THE POSITION OF WOMEN IN THE DIGITAL AREA

BEÁTA ŠOFRANKOVÁ[1] – ELENA ŠIRÁ[2] – DANA KISEĽÁKOVÁ[3]

Abstract: *In recent times, digitization has entered many areas of life. It is a daily part of our lives and affects us without perhaps realizing it. It is a specific area with the need for certain knowledge and skills. At first glance, it may seem that it is an exclusively male domain. But the position of women in this area is irreplaceable and has a justification. Since the digital area is tied to higher knowledge and the ratio of tertiary graduates of women is significantly higher than men's, we decided to devote ourselves more deeply to this area. The main aim is to identify the position of women in the digital area in V4 countries. We use the Women in Digital Scoreboard and analyse the V4 countries and compare them with the other EU countries. We identify the weak part of this scoreboard in V4 and try to find an answer, how significant are the relationships between the share of female board members and this score.*

Keywords: *WiD score, digital area, STEM graduates, women in senior management*

JEL Classification: J24, O15, O52

[1] doc. Ing. Beáta Šofranková, PhD., University of Prešov in Prešov, Slovakia,
e-mail: beata.sofrankova@unipo.sk, https://orcid.org/0000-0001-9766-0467
[2] Ing. Elena Širá, PhD., University of Prešov in Prešov, Slovakia, e-mail: elena.sira@unipo.sk,
https://orcid.org/0000-0002-9907-1372
[3] prof. Ing. Dana Kiseľáková, PhD., University of Prešov in Prešov, Slovakia,
e-mail: dana.kiselakova@unipo.sk, https://orcid.org/0000-0001-5662-5809

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

1 Introduction

The Internet and the use of websites have provided a kind of basis for the digital transformation of the economy. Even though it may seem that the topicality of the topic is only related to today's time, the world started automating processes already thirty years ago. Digitalization referred to use of digital technologies and digital transformation is a process, which cover the whole area or country (Bloomberg, 2018). Digital processes significantly support the interaction between companies and customers (Huňady et al., 2022), for example we can cite internet banking. The processes taking place in the online world encourage the establishment of special teams in companies for the processing of mobile and social channels. Through them, companies can effectively use digital data for the benefit of their own activities and interaction with the surrounding world. Sectors of the national economy are transforming digital technologies in new ways (e.g., Ihnatišinová, 2022) and can apply significant improvements in efficiency, security, or personalization (Červeňová, 2020).

Industry 4.0 is often discussed in the context of digitalization (Čirčová & Blštáková, 2023). New developments in the fields of artificial intelligence, big data, cloud computing (Ivanov, Dolgui & Sokolov, 2019) and mobile robotics that gave rise to Industry 4.0 (Brahma, Tripathi & Sahay, 2021) also offer new opportunities for women to improve their participation in economic life (Krieger-Boden & Sorgner, 2018). Inequalities between men and women exist not only in economy and society but also in education all over the world. Many initiatives are launched to empower women with advanced skills in many countries (Perifanou & Economides, 2020a).

2 Literature review

In the last two decades, the effects of ICT on economic growth have been a very frequent topic among economists and experts in economics. Economists have been inclined in recent years to the opinion that the effect of increasing ICT is not always automatic but depends on implementation in different sectors. Therefore, it is better and more accurate to focus the attention partially on individual sectors and study the impact of ICT on education, health system, human development, profitability of companies, job creation, quality of life, etc. (Ochotnický, Alexy & Káčer, 2020). If the attention is focused on the

creation of jobs, properly used technological innovations have a positive effect on the creation of new jobs. Therefore, government institutions strive for the best possible technological environment, which leads to the development of companies and the creation of jobs, which strengthens economic stability and has a positive effect on economic development (Aksentijević, Ježić & Zaninović, 2021).

Currently, digitization, which means the process of changing from analog to digital form (Bloomberg, 2018) and digital transformation have a significant impact on business. Both areas are changing the way organizations operate. According to Martincevic (2022), the digital transformation of business is inevitable and is a key element of the further development of the organization in today's modern environment and market. Being competitive, achieving and ensuring long-term competitiveness is impossible today without new digital technologies that create the prerequisites for achieving it.

The enormous influence of the Internet and digitization is present across the entire world. Unceasing technological progress and increasing technological pace have become essential features in countries. The application of ICT has changed the way businesses, people, and global innovation work. On the other hand, with the advent of new technologies, several challenges, and risks (Ivanov, Dolgui & Sokolov, 2019) are created, which complicate the problems for policy makers. A strong emphasis is placed on governments and their roles, for which it is important to find a balance between the protection of the country's fundamental interests and the ability to ensure national competitiveness.

Due to the pandemic of Covid-19 in recent years, people need more than ever to possess digital skills. They must perform many daily activities (e.g., supermarket shopping, communicating, working, learning, socializing, entertainment) using mobile phones, computers, and Internet (Rabatinová, 2021). Of course, this situation also affects women who need to have digital skills. Furthermore, it is easier for women with digital skills to find jobs (Tomčíková & Svetozarovová, 2021), to initiate online businesses, and access online education, government, and financial services (Perifanou & Economides, 2020b).

