

Interplay of Gender and Nationality in the Early Careers of Finnish Engineering Doctoral Graduates

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Introduction

The effect of gender on engineering careers has been an interest of researchers for a long time, yet there seems to be a shortage of studies revealing the way gender interplays with other categories [1]. Most of the recent intersectional research on engineering seems to focus on the interplay of gender and race [2], [3], [4], but also the intersection of gender with the socioeconomic situation [5], [6], sexual orientation [7], family situation [8], [9], and age [10] has been investigated. Much of the research on women in engineering seems to be conducted in the North American context [1]. The research on gender differences in engineering careers also appears to concentrate on undergraduate-level engineering, where the volumes are large, with far less attention paid to doctoral-level education and graduates. When the career paths and outcomes of doctoral graduates are studied, the focus of attention is often on the academic careers and outcomes instead of the post-doc careers of all PhDs [11].

To bridge gaps in intersectional understanding, outside the North American context, and in information about PhD employment and careers of all engineering PhDs, this paper focuses on the intersectional effects of gender and nationality on the early careers of engineering doctoral graduates in Finland. Nationality as a variable is used dichotomously to distinguish between the graduates of Finnish origin from the others, and thus, it probably tells more about the social context of the graduates as natives or immigrants than about their actual ethnic or cultural differences. Nevertheless, it provides important information about the different positions toward employment and career.

Gendered features in the employment of doctoral graduates

Many studies have shown the gendered nature of the career paths of doctoral graduates. Waaijer et al. [11] found that among recent Dutch doctoral graduates, women were more likely to work in academia, whereas men were more likely to work in nonacademic research, with no gender differences in job levels. The difference remained even after taking into account differences in the fields of doctoral graduates. They also found that female doctoral graduates were less often employed with permanent contracts or temporary contracts with the prospect of permanence than males. This difference, however, disappeared when the sector and field of employment were taken into account, suggesting that the better chances of getting a permanent contract outside academia and in the field of engineering were favoring the male respondents of their study in this respect.

In contrast, Peri-Rotem [12] noted that among the doctoral graduates in the United Kingdom, the weaker position of women obtaining permanent employment could not be explained by the choice of employment or the type of occupation, and the gender gap was present even when the study discipline was included in the logistic regression model for permanent employment. In fact, she argues that the gender difference in permanent employment is particularly strong in the private sector and nonacademic occupations [12], which is also common in the employment of doctoral graduates in engineering in Finland [13]. In addition to better chances of securing permanent employment, men were also found to have better earnings than women within and outside academia [12].

A study of STEM PhD graduates from two European universities reveals that women are more likely to be employed in public administration than men and more likely to be employed in academia than in industry [14]. Analyses from the same study also indicate that graduates from outside the EU are more likely to be employed in academia than in industry or in public administration. Also in the U.S. women with doctorates in STEM are, on the whole, more likely than men to enter postdoctoral positions in academia and less likely to enter business or industry, but a comparison between different cohorts of doctoral graduates indicates that in time the gender gap in postdoc entry has been reversed and the gender gap in entering business or industry has disappeared [15].

Although the research is scarce, there is some evidence of the effects of gender–race interaction for the employment of engineering PhD recipients. A large dataset from the United States shows that the job-searching doctoral recipients' likelihood of receiving no job offers is affected by both gender and race with white males being the most and Asian females being the least likely to receive job offers [16]. White females' likelihood of receiving no job offers was lower than that of Asian or Black males and equal to the Hispanic males [16] suggesting that in this respect, race may be a more influential factor for employment than gender. However, the gender gaps across all the racial groups illustrate well that both aspects matter and that their interplay puts nonwhite women to the most difficult position.

Gender differences in career paths of Finnish engineers

In the Finnish context, more is known about the career paths of lower-level engineering graduates as opposed to the PhDs in engineering. Vuorinen-Lampila [17] found that the share of female graduates in technology who had experienced unemployment was almost double compared with that of male graduates. Men were also more likely than women to have permanent employment and were more likely to work in the private sector than women [17]. The gender differences were smaller among university degree holders than among those with degrees from universities of applied science [17].

