What Can Statistics Tell About the Gender Gap in ICT? Tracing Men and Women's Participation in the ICT Sector Through Numbers

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Abstract. Which narratives can statistics tell about men and women's participation in ICT? The question is relevant across the western world showing a pattern of more men than women in ICT work. This chapter presents an analysis of available statistics that contribute to an image of women's participation in ICT work and education. The scope of the study is European countries with an emphasis on Norway, however, we also present statistics from OECD. The statistics confirm that the gender imbalance in ICT work is significant, suggesting that monitoring this field is important. The analysis also reveals challenges and gaps in the material, for instance the challenge of finding comparable numbers, a reduced use of gender as a variable in later years, difficulties in identifying the gendered structures of ICT due to a mixture of occupational fields for some of the relevant numbers, while other issues found to be relevant in qualitative studies are not represented in the available statistics. The monitoring of gendered structures of ICT work can be improved by developing statistics that better can capture inequalities and hierarchies. The findings also suggest that qualitative research is an important complement and correction to statistical overviews, in particular for identifying factors that alone and together contribute to gender inequalities in ICT.

Keywords: Statistics, ICT education, ICT sector, ICT work, Women, Gender

1 Introduction

The proportion of women in fields of information and communication technology (ICT) education and work is low across the Western World. This has been documented in qualitative [1-3] as well as quantitative studies [4-6]. In the Nordic Countries, this has been identified as part of a "Nordic Gender Paradox": despite a high degree of gender equality, the Nordic countries experience a high level of vertical and horizontal gender segregation in educational fields and the labor market, particularly notable in fields of ICT [7-9].

While at least 40% of each gender is often used as a goal for (near) "gender balance", the numbers for ICT education and work are lower – in Norway around 24% and 21%. Research has identified that the lack of gender balance in male dominated environments of ICT creates several challenges for women, including making them appear "out of

place" and challenging their feeling of belonging [10, 11]. The low number of women in ICT fields even has a tendency to reproduce a low expectation towards girls' engagement in ICT [12]. Researchers' interest for solving the "women and computing problem" is abundant [13] and numerous studies have documented that in order to increase gender equality in fields of ICT, it is vital to increase the proportion of women participating [14], thus, it is also important to monitor the situation closely.

In this paper we explore how the situation for women in ICT can be understood through available statistics. Numbers do not only tell us who participate in the field but can also tell stories about internal hierarchies and work cultures, for instance indicated by gender distribution in working time and salaries [15-17]. Statistics is often used to establish a starting point for understanding or exploring a field. The main research questions we pursue here are: which narratives can statistics tell about women in ICT? And, equally important, which stories cannot be told by available statistics? We approach these questions from our dual background in qualitative research within Feminist Technology Studies [18] that guides our understanding of the field, and in a tradition of engaging statistical material as a tool for identifying trends and tendencies in, for instance, working life [19].

Our use of statistics is explorative and not explanatory as we aim to identify which narratives the available statistics can tell about gender distribution in ICT work, part-time and full-time employment, and in salaries and participation in ICT education. An underlying premise for this work is the recognition that statistics is based on choices informed not only by research, but also by policies. The tables and figures of statistics presented below aim to give an overview of statistics that has been collected by public and national institutions to produce an image of women's participation in ICT work and education, before we discuss how well the available statistics cover and give insight into what has been identified as important issues within qualitative research in the field.

The scope of this study is European countries with an emphasis on Norway, however, we also present statistics from OECD.

1.1 Navigating the Statistics

Statistics presented in this study come from national statistical agencies in Norway, EU (Eurostat) and OECD as well as from a report from EU's Institute for Gender Equality [20]. Two code structures are relevant for classification of occupations. One is the NACE code structure developed by the EU[1] which represents "a statistical classification of economic activities in the European Community"[2] used across all member states. The other is ISCO developed by the International Labour Organization,[3] defined as "a tool for organizing jobs into a clearly defined set of groups according to the tasks and duties undertaken in the job".[4]

[1] SSB - Norwegian (Statistics Norway)
[2] Eurostat, NACE Rev. 2
[3] https://www.ilo.org/public/english/bureau/stat/isco/isco08/
https://www.ilo.org/public/english/bureau/stat/isco/docs/groupdefn08.pdf
[4] ISCO Web site

Occupations related to ICT are defined differently in the two structures. Statistics Norway (SSB) uses both structures. For data related to the category 'occupation' the ISCO structure is used. For the category 'industry' the NACE structure is used.[5] Generally, more data is available for the NACE structure than for ISCO.

2 Men and Women in ICT-related Occupations in Norway

Table 1[6] shows number of employees in ICT-related occupations in Norway. The major group 25 in the ISCO structure[7] is for ICT Professionals. The table contains information about the subgroup 251 - Software and Applications Developers and Analysts.