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

Research on the digital gender gap can be divided into three main phases. Early feminist and gender studies on the digital revolution were optimistic about the potential of digital technologies to empower people. The role of women in it was clear, and they just needed support to reach a level of access to ICT. However, the second wave of studies of the digital gap from a gender perspective found that access to technology alone does not lead directly to greater social opportunities. The digital divide is thus not simply a question of access to digital technologies but about the capacity to make meaningful use of its access (Mariscal et al., 2019). In fact, gender gaps in the EU are still widening at higher and more specialized levels skills that are generally considered to be key factors for future digital inclusion and employment. Therefore, the third level of digital divide studies focuses on quantifying the impact of unequal's distribution of the benefits of using the Internet. Refers to the EU Women in Digital Scoreboard confirms that there is still a substantial gender gap in specialist digital skills (Damiani & Rodríguez-Modroño, 2022).

The digital revolution affects gender equality in at least two ways. First, the change in the structure of jobs brought about by the digital revolution also affects the necessary skills. Greater emphasis is placed on the automation of work, the use of digital technologies, and thus also affects the demand on the labour market. Second, innovations in digital services and numerous digital platforms enable considerable work flexibility, telecommuting and adaptation of working hours to workers' requirements. These bonuses of the digital revolution allow women to enter new markets, work flexibly and thereby improve their financial autonomy and qualification level (Krieger-Boden & Sorgner, 2018).

Equality between women and men is one of the European Union's founding values, dating back to 1957 (Rosa, Drew & Canavan, 2020). The European Union is trying to significantly encourage the development of digitization and entrepreneurship in member countries, and off course, to minimize the "glass ceiling" - preventing women from being promoted to top jobs in management. The EU strives to be digitally sovereign in an open and interconnected world and to promote digital policies that enable people and businesses alike to prepare for a sustainable and prosperous human-centered digital future. The "Digital Europe" program, which was launched for the period 2021-2027 with the main goal of shaping and supporting the digital transformation of companies and economies, is supposed to help. It is focused on five priority areas: supercomputers, artificial intelligence, cyber security and trust, advanced

digital skills, ensuring the use of digital technologies throughout the economy and society. Improving the efficiency and scale of services using digital technologies is not enough for long-term competitiveness, it is necessary to explore and understand them. Without innovations in this area, there is no possibility of long-term and sustainable competitiveness (Martincevic, 2022).

Within EU programs, there are many tools to eliminate the gender gap. Acilar & Sæbø (2023) pointed out the importance of implementable policies to bridge the gender digital divide. The EU regularly evaluates the participation and positions of women in various areas, including the digital area. Several tools are used to evaluate the status of women. On the one hand, the created Women in Digital (WiD) scoreboard, on the other hand through various Sustainable development indicators (SDG) growth goals. For example, in the framework of Sustainable development, the 5th goal is dedicated to the family side. We follow up on these 2 EU instruments in the next section.

3 Data and methodology

The main aim of the article is to identify the position of women in digital area in V4 countries. To fulfil this goal, it was necessary to proceed in the partial goals listed below. First, an analysis of professional sources and publications was necessary, which resulted in the processing of the previous part of the article. Subsequently, the investigated issue was subjected to the analysis of partial inputs, i.e.:

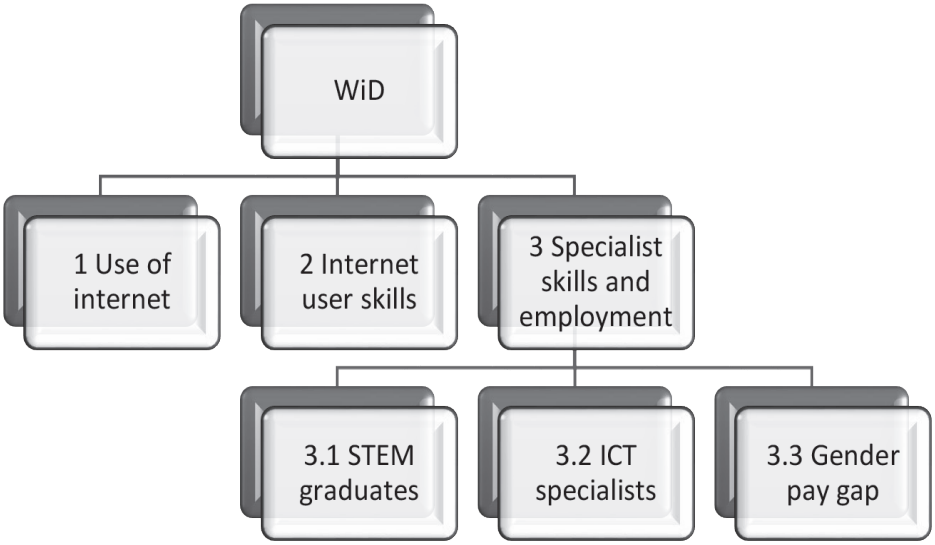
- Analysis of the overall performance of WiD score,
- Analyses of the 3 areas of WiD:
  - 1 Use of Internet,
  - 2 Internet user skills,
  - 3 Specialist skills and employment,
- Analyses of indicators forming the 3rd area:
  - 3.1 STEM graduates,
  - 3.2 ICT specialists,
  - 3.3 Gender pay gap, Investigation of dependencies between selected indicators.

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

- Analyses of other indicators:
  - Graduates in tertiary education,
  - The share of female board members.

The scheme of the analyses of WiD is shown in Figure 1.

Figure 1: Scheme of WiD



Source: own processing

The position of women in top management, their education level and their position across digital area is the fundamental of our analyses. According to this, we set 2 research questions.

