></p>	<p>1926–1937: Governmental laboratory</p> <p>1937–1946: Central Research Centre</p> <p>1940–1975: Patent Office, Patent Engineer</p>	<p>1927–1969: Paper Mill</p>	<p>Only one job posts mentioned, hard to track career development. Man has only one workplace and probably one post through the career. Woman does not have significant career development.</p>



W:1900, M:1904				
4. <b>Joined:</b> 1945 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> 1918	1943–1947: Forest Industry Factory	1945–1947: Forest Industry Factory	1948–1950: Forest Industry Factory (Different Location) 1951–1952: Forest Industry Factory, Operating Engineer 1952–1958: Division Engineer 1959–1963: Technical Manager 1964–1970: Main Engineer 1971–1977: Development Director  1967–1977: Forest Industry Company, CEO  1977–1978: Forest Industry Company, Deputy Development Director	Woman's career is short, 5 years, probably gets married and quits working. Men has long career and career development follows the theory of CD until in the end there is a small decrease in CD.
5. <b>Joined:</b> 1946 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> W:1914, M:1915	1942–1943: Univer- sity, Research Assis- tant 1943–1945: Univer- sity (Germany) 1945–1950: Central Research Centre 1950–1954: Forest In- dustry Factory  1934–1955: Forest In- dustry Company (New Zealand)	1945–1961: Forest Industry Factory	Woman's career is short, only 13 years but has several international assignments. Men has longer career but only one workplace and probably one posts. Only one post mentioned; hard to look CD.	

<p>6. <b>Joined:</b> 1947 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> 1923</p>	<p>1947–1952: Forest In- dustry Factory, Chem- ist  1952–1957: Forest In- dustry Factory, Chem- ist</p>	<p>1946–1951: Paper Making Related As- sociation  1947–1959: Univer- sity  1951–1960: Paper Making Related As- sociation (Germany), Industry Economy Assistant 1960–1966: CEO  1967–1977: Paper Making Related As- sociation, CMO 1976–1979: Manager 1980–1982: Deputy CEO</p>	<p>Woman has short career, only 10 years, no CD. Man has longer career with CD and has international assignments. (Career ends about 10 years after marriage)</p>
<p>7. <b>Joined:</b> 1948 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> W:1921, M:1920</p>	<p>1946–1947: Chemis- try Related Union  1947–1949: Forest In- dustry Company’s La- boratory  1949–1954: Paper Mill  1954–1962: Trade School</p>	<p>1959–1964: Engi- neer association, Di- vision Secretary  1947–1977: Paper Mill  1978–1980: Forest Industry Company, Manager</p>	<p>No observable CD in woman’s career, lot of workplaces. Men has eventually CD.</p>
<p>8. <b>Joined:</b> W:1949, M:1948 <b>Education:</b> Master of Science in Engineering, HUT</p>	<p>1949–1955: Forest In- dustry Company’s La- boratory  1956–1979: Same Company, Library Services  1980–1984: Head of Library Services</p>	<p>1948–1951: Forest Industry Company  1951–1953: Paper Mill (Italy), Operat- ing Engineer  1953–1961: Paper Mill (Italy), Manager</p>	<p>Woman has long career in one company, different departments, gets to lower management. Man has several international assignments and CD is observable.</p>

<b>Year of Birth:</b> W:1923, M:1925		1961–1966: Paper Mill (Italy), Technical Manager	
		1963–1968: Paper Mill (Netherlands)	
		1968–1977: Forest Industry Company	
		1971–1977: Forest Industry Company	
		Died in 1977.	
<b>9. Joined:</b> 1949 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> W:1921, M:1918	1946–1949: Central Research Centre  1949–1956: Forest Industry Company’s Laboratory  1956–1957: Intellectual Property Law Firm  1957–1964: Entrepreneur  1959: Organization for Standardization  1959–1970: Pharmaceutical Company  1970–1971: Chemical Industry Company  1971–1977: Pharmaceutical Company	1946–1948: Machine Shop and Mechanical Industry Company  1948–1954: Forest Industry Company  1954–1961: Forest Industry Company, Head of planning and Division Leader  1961–1968: Forest Industry Company, CEO  1968–1972: Forest Industry Company, Division Leader and Member of the Board 1972–1977: Deputy CEO 1978–1981: CEO	Woman has a lot of workplaces from diverse area of different industries. She was entrepreneur for a time. No observable CD. Man had observable CD that follows CD theories.
<b>10. Joined:</b> 1949 <b>Education:</b> Master of Science in	1948–1955: Central Research Centre  1955–1956: Paper Mill (England)	1947–1950: Central Research Centre 1950–1952: Division Leader  1953–55: Paper Mill, Operating Engineer	Woman has no observable CD but has several international assignments. Man has usual CD inside one company. Lateral rise.

