Digital Gender Gap in EU-27 ICT Employment During COVID-19 Impact

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Abstract. This paper focuses on the impact of the COVID-19 pandemic on ICT sector employment through the prism of digital gender gap divide change in 2020 as a comparative analysis of EU-27 country's performance. The paper aims to examine the share of employed women and men ICT professionals in total employment in the ICT sector, aged 15 to 74, from 2011 to 2020 in the EU-27, highlighting annual national disparities in the 2020 pandemic year. The standard deviations (Z-score) and percentage deviations of the European Union countries from the EU-27 average in 2020 were calculated. The data used for the analysis have been obtained from Eurostat (2021): Employed ICT specialists by sex.

The analysis results show that in the pandemic 2020, the deviation of women's employment in the ICT sector of the EU-27 from the EU-27 average ranges from 2.4 σ to -1.6 σ. The deviation of employed men in the ICT sector from the EU-27 average is in the same range but opposite.

Peak differences and their causes have been explained. Conclusively, limitations and further research orientations within the wider topic frame are elaborated.

Keywords: Digital gender gap · ICT employment · European union · COVID-19

1 Introduction

The early 2020 outbreak of the COVID-19 pandemic has brought about years of change in the ubiquity of digitization. How our lives have changed has not left space untouched, including all business sectors in all world regions. According to the McKinsey Global Survey, business companies have accelerated the digitization of their customer interactions, supply chain and internal operations in three to four years. The share of digital or digitally enabled products in their portfolios has accelerated almost twice as fast: in a shocking seven years [1].

Besides the digital acceleration, the pandemic outbreak also exposed and further reinforced our existing traditional divides between north and south, east and west, developed and underdeveloped, rich and poor, transforming them into connected and disconnected. Various social, cultural and individual modifications in the frequency of ICT presence worldwide have been defined through the term digital divide (inequalities in access, capacity to use and ways of engaging with ICTs) throughout the research literature.

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The digital divide problem appears as an obvious obstacle, a measurable gap between different areas of ICT implementation, integration, use, education, and employment availability for other social groups. The gap in prosperity between those who have access to ICT and the digitally excluded, if not corrected, will further widen and thus increase inequalities in all other social inclusion areas, resulting in even more significant societal deviations. The digital gender gap has been under European Commission policy closer loop recently due to EUs "Digital Compass: the European way for the Digital Decade" [2] and "Path to the Digital Decade" [3] enabling complex, structured, multilevel approach in achieving digital societal transformation in EU. Among numerous tools Digital Economy and Society Index (DESI) specific area Women in Digital Scoreboard [4] aims to place focus on woman's path in digital environments indicating how persisting extensive underrepresentation of women in digital indicators is present across EU-27 countries with only 19% of women ICT specialist whose role in digital transition acceleration is of the most importance. Digital Compass, therefore, set a target of gender balance (convergence) in ICT specialists by 2030 [2].

The main focus of this research paper is to investigate the digital gender gap between employed women and men ICT specialists, as defined by the ISCO-08 classification and including jobs like ICT service managers, ICT professionals, ICT technicians, ICT installers and servicers in the total number of employees in the ICT sector, aged 15 to 74, from 2011 to 2020 in the EU-27, highlighting annual national differences in the pandemic year 2020.

2 Literature Review

In a recent information society [5], digitalization is undeniably a total social fact [6] Its power, embedded in a technological process as a fundamental societal developmental driver, transforms the world as we know it at the speed of a mouse click. Global socio-economic stakes of digital social transformation reinforced by a COVID-19 pandemic outbreak are dizzyingly high while provoking further enforcements of inherited societal gaps (demographic and climate change, environmental degradation and social inequality growth) defined as a digital divide [7].

The digital divide is a part of the wide topic of social inequality placed in a focus of a contemporary society due to its rapid technological progress upon all other parts of today's existence lay upon. The digital divide of today can reinforce and build upon traditionally existing poles rooted in several fundamental aspects: economic resources availability, geographical distinction between urban and rural, inter-generational approach obstacles where elderly are subordinated, gender where women are severely underrepresented and suppressed, language obstacles due to the predominance of English language in ICT service and industry, educational achievement and long-life learning opportunities, social and cultural environment and support, employment rate and other forms of social exclusions (as minority, invalidity, ethnicity, religion, race, class, socially excluded and underrepresented groups). All of the above factors (or their multi-combination) can be understood as a source, cause and consequence of unequal digital attainability, reinforcing and deepening further socio-economic divisions and discrepancies [8].

2.1 Overall Frame and Literature Inputs

The term digital gender gap itself is identified when women access and use ICTs less than men, thus exacerbating and widening further gender inequalities [9] Gender characteristics of the digital divide have been of a wider interest lately due to socio-economic and demographic specificities with the exponential growth of the ICT sector worldwide as authors reinvent empowering forces of women's presence in the ICT sector [10–12] Gender bias has been often masked in the traditional binary legacy of established social norms, statuses, roles and prejudices. Mainstream was thou gender blindness as a tool for the maintenance of male privilege [13, 14], reinforcing and supporting further deeply rooted social structure of gender bias through gender pay gap and glass ceiling existence [15–19].

Berger and Luckmann, in a theory of social constructionism, explained the essence of the existing gender gap in a contemporary digitalized society considering social systems as based on interaction. Eventually, interactions develop into accustomed norms and roles while they become institutionalized and embedded in society as standardized terms of cultural expectations. Therefore, the social construction perspective could contribute to understanding cross-cultural variation in social gender roles and expectations, including the digital gender gap [20] Additionally, Crenshaw interprets gender norms in societies through intersectional theory, in which she discusses the multidimensional experience and identities as fluid and susceptible to changes through microcultural frames present [21] Cultural differences, as explained by Hofstede (2001) who has provided a powerful tool for cultural comparisons in defining culture as the "collective programming of the mind which distinguishes the members of one group from the other' and helps in understanding the difference between national cultures" can be a starting point in understanding the digital gender gap in EU-27 ICT employment [22].