Research question 1: *How significant are the relationships between the share of female board members and the WiD?*

Research question 2: *Which clusters can the analysed countries be divided into according to the position in the share of female board members?*

To solve the research questions and main aim, we use the data from European Commission and Eurostat.

WiD score was analysed for the last available data, for the year 2022. In a more detailed analysis of WiD areas where problems and weak values were identified, we focused on the period 2012-2022 due to the greater relevance of the results.

Due to the absence of data, a different time is given for the selected indicators. The lack of data either in individual years (Gender earnings gap) or from past periods (STEM graduates, Graduates in tertiary education) caused us inconsistency in this article. We did not consider the reduction to 5 years as a period with a higher notice value, therefore, where possible, we tried to use data from the period 2012-2022.

The WiD score were analysed in the whole EU. We pay more attention to the average values of EU countries and especially for V4 countries, which were in our major interest. For better clarity of figures and tables, we have decided to mark the EU countries with the abbreviations. Below is an overview of country designations:

AT Austria
BE Belgium
BG Bulgaria
HR Croatia
CY Cyprus
CZ Czechia
DK Denmark
EE Estonia
EU European Union
FI Finland
FR France
DE Germany
EL Greece
HU Hungary
IE Ireland
IT Italy
LV Latvia
LT Lithuania
LU Luxembourg
MT Malta
NL Netherlands
PL Poland
PT Portugal
RO Romania
SK Slovakia
SI Slovenia
ES Spain
SE Sweden

4 Results and discussion

4.1 WiD score

The Women in Digital Scoreboard (WiD) is part of the Digital Economy and Society Index (DESI). The European Commission uses these indexes to evaluate the performance of member states in the areas of using digital skills and access to the Internet. It focuses its attention mainly on the use of the Internet, professional skills, and employment. Women in Digital Scoreboard focuses exclusively on the performance of women in the digital area. Based on the obtained results, it confirms that there is still a significant gender gap in specialized digital skills. That is why the EU focuses on this gender area

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

and tries to point out the differences as well as the specifics arising from the examined issue (European Commision, 2023).

WiD score consists of three main areas, with equal weight. Into each of the three areas enter the values of the indicators, which help to complete the image and performance of it. The list of indicators is set in Table 1.

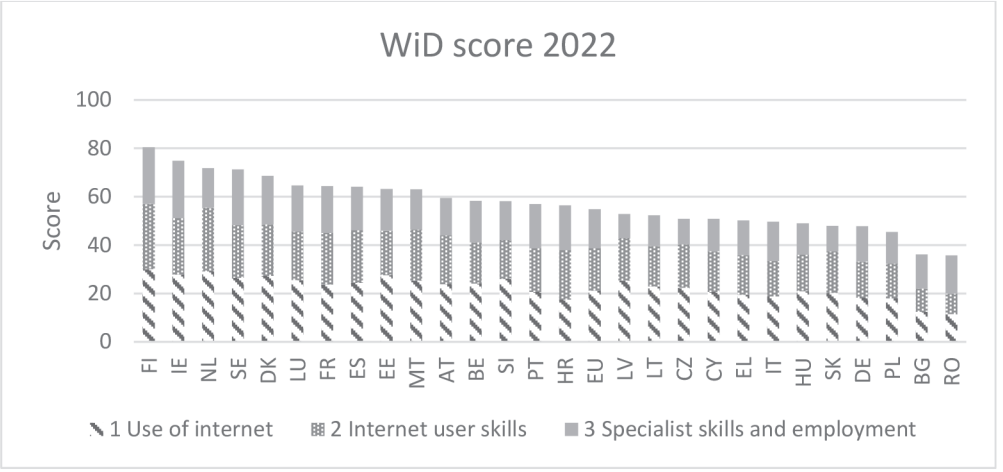
Table 1: Women in digital scoreboard

WiD areas	Weight	Indicators	Weight
1 Use of Internet	33.3%	1.1 Regular Internet use	16.67%
		1.2 People who never used the Internet	16.67%
		1.3 Online banking	16.67%
		1.4 Doing an online course	16.67%
		1.5 Online consultations or voting	16.67%
		1.6 eGovernment users	16.67%
2 Internet user skills	33.3%	2.1 At least basic digital skills	33.3%
		2.2 Above basic digital skills	33.3%
		2.3 At least basic digital content creation skill	33.3%
3 Specialist skills and employment	33.3%	3.1 STEM graduates	33.3%
		3.2 ICT specialists	33.3%
		3.3 Gender pay gap	33.3%

Source: own processing

In Figure 2 we can see the comparison of EU countries in the context of WiD scores. The overall performance is color-coded and takes into account the mentioned 3 areas, that enter the given score. We can see how individual areas affect the result of the overall score. Among the EU countries with the best WiD scores there are Finland, Ireland, and the Netherlands. On the contrary, the weakest results were found in 2022 in the case of Bulgaria and Romania. From among the V4 countries, the best place was the Czech Republic, and the worst place was Poland. However, we must state that none of the V4 countries surpassed the EU average values.