Engineering, HUT <b>Year of Birth:</b> 1923	1956–1960: Paper Mill (Italy) 1961–1982: Forest Industry Company	1955–1961: Division Leader 1961–1969: Tech- nical Manager 1970–1979: Director of the Mill 1979–1982: Deputy Local Director  1962–1965: Engi- neering association, Division secretary 1976–1977: Presi- dent	
11. <b>Joined:</b> 1950 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> 1925	1949–1957: Forest In- dustry Company’s La- boratory 1957–1983: Forest In- dustry Company	1948–1950: Forest Industry Company (USA) 1950–1963: Paper association, Tech- nical Worker 1963–1969: Deputy Director 1970–1977: Tech- nical and Marketing Director 1978–1987: Presi- dent  1961–1977: Engi- neer’s Association, Club Master 1968–1977: Member of the Board	Woman has only two companies, no mentions of the posts, therefore no observable CD. Man has international assignments and works with associations where he has lateral CD.
12. <b>Joined:</b> 1951 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> W: 1919, M:1921	1946–1947: Chemis- try Union, Secretary 1947–1956: Forest In- dustry Company 1956–1957: Chemis- try Union	1949–1951: Paper Mill 1951–1954: Paper Mill 1954–1959: Paper Mill, Director 1959–1977: Local Director	Woman has short career, 11 years and no observable CD. Man has in his later career observable lateral CD.
13.	1949–1952: Forest Industry Company	1941–1947: Forest Industry Company	Both do not have observable CD and

<b>Joined:</b> 1953 <b>Education:</b> Bachelor of Science in Engineering, TTO <b>Year of Birth:</b> W:1917, M:1918	1952–1975: Forest In- dustry Company’s La- boratory	1947–1952: Forest Industry Company  1952–1979: Forest Industry Company	only couple of workplaces, relatively same careers.
14. <b>Joined:</b> W:1956, M:1953 <b>Education:</b> Master of Science (Chemistry), HU <b>Year of Birth:</b> 1925	1952–1963: Central Research Centre 1963–1985: Division Leader	1951–1957: Central Research Centre  1957–1972: Consumer packaging Manufacturer (Sweden), Laboratory Leader  1972–1977: Forest Industry Company (Sweden)	Same kind of CD, both stay in lower management, man changes to work in Sweden.
15. <b>Joined:</b> 1956 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> W:1916, M:1919	1943–1947: Central Research Centre  1947–1949: Central Research Centre (Sweden)  1949–1950: Tobacco Company (Scotland)  1950–1954: Central Research Centre 1954–1988: Division Leader	1947–1948: Central Research Centre, Assistant  1948–1949: Forest Industry Company, Research Engineer  1949–1956: Forest Industry Company, Operating Engineer and Division Director  1961–1964: Forest Industry Company, 1964–1981: Deputy Technical Leader	Woman has several international assignments and CD goes to lower management. Man, as well goes to lower management.

<p>16. <b>Joined:</b> 1856 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> W:1919, M:1920</p>	<p>1955–1967: Forest Industry Company’s Laboratory, Laboratory Engineer 1967–1983: Librarian</p>	<p>1951–1959: Paper Mill, Division Leader 1956–1961: Another Division’s Leader 1961–1966: Another Division’s Leader 1966–1978: Maintenance Manager and Main Engineer</p>	<p>Woman’s career goes backwards from researcher to librarian. Man works in lower management for the whole career, no real CD.</p>
<p>17. <b>Joined:</b> 1956, M:1952 <b>Education:</b> Licentiate of Science (Chemistry), HU <b>Year of Birth:</b> 1915, M:1923</p>	<p>1939–1943: University, Assistant 1943–1946: Rubber Product Company, Chemist 1946–1949: University, Research Assistant 1949–1971: Government’s Research Centre, Research Assistant</p>	<p>1951–1959: Central Research Centre 1959–1960: Pharmaceutical Company, Main Chemist 1960–1983: Forest Industry Company, Head of Research 1984–1993: Head of Research</p>	<p>Both satays in research, man has little CD to lower management, not that much difference.</p>
<p>18. <b>Joined:</b> 1957 <b>Education:</b> Master of Science in Engineering, HUT <b>Year of Birth:</b> 1930</p>	<p>1955–1956: Forest Industry Company’s Laboratory, Deputy Librarian 1956–1976: Research Engineer 1976–1991: Special Researcher 1992–1995: Development Director</p>	<p>1956–1959: Paper Mill 1959–1968: Forest Industry Company 1962–1963: University (USA) 1968–1971: Forest Industry Company (Switzerland) 1971–1977: Forest Industry Company 1978–83: Different Division 1984–1990: Different Location, Development Director</p>	<p>Man has international assignments; in both cases CD stays in lower management roles. Woman styes in the same company.</p>