Table 1. Number of employees in ICT related occupations (1000's)[8] showing the ISCO subgroups *2512 Software developers* and *2519 Others*

	2011	2012	2013	2014	2015	2016	2017	2018	2019
Men									
2512	11	11	12	11	11	10	10	14	17
2519	7	11	13	16	17	19	18	15	15
Women									
2512	2	2	1	2	3	2	2	3	6
2519[9]	1	2	3	3	4	3	4	5	5
Percentage of women	14	15	14	16	20	15	18	22	26

Note that there were no available statistics for categories 2513, Web and multimedia Developers, 2514, Applications programmers as well as 252 - Database and Network Professionals because their samples are too uncertain to be published according to Statistics Norway.

A total of 43 000 people was employed in group 251 in Norway in 2019. Of these, 26% were women. There is a clear under-representation of women in these occupations, although the percentage share of women has risen by 8 percentage points in 8 years from 2011. As a reference point, the general occupancy rate for women in Norway in 2019 was 48.1% of the total workforce.[10]

Historically, there are no statistics for 1980-1995 for the occupations defined in Table 1. But there are some clues. From 1982 until 1993, Statistics Norway grouped employees into the category "computer operators". The share of women in this category

[5] https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF
[6] https://www.ssb.no/statbank/table/09792/
[7] The code structure is based on ISCO-08
[8] See also https://www.ssb.no/statbank/table/11411/ for salary earners
[9] Classified as: Software and Applications Developers and Analysis Not Elsewhere Classified
[10] https://www.ssb.no/statbank/table/11153/

was 83% in 1982 and 67% in 1993. Of course, this is not the same as computer developers today, since computers in this period also included back office tools operated by clerks. But it is still interesting to see that as computer technology advances, the share of women decreases. There was also a category for employees in "Post- and telecommunication". In the same statistics, number of employees in post services was given and thus telecommunication personnel can be calculated residually. The share of women in telecommunication was 44% in 1982 and 32% in 1995. Again, it seems that when telecommunication technology advances, the share of female employees declines.[11]

Table 2 shows number of salary earners for the same ISCO codes. The total number is lower than in Table 1, since employees also includes self-employed.[12]

Table 2. Number of salary earners in ICT related occupations[13]

Men	2015	2016	2017	2018
2512 Software developers	3351	3500	3769	4155
2513 Web and multimedia Developers	149	137	155	180
2514 Applications Programmers	92	116	149	170
2519 Others	10441	10567	10991	11718
Women				
2512 Software developers	391	405	407	460
2513 Web and multimedia Developers	36	44	45	49
2514 Applications Programmers	34	49	48	51
2519 Others	2868	2775	2904	3076
Total	17362	17593	18468	19859
Women percentage	19%	19%	18%	18%

Table 3 shows median[14] monthly salary for the minor groups 2512 and 2519 distributed on working time (full time or part time), gender and sector for Norway 2018. The sectors are private (including public corporations) and public employed. The table is constructed as percentage of men's corresponding salary and as percentage of maximum salary which was earned by men in private sector. Women earn less than men measured by the median for full time but not for part time jobs. The female salary for full time

[11] Statistics Norway, Arbeidsmarkedsunderøkelser 1980-95

[12] See definitions here https://www.ssb.no/regsys

[13] https://www.ssb.no/statbank/table/11411/

[14] The median is used since the average salary level is more sensitive for very high or very low salaries. This means the average may fluctuate more because of more variation even if the median salary (middle income level) has not changed very much.

workers varies from 93% to 96%. The difference between men and women are smallest where the salary level is lowest.

TABLE 3.[15] Median monthly salary for women in the ICT sector distributed on working time and sector, in percentages

	Percentages of men's salary	
	Full time	Part time
2512 Software developers		
Sum all sectors (private, state, municipality)	92.7	
Private sector and public corporations	92.6	
2519 Other software and applications developers		
Sum all sectors (private, state, municipality)	92.5	100.9
Private sector and public corporations	91.8	100.0
Municipal administration	96.3	

EU's Institute for Gender Equality (EIGE) has released a study [20] of employees in the ICT sector in different EU countries distributed by gender. The ISCO occupational categories included are 133 Professional managers, ICT professionals defined as subgroup 25 (see above) and ICT technicians defined as subgroup 35. Together, they form the category ICT specialists.

Table 4 shows number of employees in the EIGE definitions in Norway 2018, distributed by gender. All in all, 77 000 people are employed in these categories. Of these, 27 000 worked as ICT professionals as defined by EIGE. This group also includes code 2511 - System Analytics and System architects. This group is not included in tables above, accordingly the sum of people employed in subgroup 25 in Table 4 is larger than the groups used above.