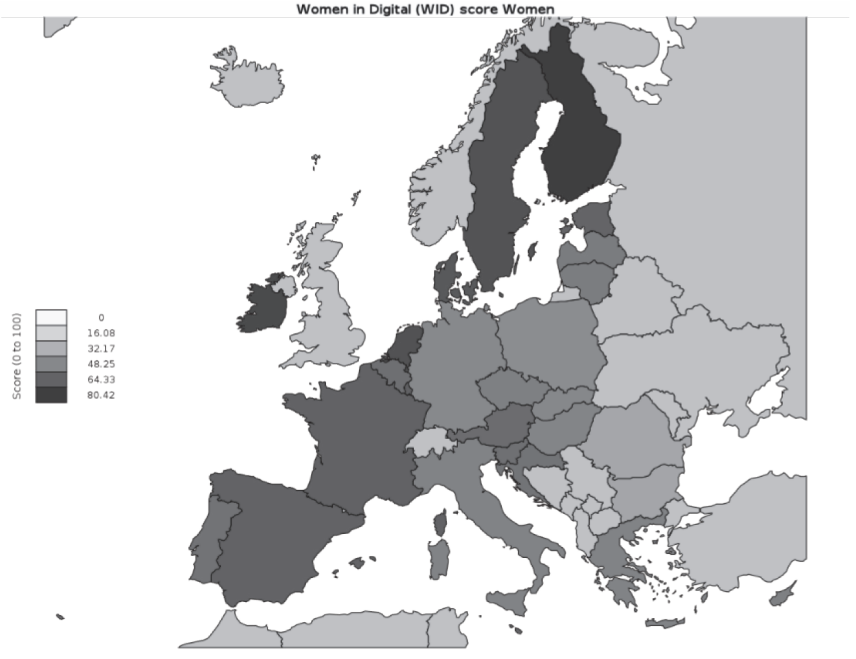
Figure 2: WiD Score 2022



Source: own processing according to data from European Commission.

The presentation of EU countries abroad WiD score is shown in the figure 3, too. The countries of Central and Eastern Europe are in lighter colors, which means their lower performance in this score.

Figure 3: EU countries abroad WiD



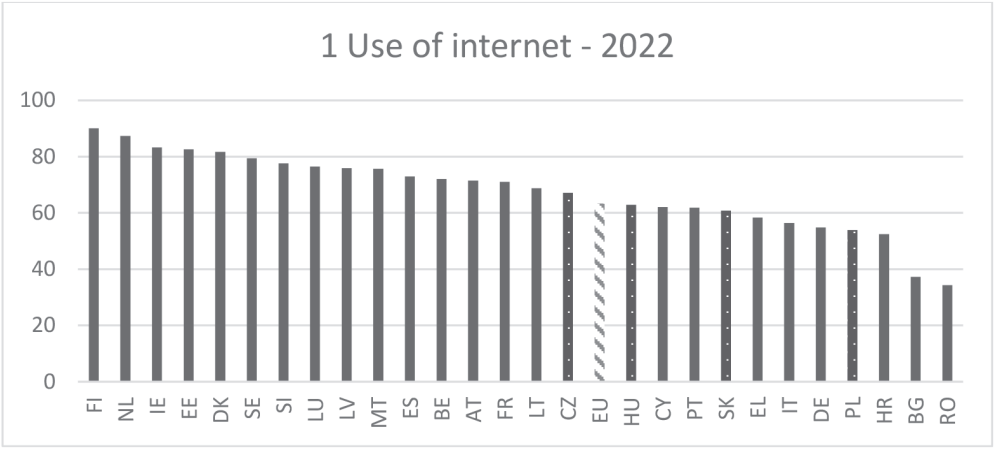
Source: European Commission .

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

In the next step, we took a closer look at the outputs of the countries in the individual areas forming the WiD. The first of them was the Use of Internet area. Within this area, the highest values are achieved, when the EU average is about 65%. Only the last 2 countries, namely Bulgaria and Romania, lag significantly behind in this area. All other countries have values of around 50%. This means that the inhabitants of the remaining countries use the Internet to a greater extent for entertainment and education as well as for fulfilling their civic responsibilities.

In this Figure 4, we use the red and green colours to show the results of analysed V4 countries, as well as the EU average. V4 countries are red and EU average is green. We can see that the Czech Republic is above the EU average and the other countries are under this value. But Hungary is very close to the EU average and the Czech Republic as well. The worst performance of V4 was in Poland.

Figure 4: Use of Internet

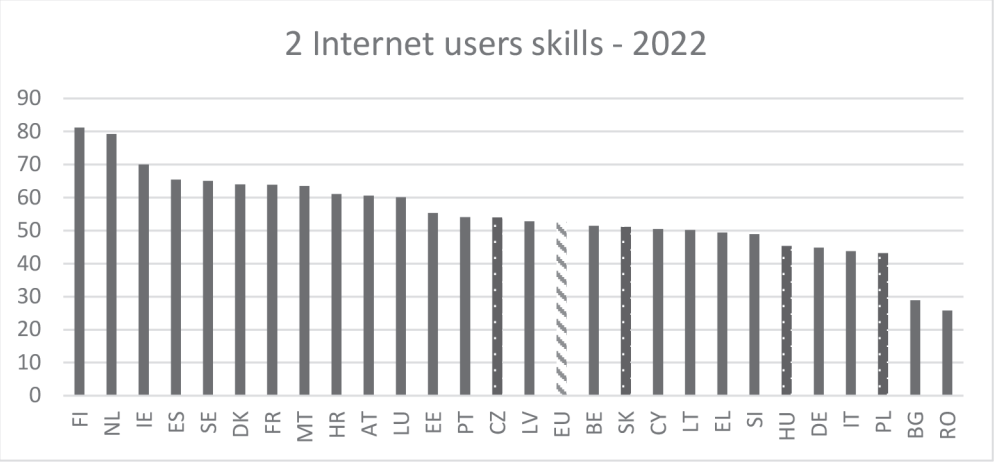


Source: own processing according to data from European Commission (Digital Agenda, 2023).