		1991–1991: Different Location, Project Manager	
		1992–1993: Different Location, Project Manager	
19.	1954–1956: Chemical Industry Company	1958–1959: Paper Mill	Woman's career develops to lower management and then changes career which creates small drop. Man has short career, only one year, could have changed to another career and dropped from the association
<b>Joined:</b> 1957			
<b>Education:</b> Master of Science in Engineering, HUT	1956–1960: Forest Industry Company, Literature Research		
<b>Year of Birth:</b> 1926	1960–1970: Oil Refining Company, Division Leader		
	1970–1972: Consulting Company, Informaticist		
	1973–1974: University (Estonia)		
20.	1959: Paper Mill	1952–1978: Forest Industry Company	Woman's career is short, only one year, could drop from association and change career or got married. Man has relatively long career in the same company, no observable CD, could stay at the same post.
<b>Joined:</b> W:1957, M:1958			
<b>Education:</b> W: Bachelor of Science, HU, M: Licentiate of Science (Chemistry), HU			
<b>Year of Birth:</b> 1925			

## APPENDIX 2 Case 2: Pairwise Comparisons (1980–1984)

Information of the Pair	Career Development of Women	Career Development of Men	Results and Notes
1. <b>Joined:</b> 1980 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1951	1980: Food Industry Company, Research Engineer 1981–1983: Paper Industry Company, Research Engineer 1986–1991: Division Leader 1992–1994: Development Manager 1995–1996: Paper Industry Company, Product Researcher 1997–2000: Paper Industry Company, Product Researcher 2001–2014: Senior Researcher	1981–1982: Paper Industry Company 1983: Paper Industry Company, Operating Engineer 1984–1985: Paper Industry Company, Operating Engineer 1986: Production Manager 1987–1990: Paper Industry Company, Production Manager 1991–1996: Paper Industry Company, Production Manager 1997–1998: Paper Industry Company, Factory Manager 1993–2003: Local Director 2004–2012, Same Company, Different Location, Factory Manager	Woman's Career goes to lower management and then drops. Man's Career follows latter CD theories to top management. They get to lower management at the same time.



<p>2. <b>Joined:</b> 1980 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1953</p>	<p>1981–1984: Forest Industry Company, Research Engineer 1985–1987: Government’s Research Centre (Sweden), Main Engineer 1988–1990: Consulting Company 1991–1992: Consulting Company, Process Consultant 1993–2003: Consulting Company, Process Consultant 2004–2007: Consulting Company, Process Consultant 2008–2017: Consulting Company, Process Consultant</p>	<p>1980–1985: Forest Industry Company, Project Engineer 1985: Production Manager 1986–1987: Paper Mill (Sweden), Deputy Operations Manager 1988–1990: Paper Mill (Sweden), Technical Manager 1990: Forest Industry Company, Project Manager 1991: Forest Industry Company, Project Manager 1992: Paper Mill, Division Leader 1993–1995: Factory Manager 1996–2002: Quality Manager</p>	<p>Both go to work for their international assignment to Sweden, Man is there longer. Man gets to middle management; woman have no CD</p>
<p>3. <b>Joined:</b> 1980 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1954</p>	<p>2013–2022: Consulting Company, Marketing Manager</p>	<p>1981–1983: Forest Company Factory, Operating Engineer 1984–1986: Forest Company Factory, Researcher 1987–1990: Forest Industry Company, Researcher 1991–1993: Forest Company</p>	<p>Woman has not given her work information from the beginning, at the end of her career, she has reached lower management. Men develops to lower management as well.</p>