For university graduates the start of a career in engineering is more challenging for women than for men. Although no differences in the likelihood of unemployment or the length of unemployment periods were detected among master-level graduates, women's early careers were more fragmented with more employers and contracts, and longer periods of absence [18]. The lower salaries and fewer permanent contracts of women compared with men were confirmed also in this study [18].

In Finland, female engineers seem to end up in nontechnical occupations more likely than male engineers [13]. This applies both among graduates with a master-level degree and a doctoral-level degree, although the tendency is slightly lower with doctoral-level graduates. Gender differences in the distribution of workforce in different occupational groupings are not radical. However, at both levels, women are overrepresented among public administration managers and professionals, and underrepresented among research and development managers [13]. Women with a master-level degree in engineering are also overrepresented in teaching- and education-related occupations, but this overrepresentation is no more present among women with a doctoral degree [13].

Research objective and methods

The objective of this study is to understand how gender and nationality affect the employment and career of engineering doctoral graduates in Finland. Although the effects of both gender and nationality are interesting as such, a special interest of this study is to examine their interplay and the inequalities that the intersections may emphasize. Employment and career are investigated, on the one hand, as the actualized features in one's path in the working life, but on the other hand, as more subjective perceptions between the degree and one's job. The objective is pursued by answering two research questions:

1. *How do the employment and career paths of Finnish engineering doctoral graduates differ by the gender and nationality of the graduate? What kinds of interplays can be detected?*
2. *How do the satisfaction toward the doctoral degree and the perceptions of the benefits of a doctoral degree for employment as well as other employment-enhancing factors differ among Finnish engineering doctoral graduates by gender and nationality? What kinds of interplays can be detected?*

The data of the study consist of 633 responses to a national career monitoring survey administered three years after graduation to doctoral graduates in engineering in Finnish universities [19]. The data were collected in the years 2018–2020, meaning that the respondents had completed their doctoral degrees between 2015 and 2017; 70% of the respondents were male and 30% female, and they represented 50 different nationalities. In the survey 78% of the respondents were Finnish and 22% of other nationalities. Table 1 shows that when comparing the number of respondents in the data and the number of doctoral graduates and doctoral students in engineering in the years of the target groups' graduation, the average response rate to the survey was around 62%, and Finnish males were slightly overrepresented and non-Finnish males slightly underrepresented among the survey recipients.

Table 1. Finnish and non-Finnish males and females among the respondents of the survey, and the doctoral students and graduates in 2015–2017

	Respondents (N=633)	Doctoral students 2015-2017 (N=9642)*	Doctoral graduates 2015-2017 (N=1020)
Finnish males	55 %	51 %	48 %
Finnish females	24 %	26 %	25 %
Non-Finnish males	16 %	17 %	21 %
Non-Finnish females	5 %	7 %	6 %

*The numbers do not add up to 100% due to rounding

The survey was administered to all persons who had graduated with a doctoral degree three years earlier. The respondents were asked about satisfaction with their degree, their overall career progress, perceptions of the factors contributing to their employment, competences required in their work, and the development of those competences during their university studies [19]. The process follows the ethical principles of Finnish universities' feedback surveys [20], established by the Finnish Council of University Rectors.

The questions used in this study consisted of closed questions, with alternatives to choose from or statements to be evaluated with a 6-point Likert scale. In addition to these, the respondents were asked to report their monthly income in euros as well as the duration of

their possible unemployment in years and months. The exact questions and their respective answers are presented in Table 2.

Although we are aware that there are more than two kinds of expressions of gender, the nature of the data restricts us to view gender as a binary variable according to the self-identification of the respondents as either male or female. In the original dataset, only five out of 638 respondents left the gender identification blank. Considering them as a separate respondent group would have been neither statistically nor ethically justified, as leaving the question unanswered cannot be interpreted as any particular identification of gender. Nationality was also used as a binary variable differentiating respondents with the Finnish nationality from the others. Hence, it probably tells more about the social context of the graduates as native Finns or immigrants than about their actual ethnic or cultural differences.