In the second area (Figure 5) dedicated to Internet user skills, the situation is different. We identify there 2 very strong and 2 very weak countries. With a score of almost 80 points are Finland and the Netherlands. On the other hand, Bulgaria and Romania scored below 30 points in this area. This area talks about skills that are necessary for women's work on the Internet. Skills can be achieved and developed if suitable conditions are created for it. Since Bulgaria and Romania are countries that are less equipped compared to other EU countries, this phenomenon is clear.

If we take a closer look at the V4 group, the Czech Republic once again achieved the highest score among the evaluated countries, but also higher than the EU average. Within this area, Slovakia is in second place, which also has values of 50 points.

Figure 5: Internet user skills



Source: own processing according to data from European Commission (Digital Agenda, 2023).

Almost all EU countries had problems with the last analysed area - Special skills and employment (Figure 6). This can also be seen in the value of the EU average, which is below 50 points for the first time. There are three strong economies in this area, which significantly exceed the rest of the countries. They are Ireland, Finland, and Sweden. On the contrary, the V4 countries achieved one of the worst positions here, while the Czech Republic, which excelled in the remaining 2 areas, has the worst score among the V4 and the second worst (score 31.5) in the entire EU. Only Latvia (score 29.9) placed behind it with a lower score.

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

Figure 6: Special skills and employment

Source: own processing according to data from European Commission (Digital Agenda, 2023).

Because the V4 countries obtained the worst performance in this area, we try to analyse it closer. Since the results for 2022 may or may not be random only for this year, we decided to analyse the period from 2015 to observe not only the absolute value of the last year, but also the trend in development over a longer period. The 3rd area Specialist skills and employment are divided into 3 indicators. Because of the lack of up to date data for the indicators from European Commission, we choose the data from Eurostat. We analyse these indicators:

- STEM graduates,
- Graduates in tertiary education by education level,
- Employed ICT specialists,
- Gender overall earnings gap.

Only the Graduates in tertiary education by education level is additionally compared to the original indicators of 3 Special skills and performance. We consider it interesting and suitable for addition to the already analysed indicators.

4.2 STEM graduates

STEM graduates (Table 2) mean the graduates with degrees in Science, Technology, Maths, and Engineering. Mihai-Yiannaki, et al. (2020) pointed out, that there are differences between each university and the knowledge gained by graduates. In principle, the level of the universities of the V4 countries is very similar, so these differences do not play a significant role in this case.

We calculate it as a % of women at total STEM graduates. The values are not surprising, when we compare it with other studies (e.g., Verdugo-Castro, Sánchez-Gómez & García-Holgado, 2018; Ulicna & Royale, 2015; Rosa, Drew & Canavan, 2020). In all V4 countries, female graduates predominate over men. It was most pronounced in Poland during the entire examined period. The lowest average values were in Hungary, but almost over 60%. In conclusion, we can add that the % of women in STEM graduates is, from a longer-term perspective, stable at over 60% in the analysed countries.

Table 2: STEM graduates

	2015	2016	2017	2018	2019	2020
CZ	61	63	61	61	61	61
HU	61	61	61	60	59	62
PL	66	66	65	66	66	65
SK	63	63	63	62	61	61

Source: own calculations according to data from Eurostat.

4.3 Graduates in tertiary education

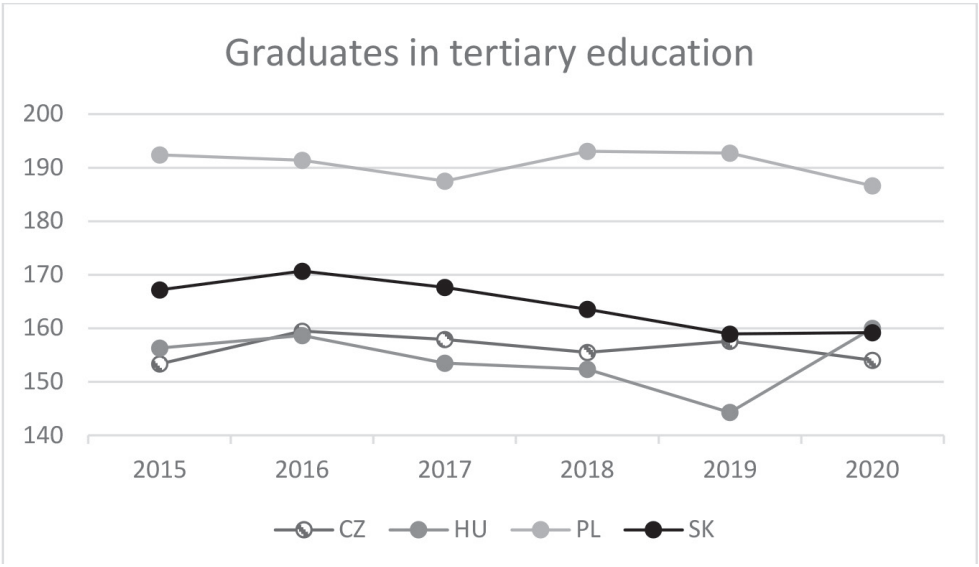
When evaluating tertiary education, it is appropriate to deal not only with the quantitative but also with the qualitative component of inputs and outputs, which, according to Nadoveza Jelić & Gardijan Kedžo (2018), allows us to distinguish the effectiveness of tertiary education. Since this article is more focused on the quantitative part of this indicator, we can use the qualitative part for further research in this area.

