Digital Gender Gap in the European Union ICT employment

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Content

FOREWORD

The 11th RED conference is back again live. After two years of of virtual conferencing experience we are glad to host another RED conference at Faculty of Economics in Osijek. We hope that live meeting, networking, our panel and workshop on scientific publishing, as well as the social acitvities will provide a value added experience to all the conference participants and bring us all one step closer to the „old normal" that both we as organizers and our guests have enjoyed in the past.

Toghether with our partnering institutions: University of Tuzla, Faculty of Economics in Tuzla Croatian Academy of Sciences and Arts, The Institute for Scientific and Artistic work in Osijek and University of Maribor, Faculty of Economics and Business, we gave our best to once again provide a memorable conference to all our participants. This year we have focused on papers, i.e. scientific input quality.

This proceedings include altogether 60 papers in the three areas that we try to cover: region, entrepreneurship and development. Our studies come mainly from Croatia, but they also include a few cases of international collaboration (Slovenia, Nigeria, Bosnia and Hercegovina), which is warmely welcomed. Additionally, some studies come from Portugal and Hungary.

Since this is a first live meeting after two years, we have provided few interesting events: keynote speaker, prof. Zsolt Bedő, from Faculty of Business and Economics, University of Pécs, Hungary how will present his study and experience on university as the platform of entrepreneurial activity; secondly we have organized a workshop on publishing in good scientific journals, which will be led by Dino Krupić, assistant professor from Faculty of Humanities and Social Sciences of JJ Strossmayer University of Osijek. Our third event is the panel on CROVIZONE (EU project: Adaptation of vineyard zones to climate change in the Republic of Croatia). Finally, our social event includes trip to Baranja, with wine tasting in tradional wine cellar (gator), visit to Street of forgotten times and conference dinner.

As we have introduced during past few conferences, this year we also announce the best paper award. The best paper award for RED 2022 goes to the paper entitled: CLUSTER ANALYSIS FOR PROFILING PUBLIC SECTOR BUILDINGS OF CONTINENTAL CROATIA AS A SUPPORT FOR REGIONAL DEVELOPMENT, co-authored by Kristina Hodak, Adela Has and Marinela Mokriš, from Faculty of Economcs in Osijek. This article deals with a problem that is significant for the public sector (energy efficiency of buildings) and makes up a huge share of total costs and energy consumption. The problem is approached from different aspects and complex methodology is extremely well-described and conducted. Congratulations to the authors and we hope to have them next year with similarly good input.

We hope to have interesting sessions, fruitful discussion and that all our participants will enjoy all the conference events…and, of course, join us next year.

Finally, I would personally like to express my gratitude to all the partners in the RED project – Organizing and Program committee members, our reviewers, keynote speaker, workshop leader and authors for continuous support. You all made this event best possible.

Mirna Leko Šimić
RED 2022 Organizing Committee Chair

A scientific paper

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DIGITAL GENDER GAP IN THE EUROPEAN UNION ICT EMPLOYMENT

ABSTRACT

This paper aims to explore the correlation between ICT educated employed women and selected socio-economic and educational indicators in EU-27 leading towards a deeper understanding of the digital gender gap throughout wide national varieties.
The interconnection between the share of ICT educated women employment ratio and selected socio-economic and educational indicators for overall, former socialist and all other EU-27 countries has been observed to determine the cross-cultural varieties in EU-27, reveal positive practices, and enable their wider adoption working towards better gender-balanced ICT initiatives throughout the whole EU-27.
The research conducted found both positive and negative correlation varieties in grouped countries suggesting explanatory solutions for strengthening gender-balanced policies of EU-27 need to address and respect cross-cultural differences and carefully plan joint activities in making progress towards overall gender equality.

Key words: *Digital Gender Gap, ICT Educated Women, Employment, European Union.*

1. Introduction

Although women employment rate in EU-27 is reaching its historical peaks, persisting gender segregation and employment imbalance across sectors is a well-documented fact deeply rooted into civilization and cross-cultural societal development pathways. Report on Gender Gaps and Employment structure in European Union (Eurofound and European Commission Joint Research Centre, 2021) reveal how women in EU-27 account for the majority of employment in education, human health and social work (over 70 %) service, sales and clerical support workers (over 60 %). In contrast, women are severely under-represented in certain jobs in science, technology, engineering and mathematics (STEM), while they account for less than one in five of EU-27 ICT sector employment.

The legacy of the case of traditional women-men roles in labour division, often taught to be prevailed in our contemporary societies therefore seem to be so very well hidden under the society's surface. Their overall gender imbalance presence and persistence also reflects social and hierarchical gender status differences expecting men are to have higher work-related competences, effectiveness and performance than women, resulting further in gender pay gap

and marking ICT education and consequently employment in EU-27 predominantly a male domain.

As striving to the union of equality EU-27 is to implement a set of policies and practices in its effort to tackle the barriers grounded traditionally in gender roles defined by social norms, etiquettes and stereotypes socialization transmitted. Gender equality upward is currently under EU-27 loupe since it does not account only for the sake of European core values uplift but also indirectly tackles further key EU-27 transformative challenges on digital and green transition, demographic, productivity and global lead issues.