The statistical significance of differences between males and females and/or the respondents' nationality being Finnish or other was examined with different methods depending on the type of question and the resulting variables. For the categorical questions, the differences between distributions were studied with separate Mann–Whitney tests for gender and nationality. In the case of binary variables, the effects of gender and nationality were studied simultaneously with a logical regression analysis. The differences between continuous and Likert-scale variables were examined with a variance analysis followed by a comparison of the four respondent groups (Finnish males, non-Finnish males, Finnish females, non-Finnish females) using Tukey approximation. The analysis methods used for particular questions and variables are also presented in Table 2. The confidence level for statistical significance used in all of the analyses was 95% ($p < 0.05$). All the analyses were conducted with the statistical software Stata.

Table 2. Survey questions with respective variables and methods of analysis used to detect the differences by gender and/or nationality.

Question	Answers/Variables	Methods of analysis
Which of the next options best describes your (employment) situation 6 months before graduation / 6 months after graduation / at the moment?	Categorical variable with 13 options of employment or activity → 9 broader categories → Binary variable (regular full-time job / other)	Mann–Whitney test by gender and nationality (distribution of employment types) Logistic regression (regular full-time job) with gender and nationality at all three time points
Have you been an unemployed job seeker after completing your doctorate?	Binary variable (has not been unemployed / has been unemployed) Continuous variable Duration of unemployment (years and months → converted into years for calculations)	Logistic regression (not unemployed) with gender and nationality Variance analysis (duration of unemployment) + pairwise comparison with Tukey approximation
Who is your main employer?	Categorical variable with 9 options of employer type → New categorization with 4 broader categories	Mann–Whitney test by gender and nationality (distribution of employer types)
Which of the next options best describes the nature of your main work assignment?	Categorical variable with 15 types of work tasks → New categorization with 6 broader categories	Mann–Whitney test by gender and nationality (distribution of task categories)

Was a doctoral degree a qualification requirement for your current job?	Categorical variable with five options describing the relationship between doctoral degree and one's job	Mann–Whitney test by gender and nationality (distribution of relationship types)
Assess the statement “I am able to utilize what I learned during my doctoral studies well in my current work”	6-point Likert-scale variable ranging from 1=fully disagree to 6=fully agree	Variance analysis (ability to utilize skills) + pairwise comparison with Tukey approximation
Assess the statement “The requirement level of my works corresponds well with my doctoral education”	6-point Likert-scale variable ranging from 1=fully disagree to 6=fully agree	Variance analysis (requirement level correspondence) + pairwise comparison with Tukey approximation
What is your average gross wage or monthly income in euros (including regular bonuses, tax values of fringe benefits, and overtime compensation)?	Continuous variable (euros/month) → New continuous variable through removal of two outliers (euros/month)	Variance analysis (monthly income) + pairwise comparison with Tukey approximation
Does your work career meet your goals?	Categorical variable with four options describing the situation	Mann–Whitney test by gender and nationality (match btw career and goals)
Assess the significance of a doctoral degree in working life through the following statements. Having a doctoral degree has given me: <ul style="list-style-type: none"> • a higher salary • more demanding job assignments • more meaningful job assignments • better status at my place of work • a job with new employer • a better position in the labor market 	Categorical variable with options yes/no/I do not know → 6 binary variables (yes/no) for all the six statements	Logistic regression (all the six statements) with gender and nationality
From the perspective of your work career, how satisfied are you with your doctoral degree?	6-point Likert-scale variable ranging from 1=very unsatisfied to 6=very satisfied → used also as a binary variable (not satisfied / satisfied)	Variance analysis (satisfaction, Likert scale) + pairwise comparison Logistic regression (satisfaction as a binary variable)
Assess how the following factors have affected your employment after graduation. Please base your answers on your entire work career after graduation. <ul style="list-style-type: none"> • doctoral degree • topic of your dissertation • other work experience • higher university degree • other studies or education (not those included in your doctoral degree) • experience related to NGO work or interests • international experience • contacts/networks • ability to tell about your skills and competences • being active and having high profile in social media • other, what? 	6-point Likert-scale variable ranging from 1=not important at all to 6=very important	Variance analysis (all factors besides “other”) + pairwise comparison with Tukey approximation

Results

With the aim of maximum clarity and readability, the results are introduced in two phases. First, all the results of the numerical analysis are presented in a table format according to their method of analysis. The p-values denoting statistical significance with a 95 % confidence level are given in bold in all the tables. Table 3 contains all the results from the Mann–Whitney tests, Table 4 all the results of the variance analysis, and Table 6 all the results of the logistic regression analysis. However, Table 5 provides the Tukey comparisons only for those variables that were found to have statistically significant differences between the groups.