UN's sustainable development goals empowered in 2016 set targets for goal 5 to achieve gender equality and empower women as a necessary foundation for a peaceful, prosperous and sustainable world by 2030. Latest reports show limited progress that has been made is now endangered due to the COVID-19 pandemic, while structural gender inequalities have been further amplified [23, 24].

Although the EU can be seen as a world leader in its dedication to gender equality, the Strategy 2020–2025 proves complete balance equilibrium is still a goal to be reached in numerous spheres of digitalized social life [25] Focusing closely on recent EU-27 policy development as a response toward pandemic outbreak relevant research have shown negative trends overspill towards women labour force in general, followed by a drastic gender gap widening, especially in female-dominated occupational sectors, while delicate growth of women appearance in traditionally male-dominated sectors, especially ICT has risen, although this result needs to be taken into consideration precisely as a direct result of enlarged e-services usage in all sectors due to the pandemic restrictions. Additionally, "women were more at risk of financial fragility than men, with 58% of women (compared with 48% of men) reporting that they would not be able to maintain the same standard of living" during the pandemic outbreak [26] Overall, long-term consequences consequently will trigger women harder than man, while attracting women to ICT is a matter of socio-economic developmental frames related to broad industry deficiencies [27] European Institute for Gender Equality (EIGE) has estimated benefits

of woman's full and equal participation in STEM sector could contribute towards 820 billion EUR GDP and 1.2 million more jobs in EU-27 by 2050 [28], additionally slowing down the odds for EU the keep up the leading societies in the world digital primacy [29].

Numerous studies have shown how crises generally change priorities [30], while reductions consequently reinforce the gender gap widening, as shown in Greece, Korea and Turkey [31–33] The study conducted by Jaba, E., et al. (2021) proved that the crisis influenced the employment gender gap in the EU, reviling overall convergence, with significant variation among regions and depending on educational level [34].

Socio-economic consequences regarding the digital gender gap are numerous and diverse. They include women's exclusion from higher-paid jobs, access to knowledge, skills and information, quality and diversity of products with limitations to creative potential, reduction of ideas and innovation, ability to spread their influence wide and affect developmental and policy-shaping, lack of authority. Gender biased practices lack competitiveness and are unable to supply labour markets in demand for qualified specialists as the potential of more than half of the population is unused [35–37]. Further on, as shown by Ferrant & Kolev (2016), the income loss associated with the gender gap amounts to USD 12 trillion, or 16% of global world income [38].

Reports of tiny improvements on women's progress in ICT sector have been shattered by proven declining trends throughout Western and Northern EU countries in a couple of last decades [39] provoked by women's need for flexibility in work-life balance [40], especially for women with children [41] is partly explained through the leaky pipeline theory [42] Occupational preferences related to gender thou, are confirmed to be culture influenced and different throughout the world [43] In research analyses from China, India, Saudi Arabia and Malaysia [44, 45] where indoors working spaces (including ICT sector) are prescribed as female [19], confirming Hofstede's cultural theory.

Thinking in terms of wellbeing and Sustainability, out of the growth and profit box in ICT as a new developmental driver towards degrowth and environmental transformation [46] with ICT in a critical transformative role in bridging the digital gender gap is essential [47] to avoid the transformative process of female perspective deprivation in this equity paradox as women indeed represent over half of the total population. Enabling full population potential can undoubtedly lead to fair digital societies of tomorrow overcoming contemporary, binary stereotypes.

Additionally, ICTs are seen as a cornerstone of further socio-economic and environmental transformation toward sustainable development goals [48, 49], although it may not be seen as a magic wand but need careful planning, implementation, monitoring and cross-cultural adaptation [50, 51].

2.2 Characteristics and Employment Trends in the EU-27 ICT Sector

UN Policy Brief on COVID-19 Impact on Women exposed emerging evidence on women's socio-economic lives and participation during pandemic breakdown. Women are being affected disproportionately and differently than men as their capacities to absorb socio-economic shocks are less than men. Women traditionally take on greater care demands at unpaid home labour, so cuts and layoffs will affect their jobs. Such impacts risk rolling back the fragile gains made in female labour force participation throughout different employment sectors, including ICT [52].

According to Eurostat's (2021) data, overall employment in the ICT sector in EU-27 countries is increasing annually. The absolute increase of employed persons with ICT education is shown in Fig. 1.

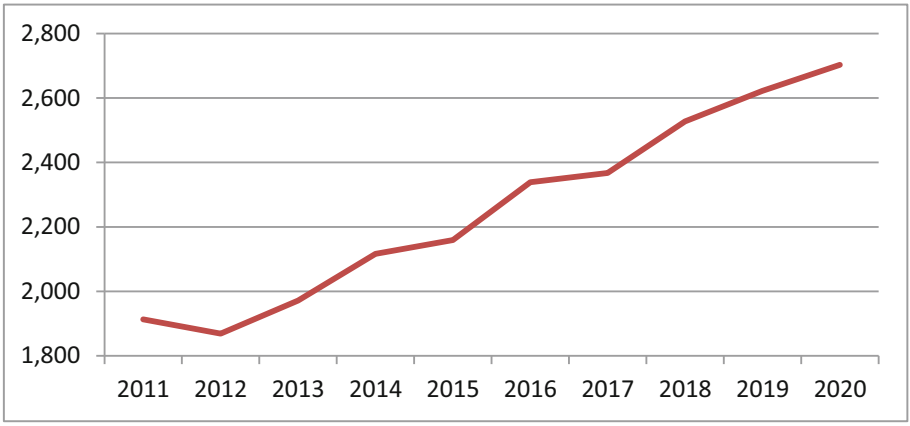

Fig. 1. Employed persons with ICT education in EU-27 2011–2020, in thousand. Source: Authors according to Eurostat (2021)