TABLE 4.[16] Number of employees in different ICT subgroups according to ISCO structure and EIGE definitions, by gender, Norway 2018[17]

Men	Number of employees (1000's)	Percentage of total per gender	Percentage of total ICT workforce	EU % of total ICT workforce[18]	EU number of employees (1000's)

[15] https://www.ssb.no/statbank/table/11418/

[16] https://www.ssb.no/statbank/table/09792/

[17] ISCO codes and definitions http://www.ilo.org/public/english/bureau/stat/isco/docs/d2434.pdf

[18] https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do, numbers are for EU-28 countries 2013-2020

1330 Leaders of ICT-units	5	8	6.5		
2511 Systems analysts	16	26	20.8		
2512 Software developers	14	23	18.2		
2519 Software and applications developers and analysts not elsewhere classified	15	25	19.5		
Sum group 25	45	74			
3511 ICT operations technicians	11	18	14.3		
Sum group 35	11	18			
Sum men	61	100	79.2	83.5	7563
Women					
1330 Leaders of ICT-units	1	6	1.3		
2511 Systems analysts	4	25	5.2		
2512 Software developers	3	19	3.9		
2519 Software and applications developers and analysts not elsewhere classified	5	31	6.5		
Sum group 25	12	75			
3511 ICT operations technicians	3	19	3.9		
Sum group 35	3	19			
Sum women	16	100	20.8	16.5	1494
Sum both genders	77				

Table 4 shows that 21% of the total ICT workforce in Norway 2018 are women. The corresponding figure for EU-28 was 17%. According to NCWIT Scoreboard [21], 26% of all employed in Computer and Mathematical Occupations in USA in 2017 were women. Bailey et al. [22] claim that women occupy 25% of all IT jobs in USA in 2018. These categories are not directly comparable to Table 4 since job definitions may vary. Still they give the impression that women in Norway account for a smaller percentage of employees in the ICT sector than women in USA.

However, the increase of women in ICT jobs are higher in Norway than in USA. In 2011, the percentage of US women in ICT jobs was 25%. Thus, the increase from 2011 to 2018 is only 1 percentage point, while the same figure in Norway was 8 percentage points according to Table 1.

In Norway 2018, a total of 1 268 000 women were employed across all occupations and sectors. The same figure for men was 1 427 000.[19] Based on these figures and Table 4 we can construct Table 5 that shows the percentage of ICT specialists of the total workforce.

Table 5. Percentage of total working force in Norway employed as ICT workers in 2018 according to EIGE definitions

	Women	Men	Total	EU total 2015
Total employed (1000's)	1 268	1 427	2 695	
133 ICT managers	0.08%	0.35%	0.22%	0.1%
25 ICT professional	0.95%	3.15%	2.12%	1.4%
35 ICT technicians	0.24%	0.77%	0.52%	0.8%
Total ICT specialists	1.26%	4.27%	2.86%	2.3%

From Table 5, we observe that the percentage of men is larger than the corresponding percentage of women in each EIGE subgroup. The difference is largest for ICT professionals. Compared to EU figures for both genders, more Norwegian employees in the ICT sector are working as ICT professionals and less as technicians while for managers the figures are more in line with EU average.

According to EIGE 2018, the figure for Norway is almost identical with EU average when both genders are considered. We may also calculate the percentage that female occupancy rate account for in each EIGE subgroup. This is done in Table 6.

Table 6. Percentage of employed in EIGE ICT subgroups in Norway 2018, distributed by gender

	Percentage of group		
ISCO code	Women	Men	Total
133 ICT managers	17	83	100
25 ICT professional	21	79	100
35 ICT technicians	21	79	100
Total ICT specialists	21	79	100

2.1 European Union

Eurostat provides statistics for ICT specialists distributed by gender.[20] From 2011, Eurostat uses ISCO-08, the same code structure used in tables above.[21] In the Eurostat table, some other groups are included that are not included in the analysis above. These are:

[19] https://www.ssb.no/statbank/table/11153/

[20] https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/DDN-20190513-1

[21] https://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm#meta_update1554210955863

- 2152 Electronic engineers
- 2153 Telecommunication engineers
- 2166 Graphic and multimedia designers
- 2356 Information technology trainers
- 2434 ICT sales professionals
- 3114 Electronics engineering technicians
- 7421 Electronics mechanics and servicers
- 7422 ICT installers and servicers

Including these groups, there are 123 800 employed ICT specialists in Norway in 2018. Using this definition for ICT specialists, the share of ICT specialists of total employed in Norway 2018 was 5.1%, slightly above EU average of 4.7%, but well below Finland (8.4%) and Sweden (7.8%). Table 7 shows that of ICT specialists in Norway 2018, 20.3% are women. The largest percentage of women is in Bulgaria with 28.3%, followed by Lithuania and Romania. The lowest percentage is found in Czechia (9.9%) and Hungary (8.5%). The average for EU-28 is 16.5%.