		Factory, Re- searcher 1994–1996: Sen- ior Researcher	
		1997–2003: For- est Industry Com- pany, Senior Re- searcher 2004–2009: Head of Research 2010–2022: Sen- ior Technologist	
4. <b>Joined:</b> 1980 <b>Education:</b> Licentiate of Science in Engineering <b>Year of Birth:</b> W:1954, M:1953	1981: Forest In- dustry Company, Research Engineer  1982: Ministry, Chief Inspector  1983–1987: Tech- nology Research Centre, Special Researcher 1988–1990: Pro- ject Manager  1991–1998: Forest Industry Related Union, Head of Research  1999–2000: Tech- nology Company, CEO  1999–2017: Engi- neer’s Associa- tion, President	1981–1984: University, Assistant  1985: Technology Company  1986: Technology Company  1987: Technology Company  1988–1992: Consulting Company, Consultant  1993: Consulting Company  1996–2005: Consulting Company, Process Engineer 2006–2008: Leading Technology Specialist	Woman gets to Highest positions as CEO and president of the association. Men has only little observable CD:
5. <b>Joined:</b> 1980	1981: Forest In- dustry Company, Research Engineer	1982–1983: For- est Company,	Woman’s career was going first up to lower management, then

<b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1952	1981–1984: Head of Laboratory 1985–1989: Project Engineer 1990: Research Engineer 1991–1996: Forest Industry Company, Product Development Engineer 1997: Forest Industry Company, Product Development Engineer 1998–2012: Division Leader	Planning Engineer 1984–1985: Operating Engineer 1986–1987: Operations Manager 1988–1994: Head of Development 1995–2001: Forest Company, Project Manager 2002–2012: Forest Company, Factory Manager 2013–2014: Forest Company, Vice President	decreased and then back to lower management. Man's career follows CD theories of lateral rise.
<b>6.</b> <b>Joined:</b> 1980 <b>Education:</b> Doctor of Science in Engineering <b>Year of Birth:</b> 1954	1981–1984: University, Assistant 1986–1991: Electronics Company, Head of Research 1992–1995: Forest Industry Company, Head of Research 1996–1999: Manager 2000–2005: Research Project, Coordinator 2006–2014: Research Centre, Manager/Professor 2015–2019: Research Centre, Division Leader	1981–1983: Forest Company Factory, Operating Engineer 1984–1986: Forest Company Factory, Researcher 1987–1990: Forest Industry Company, Researcher 1991–1993: Forest Company Factory, Researcher 1994–1996: Senior Researcher 1997–2003: Forest Industry Company, Senior Researcher 2004–2009: Head of Research	Woman gets quite fast to middle management. Man's career rises slower, gets to lower management.

		2020–2022: Specialist organization, Vice Chairman	2010–2022: Senior Technologist	
7.		1983–1985: Forest Industry Company, Head of Laboratory	1970–1973: Electronics Company, Development Engineer	Man rises quite fast in his career and does one international assignment. Finally, he gets several CEO roles and be the chairman of the board. Woman gets to middle management and has several roles, the career decreases to advisory role.
<b>Joined:</b> W:1981, M:1972				
<b>Education:</b> Doctor of Science Engineering	of in	1983–1985: Forest Industry Company, Main Chemist	1973–1977: Forest Industry Company, Production Manager	
<b>Year of Birth:</b> W:1944, M:1945		1986–1989: Division Leader	1978–1980: Forest Industry Company (France)	
		1990–1998: Central Research Centre, Division Leader	1981–1990: Chemical Supplier Company, CEO	
		1999: Manager of Department		
		1991–1992: Engineer's Association, Member of the Board	1991–1992: Finance Company, CEO	
		2000–2001: Forest Industry Company, Development Manager	1993–1996: Machine shop Company, CEO	
		2002–2005: Forest Industry Company, Development Manager	1997–2008: Forest Industry Company, CEO	
		2006–2009: Forest Industry Company, Senior Advisor	2008–2022: Chemical Supplier Company, Chairman of the Board	
8.		1984–1985: Forest Industry Company, Research Engineer	1981: Forest Industry Company, Research Engineer	Woman has short career, 9 years. no CD. Man has CD, gets to top management and has one international assignment.
<b>Joined:</b> 1981	of in	1986–1987: Project Engineer	1982–1983: Head of Division	

<b>Year of Birth:</b> 1955	1988–1992: Preparation Engineer 1993: Research Engineer	1984: Division Engineer  1985–1986: Forest Related Union, Operating Engineer  1987: Forest Industry Company, Operating Engineer 1988–1990: Head of Development  1991–1993: Forest Industry Company, Head of Company Planning  1994–1995: Forest Industry Company (Germany)  1996–1999: Forest Industry Company, Planning Manager 2000–2003: Head of Planning 2004–2014: SVP	
9. <b>Joined:</b> W:1982, M:1982 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1954	1981–1985: Consulting Company, Expenses Engineer  1986: Consulting Company  1987–1989: Consulting Company (USA)  1990–1994: Electronics Company	1982–1984: Forest Industry Company, Operating Engineer	Man has short career, only 2 years, could have changed career or left out association. Woman has international assignment. Gets to top management.