After the tables, the results are approached from two viewpoints: employment and career, and satisfaction and perceptions. Here, the results from different methods of analysis are drawn together to collate the data on actual employment and career (RQ 1) and satisfaction and perceptions around them (RQ 2).

Table 3. Distribution of the categorical variables and the results of the Mann–Whitney tests by gender and nationality

	Male		Female		M-W <i>p</i> (gender)	M-W <i>p</i> (nat.)
	Finnish	Other	Finnish	Other		
Main employer					0.0229	0.0894
Private or public company	57 %	48 %	43 %	43 %		
Government or municipality	7 %	3 %	14 %	0 %		
University or University of applied sciences	26 %	43 %	34 %	43 %		
Other	10 %	6 %	9 %	14 %		
Main work assignment					0.4674	0.0066
Research	43 %	58 %	46 %	62 %		
Teaching or education	4 %	8 %	12 %	4 %		
Management and supervisory duties	11 %	6 %	7 %	0 %		
Consulting or training	6 %	8 %	8 %	8 %		
Planning and development	33 %	13 %	22 %	15 %		
Other	4 %	7 %	6 %	12 %		
Doctoral degree as a requirement or prerequisite					0.3595	0.0003
Yes, a formal qualification requirement	24 %	47 %	31 %	38 %		
Yes, a prerequisite but not a qualification requirement	10 %	9 %	10 %	21 %		
No, but the competence derived from degree has a key role in work	52 %	34 %	49 %	21 %		
No, and it offers no practical advantages either	13 %	9 %	10 %	17 %		
I can't say	1 %	1 %	0 %	3 %		
Career meeting goals					0.1496	0.1320
Yes, completely	38 %	33 %	43 %	34 %		
Yes, in part	53 %	58 %	52 %	55 %		
No	4 %	6 %	3 %	10 %		
I can't say	5 %	3 %	2 %	0 %		

Table 4. Results of the variance analyses with gender and nationality as the explanatory variables

Dependent variable	<i>p</i> (model)	R ²	eta ² (gender)	eta ² (nat.)	<i>p</i> (gender)	<i>p</i> (nat.)
Duration of unemployment	0.0228	0.0631	0.0452	0.0259	0.0208	0.0814
Monthly income	0.0000	0.0388	0.0154	0.0261	0.0032	0.0001
Satisfaction with the degree	0.2038	0.0051	0.0002	0.0048	0.7559	0.0825
Ability to use the knowledge	0.7962	0.0008	0.0005	0.0002	0.5751	0.7380
Correspondence btw work and education	0.6953	0.0012	0.0006	0.0005	0.5576	0.5658
<i>Importance for employment:</i>						
Doctoral degree	0.0010	0.0226	0.0010	0.0210	0.4466	0.0004
Topic of dissertation	0.3736	0.0032	0.0002	0.0029	0.7310	0.1809
Other work experience	0.3536	0.0035	0.0033	0.0004	0.1645	0.6411
Higher university degree	0.0194	0.0137	0.0079	0.0048	0.0334	0.0967
Other studies or education (outside doctoral degree)	0.0000	0.0405	0.0096	0.0333	0.0231	0.0000
Experience related to NGO work or interests	0.1521	0.0069	0.0047	0.0026	0.1095	0.2340
International experience	0.0000	0.0474	0.0000	0.0471	0.9083	0.0000
Contacts/networks	0.0558	0.0096	0.0015	0.0084	0.3359	0.0245
Ability to tell about skills and competences	0.9183	0.0003	0.0001	0.0002	0.8153	0.7237
Being active and having a high profile in social media	0.0000	0.0756	0.0003	0.0756	0.6692	0.0000
Other, what?	0.5972	0.0089	0.0040	0.0061	0.4949	0.4019

Table 5. Results of the Tukey comparisons following the variance analyses, only variables with statistically significant differences between groups reported