In presenting the topic frame, this paper comprises five main parts: introduction, literature review on relevant recent research and introspective on factors influencing ICT educated woman employment in EU-27, the data and methodology used in research, results and discussion and final remarks summed up in a conclusive part.

2. Literature Review

In terms of technological determinism understanding technological process as a societal developmental driver (Reisman, 2012), digitalization is the inevitable social development phenomenon, especially in regard to a global socio-economic competitiveness in a new information society (Castells, 1996; 2002). Digital society's necessity (Lupton, 2015) is interwoven through all aspects of our digitalized lives exposing and underlying all our global village differences (McLuhan, 1989) while simultaneously it deepens our existing old divides between north-south, east-west, rich-poor and nowadays connected-disconnected. Digital became a total social fact of our contemporary society (Mauss, 2002).

Strong gender bias in ICT education, training and employment of ICT specialists is present throughout the EU-27, facing two major issues: an overall shortage of ICT specialists and a vast under-representation of women among them (Gender, 2018). ICT education is defined by the International Standard Classification of Education Fields (ISCED) comprising the Information and Communication Technologies: Computer Use, Computer Science, Database and network design and administration, Software and applications development and analysis (Eurostat, 2021).

Berger and Luckmann, in a theory of social constructionism, explained the essence of the existing gender gap in a contemporary digitalised society considering social systems as based on interaction. Eventually, interactions develop into accustomed norms and roles while they become institutionalised and embedded in society as standardised terms of cultural expectations. Therefore, the social construction perspective could contribute to understanding cross-cultural variation in socially constructed gender roles and expectations, including the digital gender gap (Berger, 1966).

Additionally, Crenshaw (1989) interprets gender norms in societies through intersectional theory, in which she discusses the multidimensional experience and identities as fluid and susceptible to changes through micro cultural frames present. 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 understanding the difference between national cultures” can be a starting point in explaining the digital gender gap in EU-27 ICT employment.

The digital gender gap is identified whereby women access and use ICTs less than men, which can further exacerbate gender inequalities (Davaki, 2018). Therefore, the digital gender gap is seen as an element of a broader frame of gender inequality. The gender-based digital gap has numerous causes. Hurdles to access, affordability, (lack of) education, skills and technological literacy, inherent gender biases and socio-cultural norms are at the firm root of gender-based digital exclusion (Huyer & Sikoska, 2003).

Cross-cultural analysis thou do not show male dominance in the ICT sector all around the globe (Galpin, 2002). Studies conducted in Malaysia, similar to China, India and Saudi Arabia, (Lagesen 2008; Mellström, 2009) have proven how different gender perspective poles (than western civilization) are a result of differences in cultural understanding of gender spatial mapping of working spaces where indoors are prescribed as female and outdoors as male working space (Frieze & Quesenberry, 2019).

The importance of reshaping the existing practices in the digital gender divide has been further emphasized regarding socio-economic elements of ICT as ensuring women can efficiently adapt, upskill and fully practice new digital technologies would benefit productivity and social development (Mariscal Avilés, 2018), taking into account the fact that women represent more than half of the total population our generation venture is to overcome men vs women stereotypes in terms of careers, professions, job segregations, social or family context if we strive for the future societies to be more sustainable, inclusive, democratic and holistic. Additionally, ICTs are seen as a cornerstone of further socio-economic and environmental transformation toward sustainable development goals (Kerras, 2020; Kostoska & Kocarev, 2019), although it may not be seen as a magic wand but need careful planning, implementation, monitoring and cross-cultural adaptation (Saidu, 2014; Hilty & Hercheui, 2010). In making positive circles of inclusion for women into different aspects of ICT presence, gender balance makes culture more inclusive for everyone (Lagesen, 2008; 2021).