Table 7. ICT specialists (1000's) by gender in EU, EFTA and Turkey 2018[22]

	Male		Female		Total employed all sectors[23]	Percent ICT specialists
GEO/UNIT	1000's	%	1000's	%	1000's	%
EU[24]	7562.6	83.5	1 493.5	16.5	192872	4.7
Belgium	193.2	84.5	35.4	15.5	4112.4	5.6
Bulgaria	68.8	71.7	27.1	28.3	2721.6	3.5
Czechia	196.2	90.1	21.5	9.9	4329.7	5.0
Denmark	98.6	80.7	23.6	19.3	2536.3	4.8
Germany	1349.9	83.2	272.7	16.8	37299.7	4.4
Estonia	29.7	78.2	8.3	21.8	579.9	6.6
Ireland	83.1	81.7	18.7	18.3	1920.5	5.3
Greece	61.2	88.7	7.8	11.3	2542	2.7
Spain	519.5	83.8	100.1	16.2	16363.2	3.8
France	887.0	83.0	181.3	17.0	23737.5	4.5
Croatia	49.5	85.7	8.2	14.3	1444.2	4.0
Italy	695.7	85.1	121.8	14.9	17650.8	4.6
Cyprus	10.5	81.8	2.3	18.2	347.5	3.7

[22] Eurostat: Employed ICT specialists by sex, EFTA=European Economic Area
[23] https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsq_eegais&lang=en, Q4 2018
[24] 28 countries (2013-2020)

Latvia	13.0	85.6	2.2	14.4	775	2.0
Lithuania	28.0	74.6	9.5	25.4	1176.8	3.2
Luxembourg	13.7	87.9	1.9	12.1	262	6.0
Hungary	151.5	91.5	14.1	8.5	3982.3	4.2
Malta	9.5	82.6	2.0	17.4	207.6	5.5
Netherlands	396.5	83.4	79.0	16.6	7275.5	6.5
Austria	156.5	81.6	35.2	18.4	3794	5.1
Poland	418.3	86.0	68.0	14.0	12853.8	3.8
Portugal	98.4	85.3	16.9	14.7	3992.4	2.9
Romania	145.4	76.5	44.7	23.5	6456.6	2.9%
Slovenia	32.6	83.7	6.3	16.3	835.9	4.7%
Slovakia	71.7	87.7	10.0	12.3	2177	3.8%
Finland	144.8	79.7	36.9	20.3	2171.7	8.4%
Sweden	274.1	79.1	72.4	20.9	4469.3	7.8%
UK	1 365.8	83.7	265.2	16.3	26857	6.1%
Iceland	6.5	84.5	1.2	15.5	167.9	4.6%
Norway	98.6	79.7	25.2	20.3	2443.9	5.1%
Switzerland	203.2	85.5	34.6	14.5	3943.4	6.0%
Turkey	244.8	89.6	28.5	10.4	19324.2	1.4%

Table 8 shows development of percentage of female ICT specialists in EU plus EFTA and Turkey from 2015 to 2018. The table also shows the difference in percentage points over the period and it is sorted so that countries with the most negative development comes first. 14 countries have a negative trend with relatively less women employed as ICT specialists. The most positive development is found in Lithuania with an increase of 5.3 percentage points. The most negative development is found in the neighboring country Latvia with a decrease of -10.3 percentage points. Norway has the fourth most positive trend with an increase of 3.3 percentage points.

According to these definitions, there were 6 100 more women employed in the ICT sector in Norway in 2018 compared to 2015. For all countries in EU, EFTA plus Turkey, about 1.6 million women were employed in the ICT sector in 2018, this is an increase of about 250 000 from 2015. For comparison, 1.1 million more men were employed in the ICT sector over the period with a total of 8.1 million men working in the sector in 2018.

Table 8. Development in percent of female ICT specialists from 2015 to 2018

	2015	2016	2017	2018	Difference 2018-2015
Latvia	24.7	24.8	21.3	14.4	-10.3

Iceland	22.6	21.9	16.3	15.5	-7.1
Romania	27.2	26.3	25.7	23.5	-3.7
Hungary	11.9	13.1	8.9	8.5	-3.4
Croatia	16.6	13.3	13	14.3	-2.3
Finland	22.4	21.9	21.8	20.3	-2.1
Greece	13.2	12.7	10.9	11.3	-1.9
Cyprus	19.7	23	17.4	18.2	-1.5
Ireland	19.7	21.1	20.9	18.3	-1.4
Spain	17.4	15.4	16.1	16.2	-1.2
Turkey	11.6	9.9	10	10.4	-1.2
Portugal	15.3	16.1	14.4	14.7	-0.6
Luxembourg	12.6	13.7	12.5	12.1	-0.5
Switzerland	14.6	14.9	14.9	14.5	-0.1
Czechia	9.9	11.2	9.3	9.9	0
United Kingdom	16.2	16.2	17.6	16.3	0.1
EU-28 (2013-2020)	16.2	16.7	17.2	16.5	0.3
Slovenia	16	17.3	16.1	16.3	0.3
France	16.6	18.1	19.6	17	0.4
Malta	17	12.1	10.2	17.4	0.4
Belgium	15.1	14.1	18.2	15.5	0.4
Germany	16.3	16.6	16.6	16.8	0.5
Poland	13.5	14.5	14.8	14	0.5
Bulgaria	27.7	30.2	26.5	28.3	0.6
Slovakia	11.4	9.2	13.7	12.3	0.9
Denmark	18.4	19.6	19.1	19.3	0.9
Italy	13.8	14.2	16	14.9	1.1
Estonia	20.3	18.7	19.4	21.8	1.5
Sweden	18.9	20.8	20.9	20.9	2
Norway	17	19.4	19.5	20.3	3.3
Netherlands	13	15.6	16.6	16.6	3.6
Austria	14.2	17.2	15.6	18.4	4.2
Lithuania	20.1	24.8	25.7	25.4	5.3