Group	Importance for employment													
	Duration of unemployment		Monthly income		Doctoral degree		Higher university degree		Other studies or education		International experience		Activity and profile in social media	
	margin	TG	margin	TG	margin	TG	margin	TG	margin	TG	margin	TG	margin	TG
Male# Finnish	0.504	A	5041		4.218	AB	4.773	AB	3.279	A	3.679	A	2.057	A
Male# Other	0.731	AB	4368	A	4.765	C	4.525	A	3.965	BC	4.500	B	2.979	B
Female# Finnish	0.800	AB	4585	A	4.113	A	5.046	B	3.613	AB	3.663	A	2.109	A
Female# Other	1.027	B	3912		4.659	BC	4.799	AB	4.299	C	4.483	B	3.031	B

Margins denote the marginal linear predictions based on the respective variance analysis; margins sharing a letter in the Tukey group (TG) label are not significantly different at the 5% level

Table 6. Results of the logistic regression analyses with gender and nationality as the explanatory variables

Dependent variable	<i>p</i> (model)	Pseudo R ²	Odds (gender)	Odds (nat.)	<i>p</i> (gender)	<i>p</i> (nat.)
Regular full-time job 6 months before graduation	0.0030	0.0146	1.1819	0.4884	0.367	0.002
Regular full-time job 6 months after graduation	0.0003	0.0186	0.6697	0.4998	0.027	0.001
Regular full-time job at the time of the survey	0.0055	0.0127	0.7071	0.5830	0.055	0.007
Not unemployed	0.0001	0.0321	0.5541	0.4266	0.006	0.000
Satisfied with the degree	0.0667	0.0132	1.0031	0.5012	0.992	0.016
<i>Benefits of doctoral degree:</i>						
Higher salary	0.6346	0.0013	0.8322	0.9566	0.345	0.839
More demanding job assignments	0.6397	0.0014	0.8210	0.9901	0.342	0.966
More meaningful job assignments	0.4956	0.0022	0.7817	0.9752	0.233	0.914
Netter status at my place of work	0.0389	0.0096	0.6465	1.3048	0.028	0.242
Job with new employer	0.0871	0.0067	0.8217	1.4915	0.308	0.060
Better position in the labor market	0.0006	0.0276	0.4394	0.7062	0.000	0.159

Employment and career

The nature of employment was surveyed as a categorical variable with nine categories (Regular full-time job, Fixed-term full-time job, Part-time job, Entrepreneur or self-employed, Scholarship researcher, Unemployed or in a labor market training, Full-time student, On family leave, Other) six months before and after the doctoral graduation as well as at the time of the survey. This categorization was then further reduced to a binary variable about respondents holding or not holding a regular full-time job. Six months before doctoral graduation the distribution of employment type categories was statistically significantly different with respect to the nationality of the respondent ($p=0.000$) but not with respect to the gender ($p=0.907$). Six months after doctoral graduation both the difference by gender ($p=0.003$) and by nationality ($p=0.001$) were statistically significant. These differences also remained at the time of the survey ($p_{\text{gender}}=0.013$, $p_{\text{nationality}}=0.008$). A similar trend can be seen in the logistic regression analysis of the respondents holding a regular full-time job at different times, where the models for all the three time points showed a statistical significance with greater effects of nationality than gender (see Table 6).

Fig. 1 illustrates how the share of respondents holding a regular full-time job developed from six months before graduation to the time of the survey (approximately three years after graduation). It shows how the women's tendency to receive a permanent contract later than men and the non-Finnish respondents' lower starting level in permanent contracts combine in a clear disadvantage of non-Finnish female engineering doctors for achieving regular full-time employment.