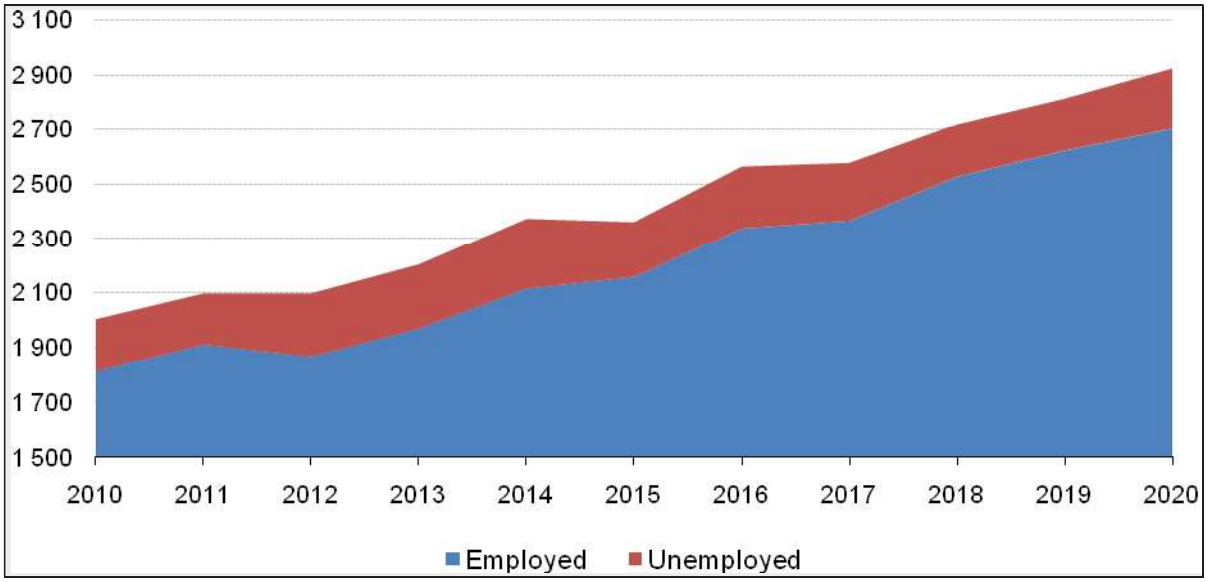
3. Overall characteristics of ICT educated persons in EU labour statistics

Most recent EU policy development shows a strong focus on the digital economy and society leaning on smart, green and inclusive Europe idea derived from EU 2020 strategy (European Commission, 2010) development built upon Digital economy and society index (DESI) data composed 2014 onwards (European Commission, 2020) and with the newest upgrade through 2030 Digital Compass. All these documents, especially the 2030 Digital Compass targets four cardinal digital developmental points: 1. Digitally skilled population and highly skilled digital professionals, 2. Secure and performant sustainable digital infrastructure 3. Digital transformation of business, and 4. The digitalization of public services (European Commission, 2021), aiming towards the importance of the topic in EU current developmental aspirations and trends.

Focusing on women ICT employment gap is relevant due to the point in which ICT sector specialists are at the top of the EU's skills-shortage list, thus attracting and keeping women into computing and ICT is often made in developmental socio-economic terms related to industry shortages. It is also a matter of fundamental developmental pathways as conserving the current perspectives consequently deprives the process of digital society transformation of a whole different, female perspective.

In accordance to the EU policy mentioned, Eurostat data (2021a) shows a continuous growth trend of ICT educated persons' overall employment in EU-27 in a period from 2010 to 2020 (Figure 1).

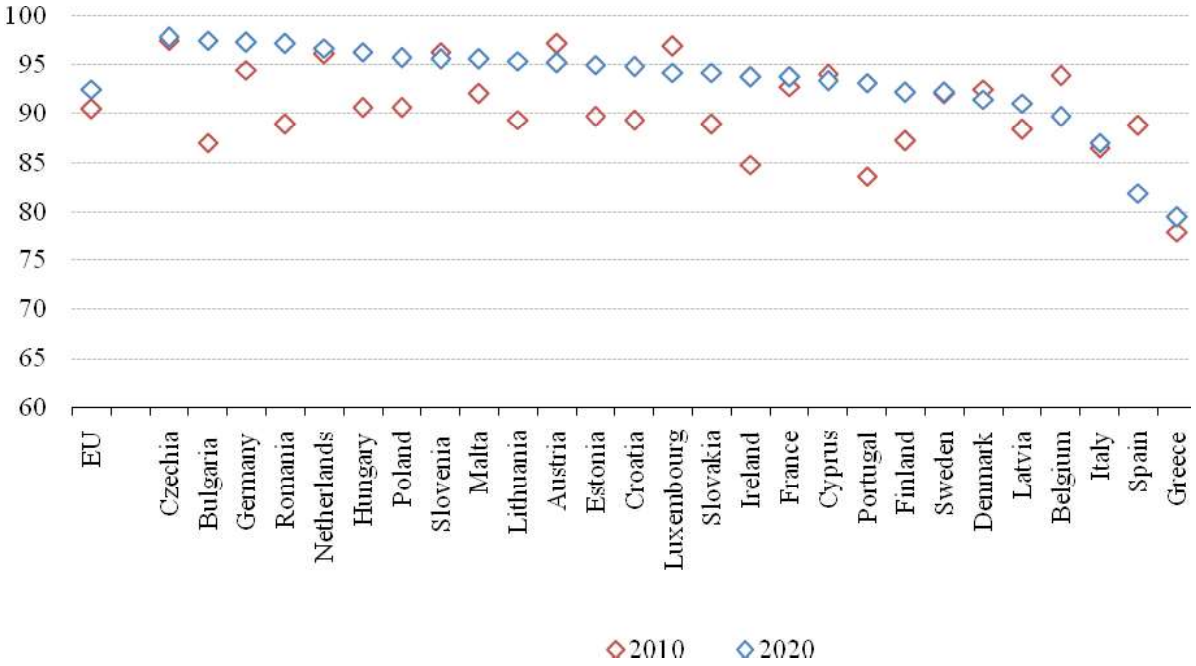
Figure 1: Employed & unemployed persons with ICT education in EU-27, 2010-2020, in .000



Source: Authors according to Eurostat (2021a)

The number of employed persons with ICT education has increased from 1.8 million in 2010 to 2.7 million in 2020. The number of unemployed persons with ICT education does not fluctuate similarly. In the period from 2010 to 2020 ranges from 190 to 210 thousand. Due to the constant number of unemployed persons, the share of the unemployed in the totally employed population of ICT educated persons is lower from year to year in overall EU-27 trend, while some national societies (as Lithuania, Luxembourg, Belgium and Spain) follow an oppositely different trend, as shown in Figure 2 below.