Calculated absolute and relative rates of change show an increase in total employment (men and women) with ICT education in EU-27 from 2012. The average increase from 2012 until 2020 amounts to 4.72% annually. To examine whether the pandemic year 2020, due to greater use of digital technology, increased employees with ICT education, relative changes in the number of employees from year to year were calculated, i.e. the

Table 1. EU-27 ICT employment 2011 until 2020

Year	Employed persons with ICT education in 000	Absolute rates of change in 000	Relative rates of change, %
2011	1.913,0	–	
2012	1.868,5	−45	−2,33
2013	1.971,2	103	5,50
2014	2.116,5	145	7,37
2015	2.158,9	42	2,00
2016	2.338,7	180	8,33
2017	2.367,2	29	1,22
2018	2.527,6	160	6,78
2019	2.622,4	95	3,75
2020	2.703,0	81	3,07

Source: Authors according to Eurostat (2021)

dynamics of change are shown (Table 1). The most significant annual increase is evident in 2014, 2016 and 2018 compared to the previous year. The growing linear trend shown in Fig. 1 and the dynamics of change in the number of employees shown in Table 1 from 2012 do not offer a more considerable increase in 2020 compared to the previous year's annual growth.

Female ICT specialist employment in 2020 is the same as in previous years, amounting to less than 20% of overall ICT specialist employment. Exceptions are evident in Denmark (32.9%), Greece (30.6%), Cyprus (27.5%), Bulgaria (27.4%), Romania (27.0%), Sweden (24.5%), Ireland (23.2%), Spain (20.9%) and Lithuania (20.7%) as shown in Fig. 2.

The trend in EU-27 was more deeply presented in a research paper by Pisker, Radman-Funarić, and Sudarić [53]. Pandemic 2020 did not provoke significant changes

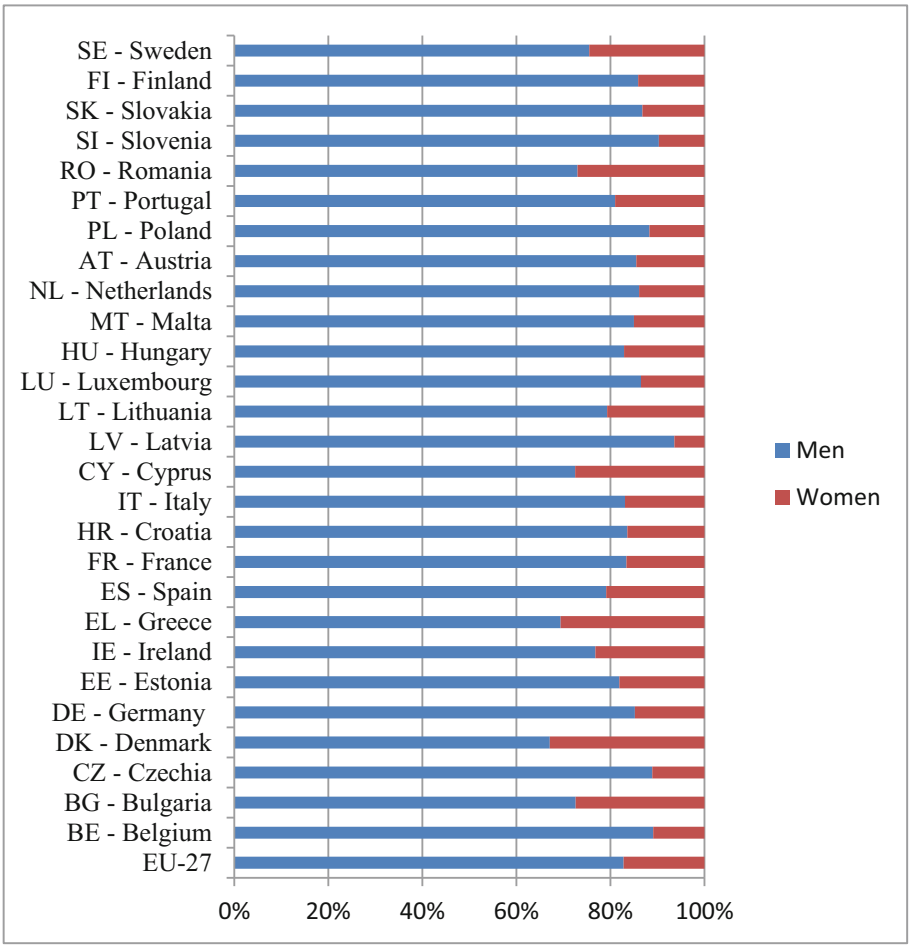

Fig. 2. Women and men ICT specialist employment ratio in EU-27, 2020. Source: Authors according to Eurostat (2021)

in the ratio of employed men and women ICT specialists, i.e. the employment of men still follows the default trend keeping men employment in the sector 4 to 5 times higher than the employment of women.

3 Data and Methodology

In the first step, the paper analyses the annual dynamics of ICT specialists' employment change in the 2020 pandemic and 2019 pre-pandemic year, aiming to determine if the overall employment increase dynamics have scaled up.

Secondly, besides the overall dynamics of change, the paper also analyses if there has happened a gender conditioned change in the ratio of women and men ICT specialists employed in EU-27 countries and their national specificities.

Third, world trade data dynamics show the growing importance of digital technologies during the COVID-19 pandemic, with ICT services growth up to 14,97% (from 12,51% in 2019) of total services exports worldwide and 5,34% (from 4,1% in 2019) in Europe [54], authors aimed to research if the ICT sector employment demand has followed women participation growth and digital gender gap decline.