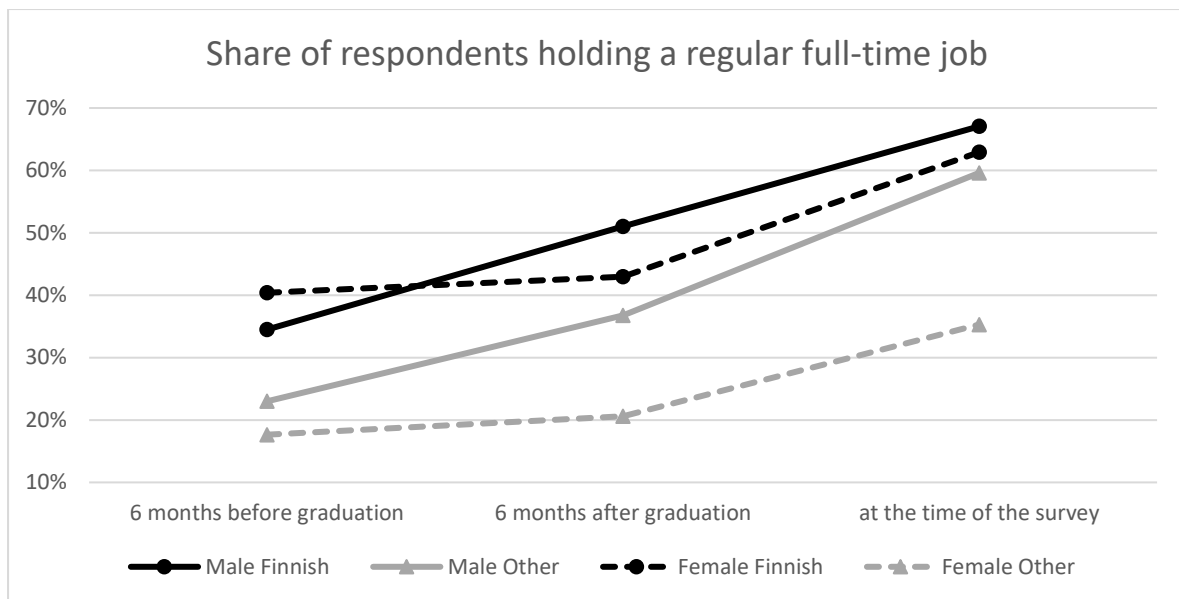


Fig. 1. Share of respondents holding a regular full-time job six months before graduation, six months after graduation, and at the time of the survey

In addition to experiencing more difficulties in securing a permanent full-time job, non-Finnish females also seem to be more inclined to unemployment after receiving the doctorate. The logistic regression analysis (Table 6) shows that both being female and being non-Finnish increase the likelihood of the respondent having been unemployed. Interestingly, according to the variance analysis (Table 4), the duration of unemployment appears to increase with being female, but it is not statistically significantly affected by nationality, and the Tukey comparison (Table 5) shows that Finnish males have experienced significantly shorter unemployment periods than the other three groups.

Table 3 shows that female engineering doctors tend to be employed less often by private or public companies, and the non-Finnish engineering doctors appear to be working in research tasks more often than the Finnish doctors. Finnish females seem to head for employment by government or municipalities more often than Finnish males do. Universities and universities of applied sciences appear to attract non-Finnish doctors and Finnish female doctors more than Finnish male doctors, with especially teaching- and education-related tasks being more common for female than male Finnish doctors. The monthly income of Finnish males is significantly greater, and that of non-Finnish females is significantly lower than the monthly income of the other groups (Table 5).

Satisfaction and perceptions

The satisfaction with the doctoral degree does not seem to depend on gender, but examining satisfaction with a binary variable (satisfied / not satisfied) showed that non-Finnish graduates were less satisfied with their degree than the Finns (Table 6). All the groups seem to have a similar view on the possibility to use the knowledge gained in doctoral studies as well as on the correspondence between the requirement level of work and doctoral education (Table 4). Nevertheless, non-Finnish doctors reported more often than Finnish ones that the doctoral degree had been a formal qualification requirement for their job. Still, there were no differences in perceptions of one's career meeting one's goals (Table 3).

When asked to assess how important different factors have been to employment after graduation, some differences emerge (Table 4). A doctoral degree, international experience, and activity in social media appear to be more important for the employment of non-Finnish than Finnish doctors, and the higher university degree prior to the doctoral degree more important for the employment of females than males. The importance of other studies and education outside the doctoral degree is affected by both gender and nationality, with Finnish males rating the importance the lowest and non-Finnish females the highest.

The benefits of a doctoral degree are perceived rather equally between the different groups (Table 6). A higher salary, more demanding and more meaningful job assignments, and a job with a new employer were reported quite similarly in all the groups. However, a better status in the workplace and a better position in the job market were experienced more rarely by females than males.