Figure 2: Share of employed person in the labour force with an ICT education, 2010 and 2020



Source: Eurostat (2021a)

As shown in Figure 2 in the EU-27, the share of employees in the labour force with ICT education in 2020 increased compared to 2010 from 90.5% to 92.5%, i.e. increased in most EU countries, except Slovenia, Austria, Luxembourg, Cyprus, Denmark, Belgium and Spain. The largest increase in the share of employees in the labour force with an ICT education is present in Bulgaria and Portugal. Czech Republic, Netherlands, Slovakia, France, Cyprus, Denmark, Italy and Greece have not shown a great change of employed persons in the labour force with an ICT education in a period shown in Figure 2-

Additionally, when discussing countries characterized by gender ICT employment parity or those that have nearly reached parity we surprisingly discover those are primarily former socialist countries - Bulgaria, Croatia and Latvia. In fact, on this indicator, the average score of the region's bottom 10 overall performers on the index is better on than that of the top ten overall performers. Further on, many Eastern European countries – and Balkan states, in particular – perform well. Additionally, two of the eight world highest ranked countries in terms of female STEM researchers are located in Eastern Europe (Equal Measures 2030, 2022).

4. Data and Methodology

Pisker, et.al. (2021) research paper focused on the share of women employees' ICT specialists in total employment in the ICT sector, in the period from 2004 to 2019 determining deviation in standard deviations (Z-score) of each of the European Union countries from the EU-27 average in 2019. According to the results obtained, the largest positive (Bulgaria, Lithuania, Latvia, Romania, Estonia) and the largest negative (Czech and Hungary) deviations of the share of women in the ICT sector have been found in the former socialist countries.

This paper aims to reveal the correlation between the share of ICT educated women employees' and selected socio-economic and educational indicators for three composite groups in EU-27, namely Overall EU countries, Former socialist EU countries and All other EU countries. The statistical method of correlation analysis was used to determine the correlation. Regression analysis was not used as a research method in this paper. According to the latest published data, in the period from 2012 to 2020, on financial aid to students, expenditure on educational institutions, funding of education and financial and economic effects of each country, the intention of this paper is to determine a connection of women's employment with their ICT education. An estimate of the parameters that can determined the quantitative effect among the variables is to be prepared the future research papers.

The analysis conducted included 23 different variables. In an additional analysis part, besides overall EU-27 observation, EU-27 countries are divided into two groups: former socialist EU countries (including Bulgaria, Czech Republic, Croatia, Hungary, Poland, Romania, Slovenia, Slovakia, Lithuania, Latvia and Estonia) and all other EU-27 countries to determine whether the share of women employed in the ICT sector is linked to the corresponding variables giving the affiliation to certain characteristics of specific socio-cultural heritage.

Data used for the analyses are obtained from Eurostat (2021):

Employed persons with ICT education. Broad definition based on the ISCO-08 classification and including jobs like ICT service managers, ICT professionals, ICT technicians, ICT installers and servicers [isoc_ski_itsex] - % of employed women with ICT education aged 15-74 of total Employed persons with ICT education in 2019 and 2020, (Eurostat, 2021a). BDP at market prices, current prices, euro, per capita, 2020 downloaded from Main GDP aggregates per capita [nama_10_pc], 2020, (Eurostat, 2021f).

Value added, gross, Wages and salaries, Employers' social contributions in Information and communication, Percentage of gross domestic product (GDP) are taken from Gross value added and income by A*10 industry breakdowns, NACE_R2, [NAMA_10_A10], 2020, (Eurostat, 2021e).

Financial aid to students for all ISCED 2011 levels excluding early childhood educational development taken from Financial aid to students by education level - as % of total public expenditure [educ_uoe_fina01], 2018, (Eurostat, 2021c).

Direct expenditure on educational institutions for Early childhood education, Primary and lower secondary education (levels 1 and 2), Upper secondary and post-secondary non-tertiary education (levels 3 and 4), Tertiary education (levels 5-8), All ISCED 2011 levels excluding early childhood educational development downloaded from Expenditure on educational institutions by education level and programme orientation [educ_uoe_fini03] Percentage of total public expenditure, 2012 to 2018, (Eurostat, 2021b).