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	1995–1996: Forest Industry Company			
	1997: Forest Industry Company, Corporate Communications Manager			
	1998–1999: Environment Communications Manager			
	2000: Environment Manager			
	2001–2003: Investor Relations Manager			
	2004–2005: Vice President, Environmental Affairs			
	2006–2008: Environment Manager			
10.	1983–1984: Forest Industry Company, Head of Product sales	1983: Forest Industry Company, Computer Engineer	Forest	Man has short career, 13 years. Has international assignment and gets to lower management. Woman works many posts in lower management.
<b>Joined:</b> 1982	1988–1989: Forest Industry Company	1984–1990: ADB Manager		
<b>Education:</b> Master of Science in Engineering	1990–1995: Head of Research	1991: Forest Industry Company (Belgium), ADB Coordinator		
<b>Year of Birth:</b> W:1958, M:1957	1996–2005: Central Research Centre, Special Researcher	1992–1996: Forest Industry Company, ADB Manager		
	2005–2009: Research Director			
	2010–2012: Government's Research centre, Development Manager			
	2013–2022: Principal Scientist			
11.	1982–1986: Consulting Company	1982–1983: Forest Industry Company, System Engineer		Woman gets to middle management. Man gets to middle management, has interruptions in
<b>Joined:</b> 1982				
<b>Education:</b> Master of				

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Science Engineering <b>Year of Birth:</b> 1953	in 1987–1989: Forest Industry Com- pany, Process En- gineer 1990: Laboratory Manager 1991: Quality En- gineer 1992–1997: Qual- ity Manager  1998–2003: Paper Mill, Director of Design 2004–2017: Direc- tor of Environ- mental Research and Design	1984–1985: Technology Company, Sales and Project Engi- neer  1986–1987: Technology Company, Sys- tem Engineer  1988: Technol- ogy Company  1990: Technol- ogy Company  1992–1993: Technology Company, Head of Sales  1994–2005: Technology Company, Head of Sales  2006–2008: En- vironmental En- gineering Com- pany, District Sales Manager	career history, could be related to reporting.
12. <b>Joined:</b> 1982 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1955	1984–1990: Forest Industry Company, Laboratory Engineer  1991–1996: Forest Industry Company, Researcher  1997–1998: Forest Industry Company, Researcher	1983–1984: University, Researcher  1985: Technology Company, Head of Development and Research  1986: Electronics Company, Head of Development and Research	Woman's career gets to top management after several roles. Man gets to top management as well and has several CEO roles but then jumps lower.

	1999–2014: Head of Research	1987–1988: Technology Company, Head of Development and Research	
	2015–2017: University, Assistant Professor and Division Director	1999–2000: Consulting Company, CEO and Consultant	
	2018–2022: Vice Dean and Division Director	2001–2007: University, Professor	
		2008–2017: Consulting Company, CEO	
		2018–2022: Senior Consultant	
13.	1982–1986: Machine Manufacturer Company, Process Designer	1990–1991: Forest Industry Factory, Project Engineer	Woman has short career, only 11 years. Has only little CD. Man's career is also short, 10 years reported, gets to lower management.
<b>Joined:</b> 1982		1992–1996: Project Manager	
<b>Education:</b> Master of Science in Engineering		1997–1998: Forest Industry Company, Project Manager	
<b>Year of Birth:</b> 1955	1988–1990: Consulting Company, Senior Designer	1999–2000: Forest Industry Company, Project Manager	
	1991–1993: Consultant		
14.	1983–1984: Consulting Company, Planning Engineer	1982–1984: Consulting Company, Process Engineer	Woman gets to middle management; career follows usual CD models. Man has two international assignments and gets to top management following CD theories lateral model.
<b>Joined:</b> 1982		1985–1986: Forest Industry Company, Process Engineer	
<b>Education:</b> Master of Science in Engineering	1985–1987: Process Engineer	1987–1990: Head of Marketing	
<b>Year of Birth:</b> 1956	1988–1990: Central Research Centre, Researcher		
	1991: Group Leader		