Limitations

There are several limitations to this study. To grasp the full idea of the interplay of gender and nationality (or the social context) in employment, both variables should be addressed in a nonbinary manner, which would take into account the richness of gender as well as the different social contexts of native Finns, indigenous people, first- and second-generation immigrants, and international students. With a finer-grained analysis comes also the need for a more extensive data pool and more sophisticated research methods. There are also limitations as to how far the interplay can be understood by means of quantitative methods. Finally, the position of both authors as native Finnish females is bound to affect the way we approach and view the data, and the results and are likely to miss some important interpretations and implications that are evident to people with a different gender identification or cultural background.

Discussion and Conclusions

Even after the doctoral degree, male engineering graduates in Finland appear to be advantaged in becoming employed, securing a permanent full-time job, and getting a better pay. Hence, the phenomena discovered in the employment of engineers after a master-level degree [18] are repeated at the doctoral level, and the observations from the Netherlands [11] and the UK [12] hold also in Finland.

As the satisfaction toward the doctoral degree, the perceptions of the fit between degree and job requirements, and the benefits of the doctoral degree toward employment are regarded rather similarly among men and women, it appears that the doctoral degree does not increase but neither does it mitigate the gender differences in the employability of engineers in Finland. However, women's less optimistic view about the doctoral degree improving their status in the workplace or their position in the job market would indicate that if there is a net effect, it is for the worse.

Not being Finnish seems to come with many of the same downsides as not being a male. Compared with the Finnish doctors in engineering, unemployment is more common, regular full-time jobs less common, unemployment periods longer, and the pay lower for non-Finnish doctoral graduates. Even though the doctoral degree is more often a requirement in their positions and the importance of a doctoral degree for employment is greater—probably because of research work and employment in universities and universities of applied sciences being more common for them than for Finns—they are still slightly less satisfied with their

doctoral degrees in general when satisfaction is viewed as a binary variable. The non-Finnish doctors also perceive their employment to benefit from factors not related to the doctoral degree, such as other studies and education, international experience, and activity in social media, more often than Finnish doctoral graduates do.

Gender and nationality also affect the sector of employment and the nature of work assignments. Finnish women, in particular, are much more often employed by the government or municipalities. This is aligned with the Swedish or Swiss female STEM doctors' greater likelihood to work in public administration compared with men, and like in Sweden and Switzerland, non-EU citizens rarely work in public administration [14]. Finnish men, on the other hand, work in private and public companies more often and in universities and universities of applied sciences less often than Finnish females and non-Finnish doctors. This is also in line with the situation in other countries [14], [15].

As expected, the non-Finnish females are left with the bad side of both worlds. Not only do they start worse off with getting a regular full-time job, but also the effect of a doctoral degree on getting it is the weakest. Their unemployment is most common, unemployment periods are the longest (although the difference is statistically significant only in comparison with Finnish males), and their monthly income statistically significantly lower than for all the other groups. Although the importance of a doctoral degree for employment for non-Finnish women is higher than for Finnish doctors, other aspects like studies outside doctoral degree, international experience and activity, and a high profile in social media are also perceived important for employment, especially in comparison with Finnish males. This suggests that in addition to doctoral education, extra efforts are needed especially for the non-Finnish female doctors to become employed.

The results reveal that the interplay of gender and nationality has a significant effect on many aspects relating to employment and career. Recognizing and understanding these differences is essential for developing actions to support the employment of minoritized groups, thereby creating a more equal working environment for all engineering doctors graduating in Finland.

References

[1] A. Moncaster and C. Morris, "Editorial: Gender and Intersectionality in Engineering," *International Journal of Gender, Science and Technology*, vol. 11, no.1, pp. 1–9, 2019.

[2] Y. Tao and C.L. McNeely, "Gender and Race Intersectional Effects in the U.S. Engineering Workforce: Who Stays? Who Leaves?" *International Journal of Gender, Science and Technology*, vol. 11, no.1, pp. 181–202, 2019.

[3] K. Doerr, C. Riegle-Crumb, T. Russo-Tait, K. Takasaki, S. Sassler and Y. Levitte, "Making Merit Work at the Entrance to the Engineering Workforce: Examining Women's Experiences and Variations by Race/Ethnicity," *Sex Roles*, vol. 85, no.7, pp. 422–439, 2021, doi:10.1007/s11199-021-01233-6.