3 ICT and Working Time

Statistics Norway has information on employees in the ICT sector distributed on working time (full or part time) and gender. This information is only available to 2015 and

comprises NACE codes 58-63.[25] This means that in addition to the ICT sector, this statistic also contains occupations such as publishing and production of movies, radio and television programmes. Table 9[26] shows that for both genders, there has been a 12% growth in this sector from 2008 to 2015. The growth has been largest for part time men (61%) and slowest for full time women (7,7%). In 2008, the percentage working part time was 3.3 times larger among women than among men, the corresponding figure in 2015 was 2.4.

Table 9. Percentages working full time and part time in ICT and information sector (NACE 58-63) Norway distributed by gender and year

	Women employed		Men employed		Both genders, number of employees		
Year	Full time	Part time	Full time	Part time	Full time	Part time	Sum employed
2008	87%	13%	96%	4%	43974	3303	47277
2009	87%	13%	96%	4%	46187	3484	49671
2010	87%	13%	96%	4%	47949	3698	51647
2011	87%	13%	96%	4%	46446	3635	50081
2012	88%	12%	96%	4%	49413	3645	53058
2013	89%	11%	96%	4%	48409	3212	51621
2014	89%	11%	96%	4%	51186	3608	54794
2015	87%	13%	94%	6%	48864	4267	53131

4 ICT and Salary

Table 10 shows monthly salary for women as a percentage of corresponding male salary in Norway. The table is distributed on working hours in ICT and communication sector from 2008 to 2015. The table shows that women are paid less than men, both as full time and part time employed. The difference is largest for full time employed. In 2008 women on average earned 83% of men's salary as full time employed. In 2015 the figure was 86%. In other words, the gap is closing but not very fast. Among part time employed, women's salary on average was 94% of men's in 2008 while the same figure in 2015 shows a negative trend with 91%.

Table 10. Monthly salary for employees in ICT and communication sector (NACE 58-63) distributed by gender and working hours Norway. Female percentage of male salary

	Women, percentage of men's salary	
Year	Full time employed	Part time employed

[25] Subgroup 61 is defined as telecommunication, subgroup 62 as services associated with information technology (programming, system management) and subgroup 63 as information services (data processing, data storing and management of web portals). The last subgroup also includes information services such as news agencies.

[26] https://www.ssb.no/statbank/table/07597/

2008	83%	94%
2009	83%	92%
2010	84%	92%
2011	83%	90%
2012	85%	93%
2013	86%	94%
2014	86%	94%
2015	86%	91%

5 ICT and Inconvenient Working Hours

Statistics Norway also provides statistics about inconvenient working hours.[27] This statistics include number of employees in NACE codes 58-63 with inconvenient working hours from 2008 to 2019. These NACE codes include employees working in radio and television broadcasts, motion picture and video production as well as in publishing and news agencies in addition to the ICT sector. This is a source of bias since these occupancies by design (deadlines etc.) have more inconvenient working hours.

Number of employees working inconvenient hours has gone down over the period 2008 to 2019. The biggest reduction in inconvenient working hours from 2008 til 2019 was on Saturdays and Sunday. Most of the inconvenient hours are worked on evenings. About 30% of employees working infrequent on evenings were women in 2019, compared to 24% women working in the ICT sector defined as NACE codes 61, 62 and 63. This shows that working inconvenient hours is common among ICT female workers, but not as common as for other occupancies in the information and communication sector.

6 Education and Employment

6.1 OECD

According to OECD,[28] 3.6 percent of all master graduates in Norway in 2017 are in the field of ICT defined according to ISCED[29] (level 7). Of all female graduates in Norway same year, 1.3% are in ICT fields while the same figure for men was 6.6 percent. This means that the gender gap for ICT graduates in Norway, defined as male percent minus female, was 5.4 percentage points in 2017.