The indicator Graduates in tertiary education (Figure 7) is calculated as the number of women per 100 men. Almost this indicator, compared to STEM

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

graduates, pointed out to the gender inequality between graduates. There are almost more women than men. The development of this indicator is only in the Slovakia decreasing. But the decrease is very moderate, from the 170 women per men in 2016 to 159 in 2019. In other 3 countries, the trend is balanced. The highest values were in Poland for the whole analysed period.

Figure 7: Graduates in tertiary education



Source: own processing according to data from Eurostat.

According to the mentioned indicators, such as STEM graduates and Graduates in tertiary education, the recent increase in the number of university and post-graduate women in Europe is considerable. What is interesting, however, is the fact, that the careers of men and women in academia show according to Rosa, Drew and Canavan (2020) significant inequalities. Gender trajectories take the form of a scissor-shaped trend, which shows a significant loss of female potential after the award of the doctorate degree. The imbalance between work and private life is one of the main obstacles to gender equality in this area (Rosa, Drew & Canavan, 2020).

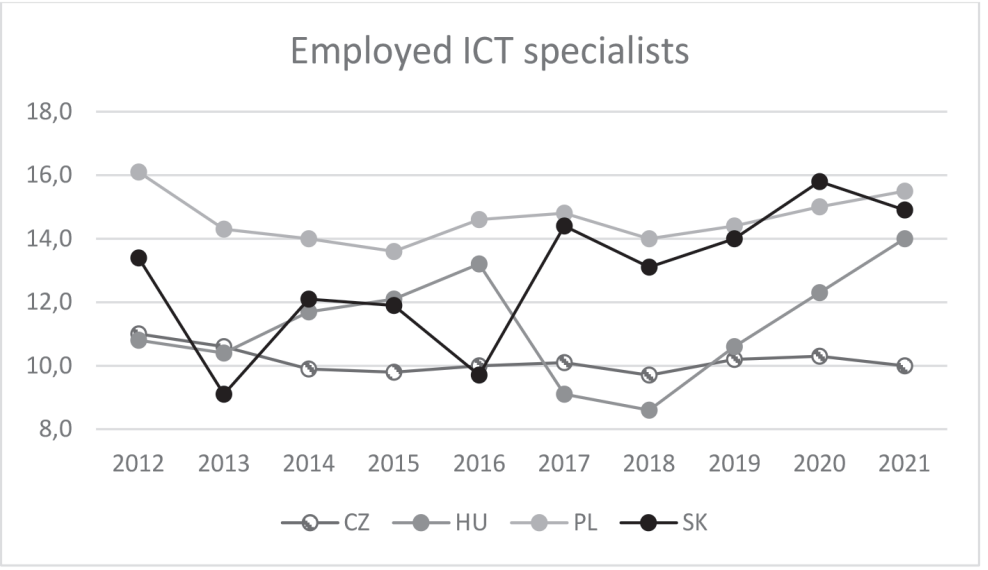
The area of the digital ICT gender gap is currently in the interest of the European Union's priorities because of efforts to apply for the leading position of the EU-27 in the global digital sphere (Pisker, Radman-Funarić & Sudarić, 2021). Although there is a high demand for ICT professionals, there are few women in the ICT sector. Perifanou and Economides (2020b) pointed out, that

in the EU there are about three times more men than women working in the ICT sector, and off course, that in EU, out of 1,000 women tertiary education graduates only 24 women have a degree in ICT-related fields, of which only 6 women went on to work in ICT jobs. On the other hand, out of 1,000 male graduates, 92 are graduates in ICT-related fields, and 49 went on to work in ICT jobs.

4.4 Employed ICT specialists

Another analysed indicator forming the 3rd area of WiD is Employed ICT specialists (Figure 8) and is presented in %. The lowest % ICT women specialist was in the Czech Republic. Significant changes, either a sudden decrease or an increase in the share of women in this area, can be seen in Hungary and Slovakia. The highest average values among the V4 countries were in Poland.

Figure 8: Employed ICT specialists



Source: own processing according to data from Eurostat.

The situation in the Czech Republic, as well as in other V4 regions according to Nedomova & Doucek (2015), points to the fact that the number of men in ICT is dominant and the number of women is also decreasing over time, while ICT specialists are important mainly in project management and in soft-based activities in ICT-oriented jobs.