[4] M. Nash and R. Moore, "In/visible: The intersectional experiences of women of color in science, technology, engineering, mathematics, and medicine in Australia," *Gender, Work & Organization*, vol. n/a, 2022, doi:10.1111/gwao.12908.

- [5] M.L. Liani, I.K. Nyamongo and R. Tolhurst, "Understanding intersecting gender inequities in academic scientific research career progression in sub-Saharan Africa," *International Journal of Gender, Science and Technology*, vol. 12, no.2, pp. 262–288, 2020.
- [6] J. L. Aldridge, S. Yoon Yoon, M. F. Cox, E. O. McGee and J. B. Main, "Workplace Climate for First-Generation Engineering Faculty: Intersectional Analyses with Gender, Race/Ethnicity, and Socioeconomic Background," in *2022 IEEE Frontiers in Education Conference (FIE)*, Oct. 8–11, 2022, doi: 10.1109/FIE56618.2022.9962568.
- [7] L. Alfrey and F.W. Twine, "Gender-Fluid Geek Girls," *Gender & Society*, vol. 31, no.1, pp. 28–50, 2017, doi:10.1177/0891243216680590.
- [8] J.B. Main, "Family formation and the career trajectories of women engineering PhDs," *Studies in Graduate and Postdoctoral Education*, vol. 14, no.1, pp. 26–46, 2023, doi:10.1108/SGPE-05-2020-0026.
- [9] G. Seo, J. Ahn, Wen-Hao Huang, J.P. Makela and H.T. Yeo, "Pursuing Careers Inside or Outside Academia? Factors Associated With Doctoral Students' Career Decision Making," *Journal of Career Development*, vol. 48, no.6, pp. 957–972, 2021, doi:10.1177/0894845320907968.
- [10] T.L. Adams, "‘I think the young women have it easier’: Age, Gender, and Women’s Experiences in Canadian Engineering," *International Journal of Gender, Science and Technology*, vol. 13, no.3, pp. 222–241, 2022.
- [11] C.J.F. Waaijer, H. Sonneveld, S.E. Buitendijk, C.A. van Bochove and van der Weijden, Inge C. M., "The Role of Gender in the Employment, Career Perception and Research Performance of Recent PhD Graduates from Dutch Universities," *Plos One*, vol. 11, no.10, pp. e0164784, 2016.
- [12] N. Peri-Rotem, "Gendered Career Pathways among Doctoral Graduates in the United Kingdom," *Social Sciences*, vol. 8, no.11, 2019, doi:10.3390/socsci8110317.
- [13] J. Naukkarinen, S. Bairoh and S. Putila, "Gender Segregation in the Occupations of Finnish Engineers," in *ASEE Annual Conference and Exhibition*, July 26–29, 2021.
- [14] A. Conti and F. Visentin, "Science and Engineering Ph.D. Students' Career Outcomes, by Gender," *Plos One*, vol. 10, no.8, pp. e0133177, 2015.
- [15] K.A. Shauman, "Gender Differences in the Early Employment Outcomes of STEM Doctorates," *Social Sciences*, vol. 6, no.1, 2017, doi:10.3390/socsci6010024.
- [16] T.J. Kinoshita, D.B. Knight, M. Borrego and W.E. Wall Bortz, "Illuminating systematic differences in no job offers for STEM doctoral recipients," *Plos One*, vol. 15, no.4, pp. e0231567, 2020.
- [17] P. Vuorinen-Lampila, "Gender segregation in the employment of higher education graduates," *Journal of Education and Work*, vol. 29, no.3, pp. 284–308, 2016, doi:10.1080/13639080.2014.934788.

[18] J. Naukkarinen and S. Bairoh, "Gender differences in early careers of Finnish engineers," in *2022 IEEE Frontiers in Education Conference (FIE)*, Oct. 8–11, 2022, doi: 10.1109/FIE56618.2022.9962687.

[19] "Graduates in working life." Aarresaari.net. <https://www.aarresaari.net/graduates-in-working-life/?lang=en> (Accessed April 5th, 2022).

[20] Universities Finland, "Ethical Principles for Kandipalaute - The Finnish Bachelor's Graduate Survey and Graduate Career Monitoring Survey," May 16, 2019.