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	1992: Consulting Company, Project Engineer	1991–1994: Forest Industry Company (Germany), Head of Marketing	
	1992–1994: Research Company, Head of Laboratory	1995–2000: Forest Industry Company (Germany)	
	1995–1999: Forest Industry Company, Development Engineer	2001–2003: Forest Industry Company, Factory Manager	
	2000: Team Leader	2004–2018: Director	
	2001–2012: Forest Industry Company, Development Manager		
	2012–2019: Forest Industry Company, Development Manager		
15.	1983: Government Own Company's Research Laboratory, Researcher	1983: Forest Industry Company, Project Engineer	Woman has only little career development, no lower management roles. Man has short career, six years. No observable CD.
<b>Joined:</b> 1982		1984–1985: Forest Industry Company, Operating Manager	
<b>Education:</b> Master of Science in Engineering			
<b>Year of Birth:</b> 1954	1984–1986: Forest Related Union, Laboratory Engineer		
	1987–1991: Forest Industry Company, Laboratory Engineer	1986–1987: Forest Industry Company	
	1992–1999: Researcher		

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	2000: Researcher and Patent Engineer		
	2001–2007: Forest Industry Company, Head of Laboratory and Patent Engineer		
	2008–2009: Specialist		
	2010–2017: Forest Industry Company, Quality Control Engineer		
16.	1982–1987: Forest Industry Company, Research Engineer	1982: Central Research Centre, Research Assistant	Woman has small career development, one lower management job, but drops again after that. Man gets to top management following CD theories.
<b>Joined:</b> 1982	1988–1990: Forest Industry Company, Development and Quality Control Engineer	1983–1984: Industrial Wholesaler (Denmark), Sale and Customer Service Engineer	
<b>Education:</b> Master of Science in Engineering		1991: Forest Industry Company, Development and Quality Control Engineer	
<b>Year of Birth:</b> 1955		1992: Development Engineer	
		1993–1994: Operating Engineer	
		1995–1996: Forest Industry Company, Operating Engineer	
			1985–1987: Industrial Wholesaler, Head of Marketing
			1988: Industrial Wholesaler, Head of Marketing
			1990: Chemistry Company, Division Leader
			1991–1992: Head of Unit
			1992–1995: Assistant Vice President
			2000: President
			2001–2005: Vice President

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	1997–2003: Forest Industry Company, Development Engineer		
	2004–2005: Forest Industry Company, Operating Engineer		
	2006–2007: Division Leader		
	2008–2012: Forest Industry Company, Senior Researcher		
	2013–2019: Senior Technologis		

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17.	1982–1983: Consulting Company, Process Engineer	1983: Forest Industry Company, Head of Consulting 1984–1985: Development Manager	Woman gets to lower management at her second post but then drops and after that leaves for the international assignments and career ends. Could have probably stayed in Austria and left the association for that reason. Man's reported first jobs are already in lower management. and rises to middle management. Then he does international assignment and comes back to work as CEO
<b>Joined:</b> 1982		1986–1987: Forest Industry Company (Germany), Product Manager	
<b>Education:</b> Master of Science in Engineering	1984–1985: Forest Industry Factory, Development Manager	1988–1989: Product Group Leader	
<b>Year of Birth:</b> 1953	1986–1991: Consulting Company, Process Engineer	1990: Forest Industry Company	
	1992–1994: Consulting Company (Austria)	1991: Forest Industry Company, Product Group Leader	
	1995–2000: Forest Industry Company (Austria)	1992: Division Leader	
	2001–2003: Forest Industry Company (Austria)		

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		1993: Director	
		1994–1995: Forest Industry Company (Switzerland), Director	
		1996–1998: Textile Production Company, CEO	
		1999–2007: Forest Industry Company, CEO	
		2008–2022: Packaging Company, CEO	
18.	1983–1985: Forest Industry Company, Operating Engineer	1982–1983: For- est Industry Com- pany, System En- gineer	Woman gets to lower management roles, has quite few workplaces compared to other, only for; works longer periods for one company. Man gets to middle management and follows CD theories.
<b>Joined:</b> 1982	1990–2000: Forest Industry Company	1984–1985: Technology Company, Sales and Project Engi- neer	
<b>Education:</b> Master of Science in Engineering	2001–2003: Forest Industry Company	1986–1987: Technology Company, Sys- tem Engineer	
<b>Year of Birth:</b> 1953	2004–2010: Head of Marketing	1988: Technol- ogy Company	
	2013–2019: Environment Protection Association, Project Manager	1990: Technol- ogy Company	
		1992–1993: Technology Company, Head of Sales	