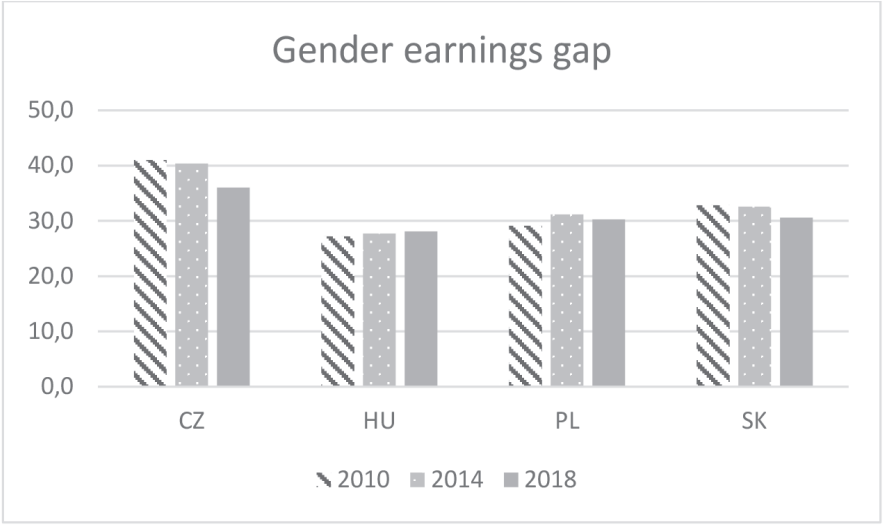
EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

Women working in ICT tend to leave their jobs between the ages of 30 and 44 to a greater extent than men. This fluctuation is more intense in women for family reasons and because of taking care of children (Perifanou & Economides, 2020b).

4.5 Gender overall earnings gap

The gender overall earnings gap (Figure 9) is a synthetic indicator, that measures the impact of the three combined factors, namely: the average hourly earnings, the monthly average of the number of hours paid, and the employment rate, on the average earnings of all women of working age - whether employed or not employed - compared to men in % (Eurostat, 2023).

Figure 9: Gender earnings gap



Source: own processing according to data from Eurostat.

When we mention the predominance of female graduates in tertiary education, or even in STEM graduates, it is very negative to find out that the wages of these women are so low compared to men. The highest values were in the Czech Republic, also only 35-40%. At the same time, since 2010, they have been on a decreasing trend. A similar situation with a decrease in women's wages is also in Slovakia, but here the level of earnings gap is approximately 30-33%. The biggest differences were in Hungary.

The analysis of wages by gender and professional group clearly shows the wage disparity in the remuneration of men and women in the Czech Republic - both in wages in the ICT sector and in the average wage by professional group, too (Nedomova & Doucek, 2015).

4.6 The share of female board members

A significant part in the position of women is also their leading position in the hierarchical structure of companies and institutions. For this reason, we also focused on the share of female board members indicator. The indicator measures the share of female board members and executives in the largest publicly listed companies. Publicly listed means that the company's shares are traded on a stock exchange. Executives are executives in the two highest decision-making bodies of the largest (max. 50) companies registered in the country listed on the national stock exchange. The two highest decision-making bodies are usually referred to as the supervisory board and the board of directors (in the case of a two-tier management system) and the board of directors and the executive/management committee (in a unitary system) (Eurostat, 2023).

Research question 1: *How significant are the relationships between the share of female board members and the WiD?*

To answer it, the authors used correlation analyses. The authors correlate the results at a significance level of 5%. Based on the performed Shapiro-Wilk test at the α (0.05), we cannot reject the hypothesis of a normal distribution of the set.

Table 3: Normality test

	Shapiro-Wilk	**p**
W_SM	.95081	.22435
WiD	.97853	.82772

Source: own processing according to data from Eurostat

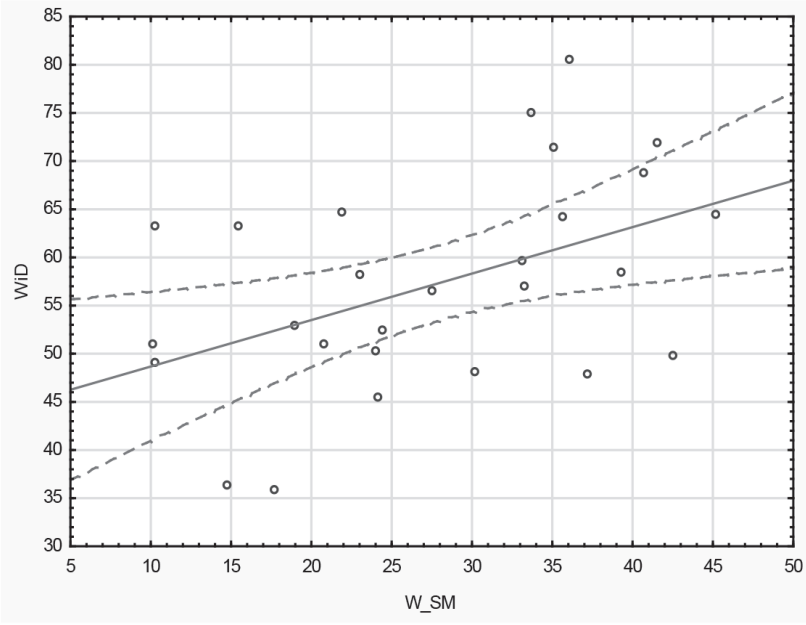
Note: *Women in senior management positions - W_SM*

To answer RQ1, we applied the correlation analyses, made by software Statistica 13.5. Normality was verified using the Shapiro-Wilk test, and the results confirmed that analysed indices have a normal distribution. The results

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

of the performed correlation analysis are presented in Figure 10. The result of the correlation analysis (r = .467997) tells us, that there is a moderately strong direct linear relationship between the variables.