Figure 1 is based on distribution of gender gap in the ICT education field for all OECD countries. The figure shows ICT share of all graduates among women on the x-axis and the gap between male and female share on the y-axis. Among the Nordic countries, Finland has the greatest gap with 9 while Sweden has 2.4. In Sweden, the

[27] https://www.ssb.no/statbank/table/09883/tableViewLayout1/

[28] OECD: Distribution of graduates and entrants by Field , https://stats.oecd.org/Index.aspx?datasetcode=EAG_GRAD_ENTR_FIELD

[29] UNESCO - ISCED 2011

percentage of graduates in ICT is the lowest among the Nordic countries when both genders are considered. Estonia has the largest gender gap where the percentage of ICT graduates among males is 9.1 percentage points larger than among females.

Interestingly, there seems to be a trend since the gap is increasing when the female share of graduates in the ICT field is increasing. In other words, when the share of female graduates in ICT field increases, the corresponding share of men increases even more and the gap between men and women increases, as shown in the figure. This is obviously a feature that should be addressed in further qualitative research.

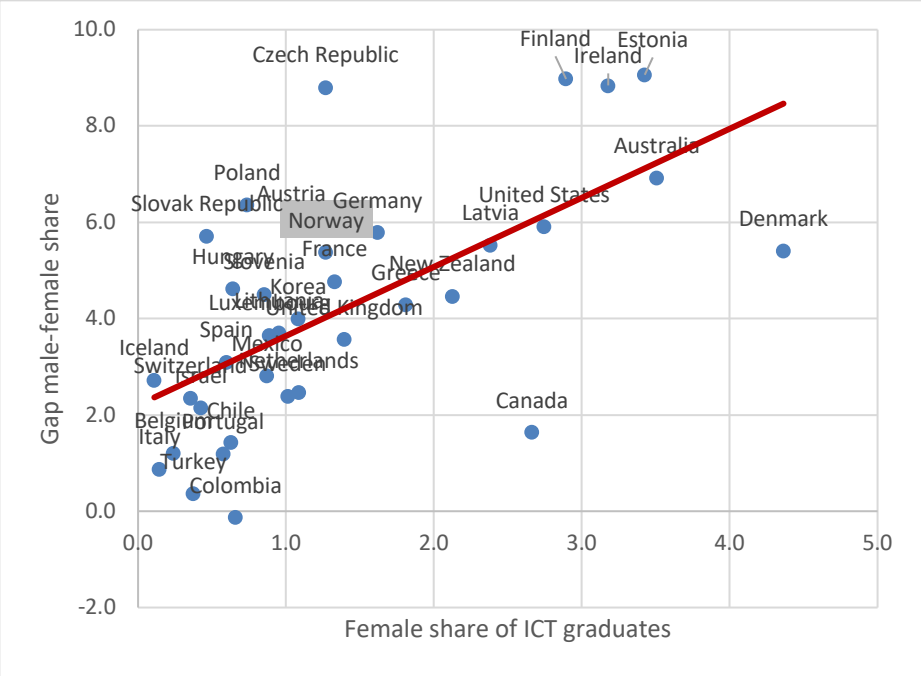

Fig. 1. Female share of graduates in the ICT field vs the gap between male and female shares

6.2 ICT Education in Norway

The table below shows number of applicants for ICT education in Norway 2008-18 by gender.[30] The table shows that the percentage of female applicants have risen by 6.8 percentage points over the whole period. The yearly increase was largest between 2015 and 2017 with an increase of 2.5 percentage points each year.

[30] https://www.samordnaopptak.no/info/om/sokertall/sluttstatistikker/so_sokerstatistikk_2017-slut-trapport.pdf

Table 11. Applicants for ICT education Norway 2008-18[31] by gender

	Women	Men	Total	% Women
2008	341	1617	1958	17.4
2009	305	1617	1922	15.9
2010	359	1678	2037	17.6
2011	375	1923	2298	16.3
2012	441	2189	2630	16.8
2013	450	2297	2747	16.4
2014	500	2476	2976	16.8
2015	609	2887	3496	17.4
2016	756	3039	3795	19.9
2017	1118	3862	4980	22.4
2018	1461	4566	6027	24.2

Table 1 above showed that 22% employed in the ICT sector in Norway in 2018 were women. The percentage of female applicants for ICT education in 2018 is therefore slightly above the percentage of women working in the ICT sector. There are two possible explanations for this. Since the table shows applicants, more women might leave during the education. Or more women than men with ICT education work in other sectors than ICT. Our recent qualitative research among women working with ICT indicates that the second answer should be further explored [23], thus also suggesting that more qualitative research is necessary to complement the statistical data.