Modelled on the previous research paper [53] exploring the share and deviation of employed women ICT specialists in the ICT sector's total employment in the EU-27 countries, this paper's primary focus is the share of women and men ICT specialists employed in the full employment of ICT specialists, aged 15–74, in 2020 and its annual national dynamics of change in comparison to the previous 2019 pre-pandemic year.

Fourth, according to Eurostat's (2021) data, in 2020, there were 2.703.000 ICT educated women employed, as shown in Table 1. Aiming to determine if specific countries' deviation from the EU-27 average is higher or lower and what are those countries the deviation in standard deviations (Z-score) [55, 56] of each of the European Union countries from the EU-27 average in 2020 was calculated.

$$Z_i = \frac{X_i - \mu}{\sigma} \tag{1}$$

Besides the Z-score can reveal the area under the standard normal curve for any value between the mean (σ = zero) and any z-score, the calculated Z-values are used for a better (more accessible) display of the deviation of an individual country from the average and the deviation between individual countries. Sample-based interval prediction is not used, as data on ICT specialists in the EU-27 countries represent the total population.

Countries are ranked according to the deviation from the EU-27 average. The percentage deviation of countries from the EU-27 average was also calculated [57]. Data are obtained from Eurostat (2021): Employed ICT specialists. Broad definition based on the ISCO-08 classification and including jobs like ICT service managers, ICT professionals, ICT technicians, ICT installers and servicers - % of individuals in employment aged 15–74, and Employed ICT specialists - % of females in employment aged 15–74 and % of males in employment aged 15–74 [58].

Finally, to avoid the impact of dispersion of data from other countries on the Z-value of each country, we calculated the change in the percentage of employed women in the ICT sector, with the mean and standard deviation calculated for 2011–2019 for that

country. We expressed this change as Z values, and we observed whether a difference greater than one or two standard deviations in both directions was present in the pandemic year.

4 Result and Discussion

The average deviation of the EU-27 countries from the EU-27 average in the employment of women ICT specialists is 6.68 p.p., calculated by geometric mean [56] Although the average deviations of women and men ICT specialists' employment 2020 data compared to 2019 show a significant similarity in the deviation ICT specialist of the EU-27 countries from the average, observing the EU-27 countries individually, numerous national differences are evident from country to country and by gender as shown in Fig. 3.

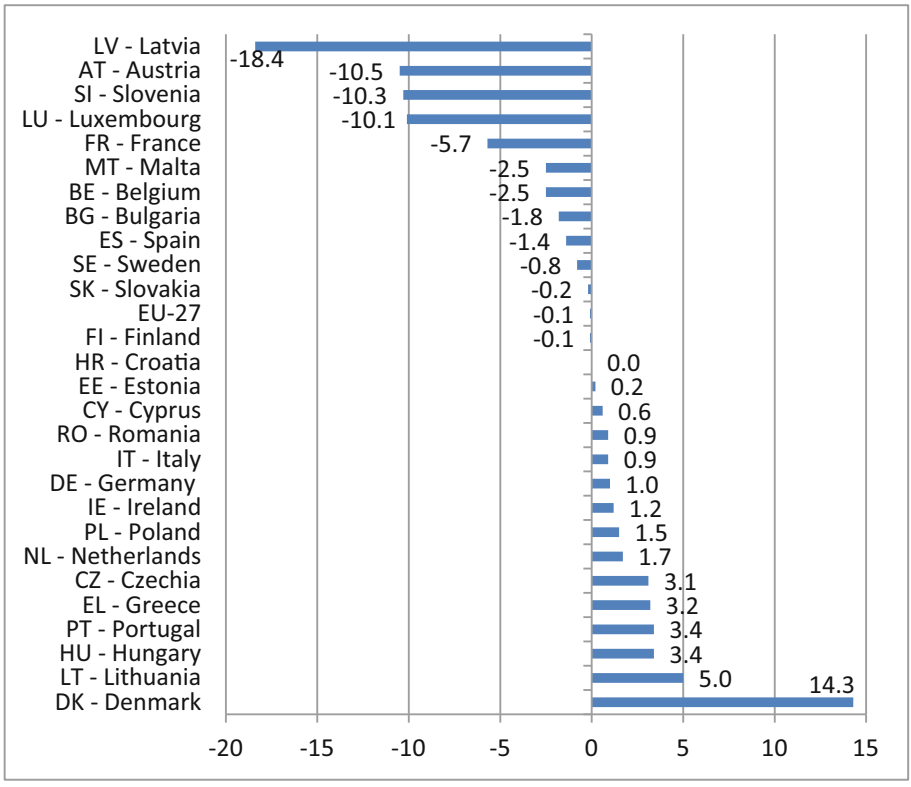

Fig. 3. Women ICT specialist employment change in overall ICT specialist employment 2020 in regards to 2019. in p.p. Source: Authors according to Eurostat (2021)

Women ICT specialist employment in 2020 in overall ICT specialist employment has fallen compared to 2019 by 0.1 percentage points. Latvia has recorded the most significant decline with a drop of 18.4 percentage points (down from 24.8% to 6.4%).

Austria, Slovenia and Luxembourg recorded a drop of about ten percentage points, and France by 5.7 percentage points. The most significant increase in women ICT specialist employment in 2020 is present in Denmark, 14.3 p.p., followed by Lithuania with five p.p. Other countries record minor changes, except Croatia, where the number of employed women ICT specialists has not changed. It is essential also to emphasize how each percentage point of change in the employment of women ICT specialists represents a change in male ICT specialists with the opposite sign.

Unlike the previous analysis, which shows the percentage change in the employment of ICT female specialists in 2020 compared to 2019 in each EU-27 country, the following shows the percentage of employed women and men ICT specialists in the total population of ICT specialists in 2020. From these data, the deviation of each country from the EU-27 average was calculated. The deviation was calculated in standard deviations to illustrate the deviation from the normal Gaussian distribution.