Funding of education: Early childhood education, Primary and lower secondary education (levels 1 and 2), Upper secondary and post-secondary non-tertiary education (levels 3 and 4), Tertiary education (levels 5-8) downloaded from Funding of education by education level, programme orientation and recipient of funding [educ_uoe_finf01], including Central Government, State Government and Local Government, Percentage, 2018, (Eurostat, 2021d).

Financial aid to students for Primary and lower secondary education (levels 1 and 2), Upper secondary and post-secondary non-tertiary education (levels 3 and 4), Tertiary education (levels 5-8) and All ISCED 2011 levels excluding early childhood educational development Financial aid to students by education level - as % of total public expenditure [educ_uoe_fina01], 2012-2018, (Eurostat, 2021c).

Public expenditure on education for Primary and lower secondary education (levels 1 and 2), Upper secondary and post-secondary non-tertiary education (levels 3 and 4), Tertiary education (levels 5-8), All ISCED 2011 levels excluding early childhood educational development downloaded from Public expenditure on education by education level and programme orientation - as % of GDP [educ_uoe_fini03], 2012 to 2018, (Eurostat, 2021g). Public expenditure on education for early childhood education was not taken into consideration as incomplete for 2012 to 2018.

5. Results and Discussion

The first part of the analysis examined the correlation of employed ICT educated persons in 2019 -% of women in total employment in ICT sector in EU-27 countries with total GDP per capita in 2020 of each country, Gross value added in ICT sector 2020 as a percentage of GDP, Wages and salaries in Information and communication 2020, as Percentage of GDP, Employers' social contributions in Information and communication, 2020 as Percentage of GDP. The aim of this analysis was to determine whether there is a correlation between the share of employed women in total employment in the ICT sector and the financial indicators achieved in 2020. The results are shown in Table 1.

Table 1: Correlation employed women - % of total employment in 2019 with ICT education with financial indicators in 2020

Correlation employed women - % of total employment in 2019 with ICT education with:	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
BDP at market prices, current prices, euro per capita, 2020	0.09323	-0.45229	0.05455
Gross value added, Information and communication, 2020, Percentage of GDP	0.22813	**0.48221**	0.15932
Wages and salaries in Information and communication, 2020, Percentage of GDP	**0.37713**	**0.75303**	-0.08562
Employers' social contributions, Information and communication, 2020, Percentage of GDP	-0.00177	0.01810	-0.03257

Source: Authors´calculation

The results showed that there is a weak positive correlation between the share of employed women with ICT education in 2019 and the achieved Gross value added in Information and communication (r = 0.228). Also, there is a medium-strong positive correlation between the share of employed women in 2019 and Wages and salaries in Information and communication, 2020 (r = 0.377). After the former socialist countries were singled out, the analysis showed that this correlation was higher in the former socialist countries (r = 0.482 and r = 0.753) than in other EU-27 countries (r = 0.159 and r = -0.086). From the results presented it can be assumed that due to higher wages in the ICT sector than in other sectors,

the share of employment of women with ICT education is growing. It is also observed that in the former socialist countries wages in the ICT sector are considerably higher than in all other sectors thus raising the employment share of ICT educated women. Unlike in all other EU-27 countries where women with different types of education also reach high salaries and therefore ICT education is not crucial for higher women earnings.

A moderately strong negative correlation was found between the share of employed women in 2019 and GDP per capita in 2020 in the former socialist countries (r = -0.452), but it does not exist in the group of all other EU-27 countries or overall EU-27 countries. The results presented in Table 1 are partly in line with the result of Frieze & Quesenberry (2019) according to which a negative correlation was found between the financial indicator Gross national income and Women's % of bachelor's degrees in ICT (r-0.31) (Frieze & Quesenberry, 2019). There is no correlation between the share of employed women and ICT education in 2019 and Employers' social contributions in the Information and communication sector in 2020, neither for the EU-27 total nor for groups composed.

Table 2: Correlation employed women - % of total employment in 2019 with ICT education with Financial aid to students in 2018

Correlation employed women - % of total employment in 2019 with ICT education with:	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
Financial aid to students by education level - as % of total public expenditure, All ISCED 2011 levels excluding early childhood educational development, 2018	0.25523	**0.60898**	-0.45512

Source: Authors´calculation

The variable Financial aid to students All ISCED 2011 levels excluding early childhood educational development, 2018 is included in the analysis to determine whether there is a link between financial investment in student work (which includes women) and employment of women with ICT education in 2019. Analysis showed that there is a weak but statistically positive correlation when overall EU-27 countries were taken into account (r = 0.255), but it is strong in the former socialist countries (r = 0.609) and weak and negative in other EU-27 countries (r = -0.455). Therefore, the analysis of Financial aid to students and women's employment was expanded in Table 5.