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			1994–2005: Technology Company, Head of Sales	
			2006–2008: Environmental Engineering Company, District Sales Manager	
19.	1983–1985: Trading Company, Sales Engineer	1984–1987: Forest Industry Company, Operating Engineer	1988–1989: Product Manager	Woman gets to lower managerial roles, but career is short, 13 years. When the recorded last job is, woman's last name changed according to records. Could have gotten married and left workforce. Man has international assignment and works in middle management until turning to be entrepreneur.
<b>Joined:</b> 1983	1986–1987: Forest Industry Company, Tender Engineer	1990–1991: Forest Industry Company (Canada), Product Manager	1992–1995: R&D Manager	
<b>Education:</b> Master of Science in Engineering	1988–1991: Forest Industry Company, Development Engineer	1996–1998: Forest Industry Company, Customer Service Manager	1999–2000: Director of Reference	
<b>Year of Birth:</b> 1957	1996: Forest Industry Company, Product Manager	2004–2014 General Manager	2015–2022: Entrepreneur	
20.	1984: Forest Industry Company, Usage and Quality Control Engineer	1984–1985: Technical Company, Head of Division	1986: Electronics Company, Head of Division	Woman works only in 3 companies which is quite few compared to others; works longer periods in one company. Gets to lower management roles. Man's recorded career starts from lower
<b>Joined:</b> 1983	1985–1987: Head of Laboratory			
<b>Education:</b> Master of Science in Engineering	1988–1991: Forest Industry			
<b>Year of Birth:</b> 1946				

	Company, Head of Laboratory 1992–1997: Head of Development  1998–2009: Forest Industry Company, Senior Specialist	1987: Electronics Company, Division Leader 1988–1989: System Manager 1990: Project Manager  1991–1992: Consulting Company, Project Manager 1993–1993: Division Leader 1997–1999: Head of Marketing 2000–2014: Specialist	management and gets to middle management.
21. <b>Joined:</b> 1983 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1955	1984–1987: Forest Industry Company, Research Engineer  1988–1991: Forest Industry Company, Operating Engineer 1992–1997: Production Manager  1998–2012: Forest Industry Factory  2013–2014: Forest Industry Factory, HR Manager	1984–1986: Forest Industry Company, System Engineer  1987: Forest Industry Company, System Engineer	Man's career is short, only 3 years. No CD happening during that. Woman gets to middle management, again only 4 companies that woman has works, quite few.
22. <b>Joined:</b> 1983 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1958	1983–1985: Consulting Company, Project Engineer  1986: Forest Industry Company, Research Engineer	1984–1985: Forest Industry Company, Operating Engineer 1986–1987: Production Manager	Man works for only two companies during his career, follows old models where employees rise in the organization. Gets to top management. Woman has no

	1987–1989: Product Development Engineer	1988–1989: Production Manager	significant CD, stays in same level jobs.
	1990: Forest Industry Company, Tender Engineer	1990–1996: Division Leader	
	1991–1992: Forest Industry Company, Tender Engineer	1997–1998: Forest Industry Company, Development Director	
	1992–1994: Quality Engineer	1999–2001: Director	
	1995–1998: Forest Industry Company, Quality Engineer	2002–2003: Branch Manager	
	1999–2007: Forest Industry Company, Operating Engineer	2004–2005: Director	
	2008–2022: Development Engineer	2006–2014: Branch Manager	
		2015–2022: CTO	
23.	1984–1987: Consulting Company, Consultant	1982–1985: Central Research Centre	Woman has short recorded career, only three years. No CD happening during that. Man gets to middle management.
<b>Joined:</b> W:1983, M:1983		1986: Forest Industry Company, Head of Sales	
<b>Education:</b> Master of Science (Chemistry)			
<b>Year of Birth:</b> W:1945, M:1942		1987: Wholesale Company, Head of Sales	
		1988–2007: Chemistry Company, Product Manager	