Table 2 shows the percentage of women and men ICT specialists in the total employment of ICT specialists and each country's deviation from the EU-27 average in standard deviations.

Table 2. Share of women employed in the ICT sector, deviation from EU-27 average in 2020, Z-score, in σ

Country	Employed ICT specialists - % of females in total ICT employment	Employed ICT specialists - % of males in total ICT employment	Deviation from the EU-27 average, Z-score, females, in σ	Deviation from the EU-27 average, Z-score, males, in σ
EU-27	**17,2**	**82,8**		
BE - Belgium	10,9	89,1	−0,9	0,9
BG - Bulgaria	27,4	72,6	1,5	−1,5
CZ - Czechia	11,1	88,9	−0,9	0,9
DK - Denmark	32,9	67,1	2,4	−2,4
DE - Germany	14,8	85,2	−0,4	0,4
EE - Estonia	18,1	81,9	0,1	−0,1
IE - Ireland	23,2	76,8	0,9	−0,9
EL - Greece	30,6	69,4	2,0	−2,0
ES - Spain	20,9	79,1	0,6	−0,6
FR - France	16,6	83,4	−0,1	0,1
HR - Croatia	16,4	83,6	−0,1	0,1
IT - Italy	16,9	83,1	0,0	0,0

(*continued*)

Table 2. (*continued*)

CY - Cyprus	27,5	72,5	1,5	−1,5
LV - Latvia	6,4	93,6	−1,6	1,6
LT - Lithuania	20,7	79,3	0,5	−0,5
LU - Luxembourg	13,5	86,5	−0,6	0,6
HU - Hungary	17,1	82,9	0,0	0,0
MT - Malta	15,0	85,0	−0,3	0,3
NL - Netherlands	13,9	86,1	−0,5	0,5
AT - Austria	14,5	85,5	−0,4	0,4
PL - Poland	11,7	88,3	−0,8	0,8
PT - Portugal	19,0	81,0	0,3	−0,3
RO - Romania	27,0	73,0	1,5	−1,5
SI - Slovenia	9,7	90,3	−1,1	1,1
SK - Slovakia	13,2	86,8	−0,6	0,6
FI - Finland	14,1	85,9	−0,5	0,5
SE - Sweden	24,5	75,5	1,1	−1,1

Source: Authors according to Eurostat (2021)

Results presented in Table 2 show that in 2020 the deviation of women's employment in the ICT sector of the EU-27 from the EU-27 average ranges from 2.4 σ in Denmark to -1.6 σ in Latvia. The deviation of employed men in the ICT sector from the EU-27 average is in the same range, but in the opposite direction, in Latvia, 1.6 σ to -2.4 σ in Denmark.

Although statistically, there is no significant gap between EU-27 countries in the employment of women with ICT education in Denmark, women's employment is almost twice as high as the average, precisely 2.4 σ, and the employment of men is lower than the EU −27 average by 2.4 σ. The employment of women with ICT education in Latvia is 2.67 times lower than the EU-27 average (−1.6 σ), and it is more than five times lower than that of women in Denmark. From these results arises the need and guidance for further examination: what are the significance and the effects of explanatory variables that contribute to widening the gender gap, whether the result is in favour of women or men, as shown by the differences in Denmark in favour of women and Latvia in benefit men (Fig. 4).

When observing the discrepancies between men and women in ICT sector employment in a specific EU-27 country, it is noticeable that men employees considerably positively deviate from the EU-27 average, and women negatively in Latvia, Slovenia,

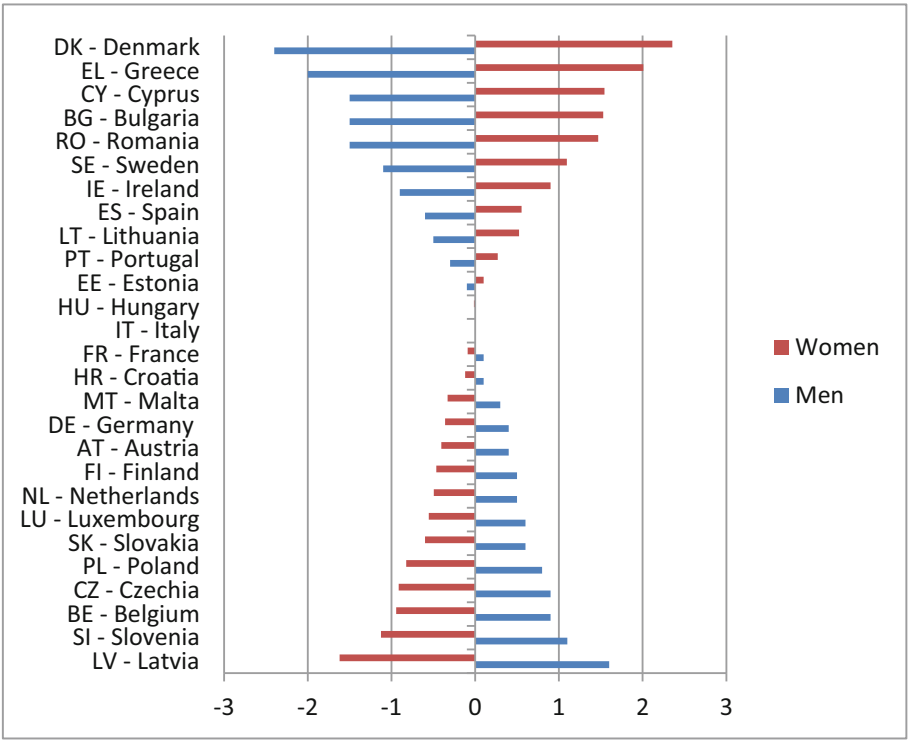

Fig. 4. Deviation of the share of women and men employed in the ICT sector from the EU-27 average, 2020 in σ. Source: Authors according to Eurostat (2021)

Belgium and Czechia. Women ICT employees in the ICT sector deviate positively from the EU-27 average (while man ICT employees notably negatively deviate) in Denmark, Greece, Cyprus, Bulgaria, Romania, Sweden, and Ireland. Although the share of women ICT specialists is significantly lower than men, the analysis of deviations of countries from the EU-27 average shows that in a larger number of countries, women deviate more positively from the average, i.e. their employment is higher than that of men. Women's employment in the ICT sector is EU-27 average in nine countries. In Estonia, Hungary, Italy, France and Croatia, there is no deviation from the EU-27 average, or it is insignificant.