6.3 European Union

Eurostat provides information on number and percentage of different genders with ICT education employed anywhere in the economy.[32] The percentage basis is number of people with ICT education employed, not necessarily in the ICT sector.[33]

The table below shows the percentage of women with ICT education in any employment situation. The table also shows the trend from 2014 to 2016 calculated as the change in percentage points of females with ICT education occupied in that time span. The table is sorted so that countries with the most positive trend appear first in the table. The percentage for Norway corresponds roughly to the percentage of women employed

[31] Data for 2017 and 2018 are taken from statistics documentation in 2018, https://www.samordnaopptak.no/info/om/sokertall/sluttstatistikker/

[32] Eurostat https://ec.europa.eu/eurostat/web/products-datasets/-/isoc_ski_itsex

33 "3.3. Coverage - sector Data on persons with ICT education does not use the concept of sectors of economic activities. Persons with ICT education can be employed in any sector or be unemployed."

in the ICT sector. This means that most women with ICT education in Norway work in the ICT sector.

Cyprus has the most positive development. Norway and Lithuania are the only countries in addition to Cyprus with a change of more than 7 percentage points. The country with the fourth most positive trend, Portugal, has a change that is less than half of Norway's.

Table 12. Women with ICT education employed as percentage of all employed with ICT education with trend between 2014 and 2016

	2014	2015	2016	Difference 2016-2014
Cyprus	25	33	32.6	7.6
Norway	12.1	9.3	19.2	7.1
Lithuania	13.6	21.7	20.7	7.1
Portugal	20.8	24.3	24	3.2
Czechia	9.4	10.8	12	2.6
France	11.1	14.1	13.6	2.5
Spain	18.6	23.3	20.4	1.8
Hungary	13.2	13.8	14.8	1.6
Slovenia	12.2	15	13.2	1
Austria		13.7	14.2	0.5
Belgium	12.5	9.5	12.7	0.2
Germany	13.3	13.3	13.4	0.1
Latvia	19.7		19.5	-0.2
Denmark	16.1	17.3	15.9	-0.2
Switzerland	15	16.5	14.6	-0.4
Poland	11.8	10.8	11.2	-0.6
Malta	18	19	16.9	-1.1
Sweden	26.1	26.3	25	-1.1
Ireland	30.5	27.7	28.8	-1.7
Turkey	25.8	26.4	23.9	-1.9
Romania	30	27	27.7	-2.3
Slovakia	14.5		11.6	-2.9
Italy	21.4	18.9	18.2	-3.2
Netherlands	14.6	17.1	11	-3.6
Iceland		33.6	27.2	-6.4
United Kingdom	24.2	23.7	16.9	-7.3
Greece	36.9	34.2	26.9	-10
Estonia	26.9	19.6	15.6	-11.3
Finland	33.1	29.4	19.9	-13.2
Croatia	22.6	10.3	6.1	-16.5
Bulgaria			29.2	
Cyprus	25	33	32.6	7.6
Lithuania	12.1	9.3	19.2	7.1

The table also shows that Cyprus has the largest growth in percentage of women among employees with ICT education in 2016, taking over for Greece and Iceland that was on top in previous years. Bulgaria, Ireland, Malta, and Romania are the countries with the largest percentage after Cyprus. Norway is in 11th place, after Sweden but well ahead of Denmark. The table, however, shows a rapid fluctuation in some countries that might also be caused by changes in the definitions behind the numbers.

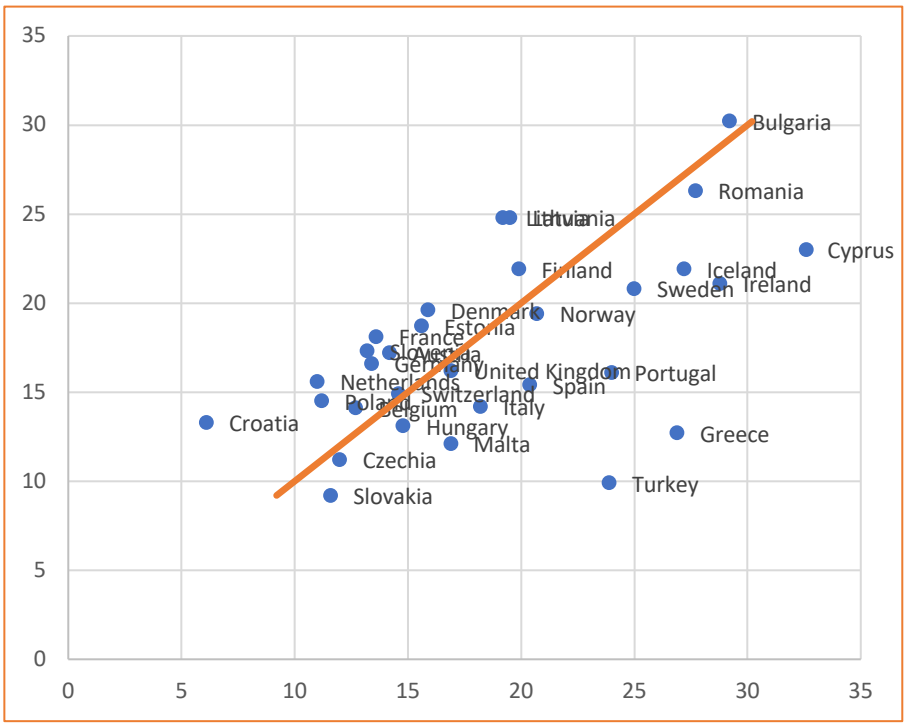

Fig. 2. Women as percentage of all ICT specialists and as percentage of all employed in the ICT sector