Table 3: Correlation employed women - % of total employment in 2019 with ICT education with Expenditure on educational institutions 2012 to 2018

Correlation employed women - % of total employment in 2019 with ICT education with Expenditure on educational institutions by education level and programme orientation [educ_uoe_fini03] Percentage of total public expenditure, Average 2012-2018	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
Early childhood education	0.11640	0.17508	0.09039
Primary and lower secondary education (levels 1 and 2)	0.06485	-0.15119	0.21604

Correlation employed women - % of total employment in 2019 with ICT education with Expenditure on educational institutions by education level and programme orientation [educ_uoe_fini03] Percentage of total public expenditure, Average 2012-2018	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
Upper secondary and post-secondary non-tertiary education (levels 3 and 4)	-0.12231	-0.23202	-0.13699
Tertiary education (levels 5-8)	-0.15165	-0.14069	-0.25302
All ISCED 2011 levels excluding early childhood educational development	0.00205	-0.06732	0.04368

Source: Authors´calculation

The results showed that the correlation between the share of employed women with ICT education in 2019 and Expenditure on educational institutions (average 2012 - 2018) is very weak or even negative at the overall EU-27 level for both former socialist countries and all other EU-27 countries.

Table 4: Correlation employed women - % of total employment in 2019 with ICT education with Funding of education, 2018

Correlation employed women - % of total employment in 2019 with ICT education with Funding of education by education level, programme orientation and recipient of funding, Expenditure of government before intergovernmental transfers, Percentage, 2018	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
Early childhood education	0.20176	0.29810	0.07863
Primary and lower secondary education (levels 1 and 2)	**0.39003**	**0.51399**	**0.38538**
Upper secondary and post-secondary non-tertiary education (levels 3 and 4)	0.29655	**0.57764**	0.20969
Tertiary education (levels 5-8)	0.15035	**0.60353**	0.31030

Source: Authors´calculation

The results showed that there is moderately strong positive correlation between the share of employed women with ICT education in EU-27, 2019 and Funding of education in Primary and lower secondary education (r = 0.390), in Upper secondary and post -secondary non-tertiary education (r = 0.297) and weak in Early childhood education (r = 0.202) and Tertiary education (r = 0.150). The connection is higher in the former socialist countries at all levels of education (r = 0.30 to 0.60). In the group of other EU-27 countries, the correlation with the share of women with ICT education is higher than in the group of all EU-27 countries in Funding of education in Tertiary education (r = 0.310).

Since the results showed a link between the share of employed women and ICT education in 2019 and the Financial aid to students for all levels excluding early childhood educational development (Table 2), the analysis was expanded to examine the link between women's employment and financial assistance to students at all levels. Education, with the further analysis using more recent published data, i.e. women's employment in 2020. The averages of

the published financial aid to students' data for the period from 2012 to 2018 were used for the analysis.

Table 5: Correlation employed women - % of total employment in 2020 with ICT education with Financial aid to students, Average 2012 to 2018

Correlation employed women - % of total employment in 2020 with ICT education with Financial aid to students by education level - as % of total public expenditure [educ_uoe_fina01], Average 2012-2018	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
Primary and lower secondary education (levels 1 and 2)	0.21923	**0.51646**	-0.15440
Upper secondary and post-secondary non-tertiary education (levels 3 and 4)	0.29220	0.08664	**0.36361**
Tertiary education (levels 5-8)	**0.31510**	0.16107	0.28750
All ISCED 2011 levels excluding early childhood educational development	**0.35980**	**0.50471**	0.21469

Source: Authors´calculation

The data presented in Table 5 showed that there is a moderately strong positive correlation between the share of employed women with ICT education in the EU-27, 2020 and Financial aid to students by education level in Tertiary education (r = 0.315) and education and all ISCED levels (r = 0.360), but for the former socialist EU-27 countries there is a strong positive correlation between the participation of employed women with ICT education 2020 and Financial aid to students by education level in Primary and lower secondary education (r = 0.516) and all ISCED levels (r = 0.505). In contrast to the former socialist countries, in all other EU-27 countries there is a medium-strong positive correlation with Upper secondary and post-secondary non-tertiary education (r = 0.364).

Table 6: Correlation employed women - % of total employment in 2020 with ICT education with Public expenditure on education by education level and programme orientation - as % of GDP, Average 2012-2018

Correlation employed women - % of total employment in 2020 with ICT education with Public expenditure on education by education level and programme orientation - as % of GDP, Average 2012-2018	**Overall EU-27**	**Former socialist EU-27 countries**	**All other EU-27 countries**
Primary and lower secondary education (levels 1 and 2)	0.12124	**-0.5477**	**0.41278**
Upper secondary and post-secondary non-tertiary education (levels 3 and 4)	-0.07599	**-0.4102**	-0.15134
Tertiary education (levels 5-8)	0.07866	-0.1916	0.07402
All ISCED 2011 levels excluding early childhood educational development	0.11603	**-0.7051**	**0.30675**

Source: Authors´calculation

The data presented in Table 6 show that there is no correlation between the share of employed women and ICT education with Public expenditure on education, if overall EU-27 countries

are observed. However, it is strong and negative in the former socialist countries, except in tertiary education. In contrast, apart from former socialist countries, for all other EU countries there is a correlation between the share of employed women and Public expenditure on education in Primary and lower secondary education (r = 0.413) and all ISCED levels (r = 0.307). From the results presented it can be concluded that women ICT education and employment in the former socialist countries is positively related to student scholarships, and in all other EU-27 countries there is a statistically positive connection with Public expenditure on ICT education.