However, the results confirm that statistically speaking, there is no large deviation of the EU-27 from the EU-27 average, which was approved by Chebyshev's Theorem [59, 60], according to which for any numerical data set, at least 75% of the data lie within two standard deviations of the mean, that is, in the interval with endpoints $\mu \pm 2\sigma$. Specifically, according to the results presented, 26 EU-27 countries or 96% of countries, are within $\mu \pm 2\sigma$, and all countries are within $\mu \pm 2.4\ \sigma$.

In contrast to the results presented in a research paper by Pisker, Radman-Funarić, Sudarić [53] in 2019, the largest positive and largest negative deviation of the share of women employed in the ICT sector is present in Central and Eastern European countries,

while in other countries it is closer to the EU-27 average, in 2020, this deviation does not follow such an observation, respectively a similar grouping of countries cannot be performed.

To avoid the dispersion of data from other countries, Table 3 shows the percentages of female employment in 2019 and 2020. The standard deviation and arithmetic mean were calculated from 2011 to 2019 for each country separately. Behind this column is

Table 3. Z values of the change in the percentage of women employed in ICT by country.

	2019	2020	SD	MEAN	Z	
Belgium	13.4	10.9	2.09	11.79	-1.19	F
Bulgaria	29.2	27.4	5.82	28.41	-0.31	
Czechia	8.0	11.1	2.77	8.98	1.12	R
Denmark	18.6	32.9	1.55	16.57	9.25	R
Germany	13.8	14.8	0.23	13.54	4.41	R
Estonia	17.9	18.1	7.30	22.84	0.03	
Ireland	22.0	23.2	3.94	28.9	0.30	
Greece	27.4	30.6	5.94	30.54	0.54	
Spain	22.3	20.9	2.68	20.61	-0.52	
France	22.3	16.6	3.23	14.47	-1.77	F
Croatia	16.4	16.4	6.05	17.28	0.00	
Italy	16.0	16.9	3.31	21.03	0.27	
Cyprus	26.9	27.5	6.19	31.04	0.10	
Latvia	24.8	6.4	8.27	22.67	-2.22	F
Lithuania	15.7	20.7	4.18	16.82	1.20	
Luxembourg	23.6	13.5	4.35	13.98	-2.32	F
Hungary	13.7	17.1	1.86	13.48	1.83	R
Malta	17.5	15.0	3.29	18.43	-0.76	
Netherlands	12.2	13.9	2.72	13.11	0.62	
Austria	25.0	14.5	4.53	15.14	-2.32	F
Poland	10.2	11.7	2.27	12.1	0.66	
Portugal	15.6	19.0	3.51	19.97	0.97	
Romania	26.1	27.0	2.01	27.93	0.45	
Slovenia	20.0	9.7	5.56	11.27	-1.85	F
Slovakia	13.4	13.2	3.73	14.54	-0.05	
Finland	14.2	14.1	6.74	24.32	-0.01	
Sweden	25.3	24.5	1.68	24.96	-0.48	

the Z value of the change in the percentage of employed women in the ICT sector from 2019 to the pandemic of 2020. In the last column, countries where the percentage of women employed in the ICT sector has fallen by more than one standard deviation, are marked in red and with the letter F, while countries with the percentage of women employed in the ICT sector are marked in green and with the letter R. grew by more than one standard deviation.

5 Conclusion

The COVID-19 pandemic overall and specifically, when we discuss gender issues, needs to be understood in a Chinese origin word for the term crisis *Wéijī* being composed of two parts: *Wéi* meaning danger and *jī* meaning opportunity. From experience and emerging data presented, it is possible to project that the impacts of the COVID-19 global recession will result in a prolonged dip in women's income and overall labour force participation, as an opposite phenomenon to the overall increase in demand for ICT specialist employment will inevitably grow and speed up.

The COVID-19 pandemic response, therefore, respecting UNs recommendation [52, 61] need to address the following issues to disable further women ICT employment representation degradation: relevant institutions are to collect sex-disaggregated data to ensure that the pandemic does not disproportionately burden women; gender expertise in national, regional and global level response teams and task forces are to be ensured; social protection plans and emergency economic schemes are to perceive gender perspective and take into account unpaid workload performed by women; potentiate specific constraints for women entrepreneurs and women in the informal sector. Additionally, it is also necessary to assure role model social transfers (coaching and mentoring) and ensure women's leadership and participation in COVID-19 pandemic response plans in the short and long term.

The observations and findings given in this paper are as follows:

1. analysis conducted shows that women ICT specialist employment in 2020 in overall ICT specialist employment has fallen compared to 2019 by 0.1 percentage points.
2. Latvia has recorded the most significant decline with a drop of 18.4 percentage points, while the most significant increase is present in Denmark by 14.3 percentage points. When we presented the change concerning the variations of individual countries, the results were similar. In this case, Latvia (2.22) is in third place behind Luxembourg (2.32) and Austria (2.32), although these results are very similar. On the other hand, Denmark's highest growth was observed, regardless of the methodology (9.25).
3. in 2020, the deviation of women's employment in the ICT sector of the EU-27 from the EU-27 average ranges from 2.4 σ in Denmark to -1.6 σ in Latvia.
4. With negative trends in women's ICT sector employment, positive one is present in men's employment and vice-versa.
5. The results presented confirm that statistically speaking, there is no large deviation of the EU-27 from the EU-27 average.