Figure 1 shows percentage of women with ICT education vs percentage of women working in the ICT sector in 2016. The red trendline shows the situation if percentage of women employed in ICT sector would be equal to percentage of women with ICT education. In other words, countries where all women with ICT education work in the ICT sector would be on the red line. For countries below the red line, women with ICT education is mostly working outside the ICT sector. For countries above the red line, most women working in the ICT sector do not have ICT education.

Norway is slightly below the red line, meaning many women with ICT education, but not all, is working in the ICT sector. It is worth noting that the percentage of women working in the ICT sector has grown in Norway from 2016 to 2018. This may indicate that Norway would be closer to the red line if 2018 data was used instead of 2016 data.

Bulgaria, UK and Switzerland are the countries where the two percentages are most equal. Cyprus has a large percentage of women with ICT education in employment but relatively fewer working in the ICT sector. Greece and Turkey have relatively large percentage of women with ICT education but few of them working in the ICT sector. Lithuania and Latvia have relatively more women working in the ICT sector than women having ICT education.

7 Visible and invisible narratives about women in ICT

The goal of this study was to explore which narratives statistics can and cannot tell about women in ICT, with a main focus on Norway and compared to European countries. The statistical material reviewed here gave us answers to the gender distribution in ICT, showing a clear underrepresentation of women in ICT education and ICT work in all European countries compared to general female occupancy rate. The statistics from Norway showed that while women have longer work hours in ICT than in average across all occupations, more women than men work part-time in ICT. Women also earn less than men for fulltime work in the ICT sector, however, these tables have not included gender since 2016. The percentage of women working inconvenient hours in ICT is difficult to measure, because the available numbers include other occupational groups that are likely to be more affected by inconvenient hours (e.g. news agencies) than the ICT occupations. Thus, while the available statistics provide important insights into trends of women's participation in ICT work, there are also some weaknesses that blur the gendered structures in ICT work.

Another challenge is to find identical and comparable numbers across regions and nations, which is complicated not only due to different code structures, but also different types of measures. Given the complicated nature of the statistics, some of the questions we started with in this project were not possible to answer, in particular numbers combining different factors that each have been identified with gendered patterns, like public vs. private sector, salary, working time, part-time work. Other questions did not have one, but several answers. The question of women's occupational rate in ICT in Norway, for instance, was answered in different ways, showing that out of a total of 123 800 employed as ICT specialists in Norway in 2018, the number of women ranged between 20.3 and 22% (ISCO subgroup 251); female ICT specialists made up 1.26% of the total working force; and women made up 20.7% of all employed with ICT education in 2016.

This last piece of information is important, but not sufficient for measuring the "leaky pipeline" – women leaving ICT work, as it indicates that many, but not all women with an ICT education are employed or work in the ICT sector. Considering that "leakage" of women is recognized as a major problem in other western countries [24], it would be valuable to see statistics on this for Norway. Based on our qualitative research in the field showing that routes to ICT work are still highly gendered in Norway [23], we also miss statistical accounts of the entire "pipeline", not only the "leakage" of women, but equally important, how and when recruitment of women is successful. Monitoring men and women's movements from education to the labor market

could help to identify whether the main challenge for increasing gender balance in ICT in Norway is "an input" or "a throughput" problem [25].

Although the different numbers suggest that a careful consideration of statistics is necessary if a precise comparison is the goal, the numbers also document a substantial gender imbalance with more men than women choosing a career in ICT. Even more worrying for the development is the trend that indicates that when the number of women in ICT education increases, the number of men in ICT increases even more, intensifying the gender gap in ICT.

Provided that gender equality including a more gender balanced workforce in ICT is a goal [20], it is critical that the combination of variables of gender and ICT are possible to identify in vital working life statistics. The trend revealed here is unfortunately not only going in the right direction, but rather also showing that with regards to some issues, the accuracy of what statistics can tell about women in ICT is rather reduced. Our exploration of public available statistics, however, confirms that monitoring of gendered structures in the ICT sector, in ICT work and regarding work conditions, can be improved by developing statistics that can show inequalities and hierarchies in the ICT sector and ICT work.

Finally, we came to this task of exploring which stories statistics can tell about women's participation in ICT from qualitative research in this field. The variation in numbers we have seen here indicates that qualitative research is an important complement and correction to statistical overviews, in particular for identifying factors that alone and together contribute to gender inequalities in ICT. Statistics are not pre-given; they are motivated to make visible certain stories while others remain invisible, thus it is critical that national statistics is constantly evaluated and updated in line with new insights from qualitative research.

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