According to the results presented in Tables 5 and 6, it can be concluded that the former socialist countries should study and apply the ways of financing education from the state budget to all other EU-27 countries in order to turn negative results into positive ones. Furthermore, all other EU countries should transfer the experience of former socialist countries in the way of student scholarships, as it is obvious that this connection has positive effects on the employment of women with ICT education. In this way, the overall effects of the EU-27 gender balanced ICT education and employment would be more effective.

5. Conclusion

The research analysis conducted revealed the following main findings:

Analysis of employed women as a percentage of total employment with ICT education correlated with Financial aid to students showed that there is a weak positive correlation with overall EU-27 countries taken into account, being strong and positive in the former socialist countries and weak and negative in all other EU-27 countries.

The correlation between the share of employed women with ICT education and Expenditure on educational institutions is very weak or even negative at the EU-27 level for both former socialist countries and all other EU-27 countries.

Moderately strong positive correlation has been observed between the share of employed women with ICT education in EU-27 and Funding of education in Primary and lower secondary, Upper secondary and post-secondary non-tertiary education while weak in Early childhood education and Tertiary education. The connection is higher in the former socialist countries at all levels of education while within the group of all other EU-27 countries the correlation result is higher than in the group of overall EU-27 countries in Funding of education in Tertiary education.

The data also showed that there is a moderately strong positive correlation between the share of employed women with ICT education in the EU-27 and Financial aid to students by education level in Tertiary education and all ISCED levels. In contrast to the former socialist countries, in all other EU-27 countries there is a medium-strong positive correlation with Upper secondary and post-secondary non-tertiary education.

Further on, there is no correlation between the share of employed women and ICT education with Public expenditure on education, if overall EU-27 countries are observed. However, correlation is strong and negative in the former socialist countries, except in tertiary education. In contrast, apart from former socialist countries, for all other EU countries there is a correlation between the share of employed women and Public expenditure on education in Primary and lower secondary education and all ISCED levels.

Overall, the research presented has shown how Financial aid to students and Funding of education positively influences women ICT education and employment in former socialist countries, while state Expenditures on educational institutions follow the opposite trend pointing toward new policy developments needed in former socialist countries leading towards stronger individual student scholarship practices in order to level up gender balance in ICT sector education and employment for socialist countries.

On the contrary, all other EU countries show negative relation toward student scholarships as traditionally those countries find different models of individual support towards education (as student loans). Additionally, having higher life standard and wider job offer with higher job security and full-time work employment rates these countries show negative relation towards financial aid to students as this might decrease their individual achievement motivation.

Research constraint and limitations of this research paper are recognized in the omitted parallel analysis of men with ICT education employment, i.e. total employment, aiming to obtain the full gender spectrum results when compared to women colleagues' results presented. Furthermore, the correlation between the variables was calculated without showing statistical significance, although with the intention of fulfilling this requirement in further analyses which are to calculate the statistical significance of individual results followed by regression analysis.

Conclusively, the practical implications of the research paper are for the policymakers and practitioners to combine the best practices of both worlds in reversing negative trends to positive ones, enabling gender-balanced solutions. Cross-cultural solutions with careful and patient, tailor-fitted solutions can bring positive effects towards higher representative quotas for women ICT education and employment aiming towards strengthening and opening new frontiers for overall gender equality in numerous lairs of its social complexity.

REFERENCES

Berger, P. L. (1966). ***The social construction of reality: A treatise in the sociology of knowledge.*** Anchor.

Castells, M. (1996). ***The information age (Vol. 98).*** Oxford Blackwell Publishers.

Castells, M. (2002). ***The Internet galaxy: Reflections on the Internet, business, and society***. Oxford University Press.

Crenshaw, K. (1989). ***Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics***. u. Chi. Legal f., 139.

Davaki, K. (2018). ***The underlying causes of the digital gender gap and possible solutions for enhanced inclusion of women and*** girls. https://www.europarl.europa.eu/RegData/etudes/STUD/2018/604940/IPOL_STU(2018)604940_EN.pdf (accessed 20 January 2022)

Equal Measures 2030. 2019 SDG Gender Index. Retrieved from Key Findings: https://www.equalmeasures2030.org/datahub/2019-sdg-gender-index/key-findings/ (accessed 20 January 2021)

Eurofound and European Commission Joint Research Centre. (2021). ***European Jobs Monitor 2021: Gender gaps and the employment structure, European Jobs Monitor series***. Luxembourg: Publications Office of the European Union.

European Commission, "2030 Digital Compass: The European way for the Digital Decade," https://ec.europa.eu/info/sites/info/files/communication-digital-compass-2030_en.pdf. (accessed 20 January 2021)

European Commission, ***"Digital Economy and Society Index (DESI) 2020***" 2020.