The pandemic of COVID-19 severely influenced global society in all its aspects. Socio-economic responses different national countries deployed in their effort to alleviate

shocks and disturbances emerged were applied in the form of a first aid model, with crisis management often tapping into the dark. Although it has been shown how women country leaders were more successful and effective in suppression of pandemic consequences [26] While it might be too simplifying to explain such extreme differences between Latvia and Denmark in our research, it certainly is a supportive fact towards EIGE data with the case of men prime minister in position in Latvia and female in Denmark. Additional evidence supporting this thesis comes from trust in government differences between these two countries according to OECD 2020 data, where Latvia scores 30.7 per cent while Denmark scores 71.6 per cent [62].

Although Finland, Sweden, Denmark, Estonia and the Netherlands are EU-27 leaders in overall women's digital scores, Romania, Bulgaria, Poland, Hungary, and Italy are at the bottom of the scale according to DESI 2021 [4]. ICT specialist lead potential lies in different parts of EU-27. The EU policymakers must prepare to tailor fitted national implementation frames to boost up the women ICT specialists' interest, acceptance, and retention.

Unfortunately, the data used are not always the result of the same methodology, which differs between countries. It is also evident that there are some strange oscillations in the effects of individual countries in the period from 2011 to 2020. Still, on the other hand, it is the only reliable source that aggregates data from individual countries.

Future research should explore structural and cultural barriers to woman's ICT education and employment through qualitative approach assessment.

References

1. McKinsey and Company: McKinsley Global Surveys 2021: A year in review. McKinsey & Company, New York (2021)
2. European Commission: 2030 Digital Compass: the European way for the Digital Decade. European Commission, Brussels (2021)
3. European Commission: Path to the Digital Decade. https://eur-lex.europa.eu/resource.html?uri=cellar:6785f365-1627-11ec-b4fe-01aa75ed71a1.0001.02/DOC_1&format=PDF (2021). Accessed 31 Mar 2022
4. European Commission: Women in Digital Scoreboard 2021. https://digital-strategy.ec.europa.eu/en/news/women-digital-scoreboard-2021 (2021). Accessed 31 Mar 2022
5. Castells, M.: The Information Age: Economy, Society and Culture (3 volumes). Blackwell, Oxford **1997**, 1998 (1996)
6. Mauss, M.: The gift: The Form and Reason for Exchange in Archaic Societies, Routledge (2002)
7. OECD: Guide to Measuring Information Society. OECD, Paris (2011)
8. Barton, J.: Preparing Workers for the Expanding Digital Economy. Investing in America's Workforce, p. 251 (2018)
9. Davaki, K.: The underlying causes of the digital gender gap and possible solutions for enhanced inclusion of women and girls (2018)
10. Hafkin, N.J.: Cinderella or Cyberella?: Empowering Women in the Knowledge Society. Kumarian Press (2006)
11. Bimber, B.: Measuring the gender gap on the Internet. Soc. Sci. Q. **81**(3), 868–876 (2000)
12. Bandias, S., Sharma, R.: The workplace implications of ageism for women in the Australian ICT sector. Int. J. Bus. Humanit. Technol **6**, 7–17 (2016)

13. Martin, A.E., Phillips, K.W.: Blind to bias: The benefits of gender-blindness for STEM stereotyping. J. Exp. Soc. Psychol. **82**, 294–306 (2019)
14. Moore, K., Griffiths, M., Richardson, H., Adam, A.: Gendered futures? Women, the ICT workplace and stories of the future. Gend. Work. Organ. **15**, 523–542 (2008)
15. Huyer, S., Sikoska, T.: Overcoming the gender digital divide: understanding ICTs and their potential for the empowerment of women, INSTRAW Santo Domingo (2003)
16. Pisker, B., Radman-Funaric, M., Ramanathan, H.: Global issues in gender inequality: a comparative study. In: 9 International Scientific Symposium Region Entrepreneurship Development. Leko Simic, M., Crnkovic, B. - Osijek: Josip Juraj Strossmayer University of Osijek, Faculty of Economics in Osijek, 1246–1260 (2020)
17. Pisker, B., Radman-Funarić, M., Kreševljak, I.: The glass ceiling patterns: gap evidence. In: International Scientific Symposium: Economy of eastern Croatia - Vision and Growth, pp. 1047–1061 (2019)
18. OECD: Bridging the Digital Gender Divide Include, Upskill, Innovate. OECD (2018)
19. Frieze, C., Quesenberry, J.L.: Cracking the Digital Ceiling: Women in Computing Around the World. Cambridge University Press (2019)
20. Berger, P.L., Luckmann T.: The Social Construction of Reality: A Treatise in the Sociology of Knowledge. Anchor (1966)
21. Crenshaw, K.: Demarginalizing the intersection of race and sex: a black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. In: u. Chi. Legal f., p. 139 (1989)
22. Hofstede, G.: Culture's Consequences: Comparing Values, Behaviours, Institutions and Organizations Across Nations. Sage publications (2001)
23. United Nations: Goal 5: Achieve Gender Equality end Empower all Women and Girls. United Nations, New York (2021)
24. Nefesh-Clarke, L., Orser, B., Thomas, M.: COVID-19 Response Strategies, Addressing Digital Gender Divides (2020)
25. European Commission: A Union of Equality: Gender Equality Strategy 2020–2025. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2020%3A152%3AFIN (2020). Accessed 15 Jan 2022
26. European Institute for Gender Equality: Gender Equality and the Socio-economic Impact of the COVID-19 Pandemic. Publications Office of the European Union, Luxembourg (2021)
27. Adam, A.: Gender, Ethics and Information Technology. Springer (2005)
28. Publications Office of the European Union: Women and men in ICT: a chance for better work-life balance. European Institute for Gender Equality, Luxembourg (2018)
29. Ashcraft, C., Eger, E., Friend, M.: Girls in IT: The Facts. Boulder, CO: National Centre for Women & Information Technology (NCWIT). Retrieved July 2013 (2012)
30. Girón, A., Correa, E.: Post-crisis gender gaps: women workers and employment precariousness. J. Econ. Issues **50**, 471–477 (2016)
31. Tsiganou, J.: The impact of crisis on gender inequality: the Greek case. In: Social Inequalities in Europe Conference, Athens, Greece, 20 June 2014 (2014)
32. Patterson, L., Benuyenah, V.: The real losers during times of economic crisis: evidence of the Korean gender pay gap. Int. J. Manpower **42**, 1238–1256 (2021)
33. Kaya, S.A., Bahçe, E.M.: Estimating the impact of the 2008–09 economic crisis on work time in Turkey. Feminist Economics **19**(3), 181–207 (2013)
34. Jaba, E., Pârţachi, I., Chistrugă, B., Balan, C.B.: Gender employment gap in EU before and after the crisis. Procedia Econ. Fin. **20**, 326–333 (2015)
35. Bishu, S.G., Guy, M.E., Heckler, N.: Seeing gender and its consequences. J. Public Aff. Educ. **25**, 145–162 (2019)