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24. <b>Joined:</b> 1984 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1958	1984–2001: Consulting Company, Process Engineer  2002–2003: Forest Industry Company, Development Manager 2004–2005: Project Manager 2006–2007: Vice President 2008–2009: Development Director  2010–2012: Chemistry Company: Vice President  2013–2014: Consulting Company: Senior Consultant  2015–2017: Ministry, Strategic Director  2018–2022: Forest Industry Company, Environmental Licenses	1984: Forest Industry Company  1985: Forest Industry Company, Production Engineer 1986–1990: Department Engineer  1991–1992: Forest Industry Company, Department Engineer 1993: Production Manger  1994–1996: Forest Industry Company, CTO  1997–1999: Forest Industry Company, Research Director  2000: Forest Industry Company, R&D Director 2001–2005: Business Unit Director 2006–2012: Local Director 2018–2019: Mill Director  2008–2012: Engineer’s Association, President	Woman gets to top management several times. Man as well gets to top management positions several time.
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			2020–2022: Manufacture Company, SVP	
25.	1984:	Forest	1985–1995: Educational Centre, CLO	Woman's recorded career is short, 6 years, gets to lower management. Man's recorded career starts from top management posts and he stays in top or middle management.
<b>Joined:</b> 1984	Industry		1996–2000: Director	
<b>Education:</b>	Company,		2001–2003: Forest Industry Company,	
Master of	Research		Assistant Vice	
Science in	Engineer,		President	
Engineering	1985–1986: Operating		2004–2005: Vice President	
<b>Year of Birth:</b> 1955	Manager		2006–2007: HR Manager	
	1987–1990: Forest		2008–2012: Forest Cooperative, HR Manger	
	Industry		2013–2014: Forest Industry Company, Senior Vice President	
	Company,		2015–2017: Forest Industry Company, HR Business Partner	
	Production Manager		2018–2019: Forest Industry Company, HR Manager	
26.	1985: Consulting		1985–1986: Forest Industry Company,	Woman gets to middle management and has several managerial roles. Man's recorded career is short, 3 years, during that there is no CD.
<b>Joined:</b> 1984	Company		1986–1987: Operating Engineer	
<b>Education:</b>	1986–1989: Forest		1986–1987: Operating Engineer	
Master of	Industry		1990–1991: Researcher	
Science in	Company,			
Engineering	Laboratory			
<b>Year of Birth:</b> 1954	Engineer			
	1990–1991: Researcher			

	1992–1995: Development Manager			
	1996–1998: Production Manger			
	1999–2001: Forest Industry Company, Head of Research and Development			
	2002–2009: Technical Leader			
27.	1985–1987: Forest Industry Company, Informationist	1985–1987: Forest Industry Company, Research Engineer	1988–1996: Head of Customer Service	1988–1990: R&D Engineer
<b>Joined:</b> 1984				
<b>Education:</b>				
Master of Science in Engineering				
<b>Year of Birth:</b> 1955				
	1997–2007: Forest Industry Company, Head of Technical Support for Sales	1991–1996: Forest Industry Company, Researcher		
		1997–2001: Forest Industry Company, Researcher		
		2002–2014: Senior Researcher		
		2015–2022: Forest Industry Company, Senior Technologist		
28.	1984: Forest Industry Company, Market Researcher	1990: Technology Company, Director	1991: Division Leader	1992–1996: Division Leader
<b>Joined:</b> 1984				
<b>Education:</b>				
Master of Science in Engineering and Executive Master of				
	1985–1994: Consulting Company, Cost Engineer			
				Woman works for only two companies which is quite few. She gets to lower management. Man has only little CD and does not get to lower management.
				Woman gets to top management, follows, CD theories of lateral rise. Man as well gets to top management but career has more ups and downs during CD.

Business Administration <b>Year of Birth:</b> W:1956, M:1954	1995–2001: Division Leader 2002–2017: Associate Principal 2018–2019: Principal 2020–2022: Consulting Company, Principal	1997: Forest Industry Company, Process Development Engineer 1998–2000: Technology Company, Division Leader 2001–2003: Group Senior Vice President 2004–2005: Forest Industry Company, Vice President 2006–2012: Forest Industry Company, President	
29. <b>Joined:</b> 1984 <b>Education:</b> Master of Science in Engineering <b>Year of Birth:</b> 1956	1985–1990: Forest Industry Company, Research Engineer 1991: Research Manager 1993–1994: Forest Industry Company, Research Manager 1995–2001: Forest Industry Company, Research Manager 2002–2014: Forest Industry Company, Research Manager 2015–2019: Forest Industry	1985–1987: Forest Industry Company, Research Engineer	Man’s recorded career is short, only 2 years, no observable CD. Woman works only in the same work positions in several companies, no CD.

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Company,  
Research Manager

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