European Commission, ***"Europe 2020 A European strategy for smart, sustainable and inclusive growth,"*** https://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf (accessed 20 January 2021)

Eurostat. (2021). ***Employed persons with ICT education by labour status***, 2021a.

Eurostat. (2021). ***Expenditure on educational institutions by education level and programme orientation***, 2021b.

Eurostat. (2021). ***Financial aid to students by education level - as % of total public expenditure***, 2021c.

Eurostat. (2021). ***Funding of education by education level, programme orientation and recipient of funding***, 2021d.

Eurostat. (2021). ***Gross value added and income by A*10 industry breakdowns, Information and communication***, NACE_R2, 2021e.

Eurostat. (2021). ***Main GDP aggregates per capita***, 2021f.

Eurostat. (2021). ***Public expenditure on education by education level and programme orientation - as % of GDP***, 2021g.

Frieze, C., & Quesenberry, J. L. (2019). ***Cracking the digital ceiling: Women in computing around the world***. Cambridge University Press.

Galpin, V. (2002). ***Women in computing around the world***. ACM SIGCSE Bulletin, 34, 94–100.

Gender, E. I. (2018). ***Women and men in ICT: a chance for better work-life balance***. Luxembourg: Publications Office of the European Union.

Hilty, L. M., & Hercheui, M. D. (2010***). ICT and sustainable development***. In What kind of information society? Governance, virtuality, surveillance, sustainability, resilience (pp. 227–235). Springer.

Hofstede, G. (2001). ***Culture's consequences: Comparing values, behaviours, institutions and organizations across nations***. Sage publications.

Huyer, S., & Sikoska, T. (2003). ***Overcoming the gender digital divide: understanding ICTs and their potential for the empowerment of women***. INSTRAW Santo Domingo.

Kerras, H., Sánchez-Navarro, J. L., López-Becerra, E. I., & de-Miguel Gomez, M. D. (2020). ***The impact of the gender digital divide on sustainable development: Comparative analysis between the European Union and the Maghreb***. Sustainability, 12, 3347.

Kostoska, O., & Kocarev, L. (2019). ***A novel ICT framework for sustainable development goals***. Sustainability, 11, 1961.

Lagesen, V. A. (2008). ***A cyberfeminist utopia? Perceptions of gender and computer science among Malaysian women computer science students and faculty***. Science, technology, & human values, 33, 5–27.

Lagesen, V. A., Pettersen, I., & Berg, L. (2021). ***Inclusion of women to ICT engineering–lessons learned***. European Journal of Engineering Education, 1–16.

Lupton, D. (2015). ***Digital sociology.*** Routledge London.

Mariscal Avilés, J., Mayne, G., Aneja, U., & Sorgner, A. (2018). ***Bridging the gender digital gap.*** Tech. rep., Economics Discussion Papers.

Mauss, M. (2002). ***The gift: The form and reason for exchange in archaic societies***. Routledge.

McLuhan, M. (1989). ***The Global Village: Transformations in World Life and Media in the 21st Century (Communication and Society)***. Oxford: Oxford University Press.

Mellström, U. (2009). ***The intersection of gender, race and cultural boundaries, or why is computer science in Malaysia dominated by women?*** Social studies of science, 39, 885–907.

OECD. (2018). ***Bridging the Digital Gender Divide Include, Upskill, Innovate***. OECD. https://www.oecd.org/digital/bridging-the-digital-gender-divide.pdf (accessed 20 January 2021)

Pisker, B., Radman-Funarić, M., & Kreševljak, I. (2019). ***The Glass Ceiling Patterns: Gap Evidence***. (M. Leko Šmić, & B. Crnković, Eds.) International Scientific Symposium: Economy of eastern Croatia - Vision and Growth, pp. 1047-1061. https://www.dropbox.com/s/sp9kp5ji9lsr1qp/GIH%20Zbornik%202019.pdf?dl=0 (accessed 20 January 2021)

Pisker, B., Radman-Funarić, M., & Ramanathan, H. (2020). ***Global Issues in Gender Inequality: A Comparative Study***. (M. Leko Šmić, & B. Crnković, Eds.) Region Entrepreneurship Development, pp. 1246-1260. http://www.efos.unios.hr/red/wp-content/uploads/sites/20/2020/06/RED-2020-Proceedings_.pdf (accessed 15 December 2021)

Pisker, B., Radman-Funarić, M., & Sudarić, Ž. (2021). ***Women in ICT: The Case of Croatia Within European Union***. International Conference on Digital Economy, (pp. 3–15).

Radman-Funarić, M. (2018). ***Uvod u gospodarsku statistiku tko kaže da lažem? U potpisu–statistika.*** Veleučilište u Požegi. Požega.

Reisman, D. A. (2012). ***The social economics of Thorstein Veblen***. Edward Elgar Publishing.

Saidu, A., Tukur, A., & Adamu, S. (2014). ***Promoting sustainable development through ict in developing countries***. European Journal of Computer Science and Information Technology, 2, 24–29.