36. Dahlmann, N., Elsner, M., Jeschke, S., Natho, N., Schroder, C.: Gender gap in technological disciplines: Societal causes and consequences. In: 2008 IEEE International Symposium on Technology and Society (2008)
37. Morchio, I., Moser, C.: The gender pay gap: Micro sources and macro consequences (2021)
38. Ferrant, G., Kolev, A.: Does gender discrimination in social institutions matter for long-term growth?: Cross-country evidence (2016)
39. Vitores, A., Gil-Juárez, A.: The trouble with 'women in computing': a critical examination of the deployment of research on the gender gap in computer science. J. Gend. Stud. **25**, 666–680 (2016)
40. Castaño Collado, C., Webster, J.: Understanding women's presence in ICT: the life course perspective. Int. J. Gender Sci. Technol. **3**, 364–386 (2011)
41. Simonsen, M., Corneliussen, H.G.: Can Statistics Tell Stories About Women in ICT? Vestlandsforsking- Western Norway Research Institute (2019)
42. Grogan, K.: How the entire scientific community can confront gender bias in the workplace. Nature Ecol. Evol. **3**, 11 (2018)
43. Galpin, V.: Women in computing around the world. ACM SIGCSE Bull. **34**, 94–100 (2002)
44. Lagesen, V.A.: A cyberfeminist utopia? Perceptions of gender and computer science among Malaysian women computer science students and faculty. Sci. Technol. Human Values **33**, 5–27 (2008)
45. Mellström, U.: The intersection of gender, race and cultural boundaries, or why is computer science in Malaysia dominated by women? Soc. Stud. Sci. **39**, 885–907 (2009)
46. Hickel, J.: What does degrowth mean? A few points of clarification. Globalizations **18**, 1105–1111 (2021)
47. Mariscal Avilés, J., Mayne, G., Aneja, U., Sorgner, A.: Bridging the gender digital gap. Economics 13, 2019-9 (2019). Walter de Gruyter GmbH, Berlin, Germany
48. Kerras, H., Sánchez-Navarro, J.L., López-Becerra, E.I., de Miguel Gómez, M.D.: The impact of the gender digital divide on sustainable development: Comparative analysis between the European Union and the Maghreb. Sustainability **12**(8), 3347 (2020)
49. Kostoska, O., Kocarev, L.: A novel ICT framework for sustainable development goals. Sustainability **11**, 1961 (2019)
50. Saidu, A., Tukur, A., Adamu, S.: Promoting sustainable development through ICT in developing countries. Eur. J. Comput. Sci. Inform. Technol. **2**, 24–29 (2014)
51. Hilty, L.M., Hercheui, M.D.: ICT and sustainable development. In: What kind of information society? Governance, virtuality, surveillance, sustainability, resilience, pp. 227–235. Springer (2010)
52. United Nations: Policy Brief: The Impact of COVID-19 on Women. United Nations, New York (2020)
53. Pisker, B., Radman-Funarić, M., Sudarić, Ž: Women in ICT: the case of croatia within European union. In: Jallouli, R., Bach Tobji, M.A., Mcheick, H., Piho, G. (eds.) ICDEc 2021. LNBIP, vol. 431, pp. 3–15. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-92909-1_1
54. United Nations: Impact of the COVID-19 Pandemic on Trade in Digital Economy. United Nations, New York (2021)
55. Šošić, I.: Primjenjena statistika. Školska knjiga, Zagreb (2006)
56. Radman-Funarić, M.: UVOD U GOSPODARSKU STATISTIKU Tko kaže da lažem? u potpisu–Statistika (2018)
57. Everitt, B.S., Skrondal, A.: The Cambridge Dictionary of Statistics. University Press, Cambridge (2010)
58. Eurostat: Employed Persons with ICT Education by Sex. Eurostat, Brussel (2021)
59. Bienaymé, I.-J.: Considérations à l'appui de la découverte de Laplace sur la loi de probabilité dans la méthode des moindres carrés. Imprimerie de Mallet-Bachelier (1853)

60. Tchebichef, P.: Des valeurs moyennes. Journal de Mathématiques Pures et Appliquées **2**(12), 177–184 (1867)
61. United Nations: Shared Responsibility, Global Solidarity: Responding to Socio-economic Impacts of COVID-19. United Nations, New York (2020)
62. OECD: Trust in Government. https://data.oecd.org/gga/trust-in-government.htm (2021). Accessed 31 Mar 2022