Figure 10: Correlation analysis



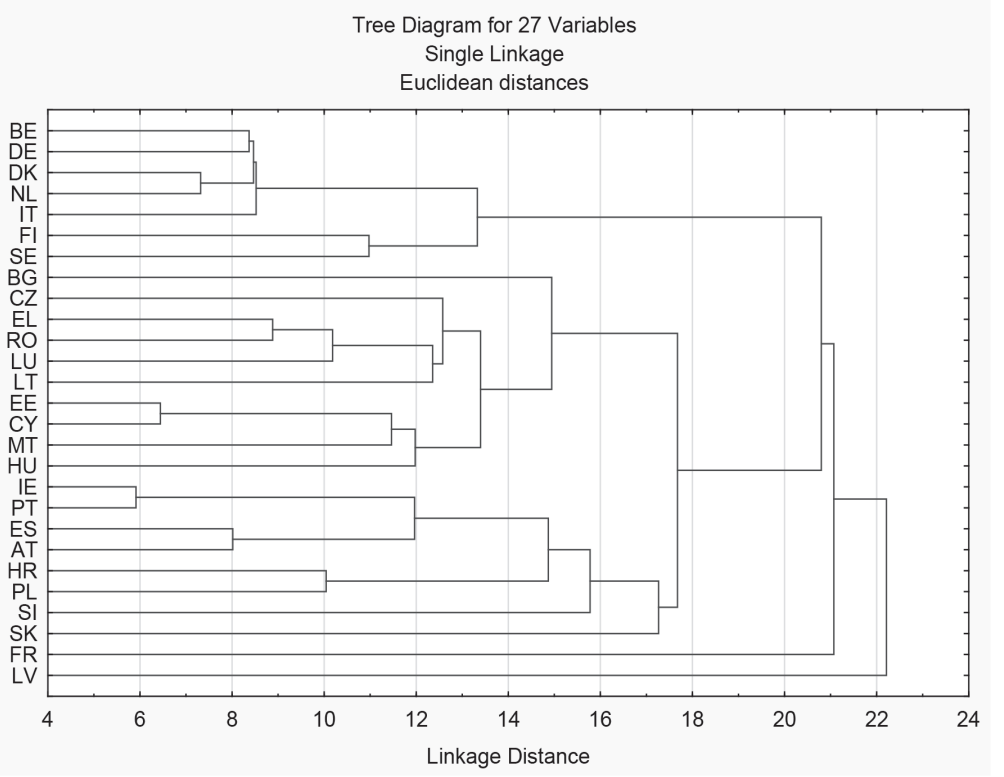
Source: own processing according to data from Eurostat.

Research question 2: *Which clusters can the analysed countries be divided into according to the position in the share of female board members?*

The study uses the cluster analysis method to solve this research question. The cluster analysis is a multidimensional method that allows to group of objects. This method is presented in the form of dendrograms and presents a wide range of techniques on a statistical and mathematical basis. Its primary goal is to find such groups of objects in which objects with similar properties are included. A cluster represents a group of objects whose distance or dissimilarity is less than the distance between objects that do not belong to a cluster (Kiseľáková et al., 2022).

The researchers evaluated 27 EU countries within the share of female board members. Countries are divided into clusters based on similar points, during the period 2012-2022. The results of the cluster analysis are summarized in Figure 11. The study used Euclidean distance, which is the most used measure. It formed clusters using the unweighted average method of groups of pairs.

Figure 11: Cluster analyses



Source: own processing according to data from Eurostat.

In the first division, it is clear that Latvia is singled out as a separate entity compared to the other countries analysed. In the similar position is France, too. At the next level, the clusters split into three large groups. The clusters are not completely identical due to the differences in the analysed area in individual studies. Very strong countries in this area are Finland and Sweden, and almost the other countries from the 1st cluster.

5 Conclusions

According to the made analyses, we can conclude, that the V4 countries are not in the leading positions in the digital area. Women in the WiD score are in the V4 countries about the average values of EU or below. The experts in this field of interest were Scandinavian countries, where the government considers digitization to be the biggest factor of change affecting all parts of society, and

EKONOMICKÉ ROZHĽADY – ECONOMIC REVIEW, 2023, 52(3), 161 ─ 183
https://doi.org/10.53465/ER.2644-7185.2023.3.161-183

therefore devote themselves to this area and its development through several programs and actions.

The Czech Republic had the highest position in the overall WiD ranking. However, that was not the rule when analysing individual areas forming WiD. The output is similar for the other V4 countries. Each country, even if economically similar (Leško, Muchová & Repiská, 2022), has strengths in different areas of WiD. Overall, however, we can conclude that women in WiD in the V4 countries have their permanent place and their situation is improving.

For further investigation of this issue, it is advisable to focus deeper attention on the other indicators from the area of 1 Use of Internet and 2 Internet user skills. Perhaps they will also bring interesting findings about the V4 countries, which will help them make better progress in the future in the field of digital area and women performance in it.

In the 3rd area of WiD – Special skills and employment, the analysed countries have the worst results. After closer look to this area, we can state, that there is a prevalence of graduates, both STEM graduates and tertiary graduates for women. But in this area, we focused only on the quantitative part of this indicator. It is appropriate to focus on the qualitative part of Tertiary graduates for further research in this area.

We see possible improvements in this pillar in the fact, that the acquisition of knowledge in the field of ICT will be supported, perhaps through some courses intended only for women. If it is possible to minimize the Glass ceiling in the V4 countries, the interest of women in positions in higher management will certainly increase, and thus we will minimize the gender pay gap and achieve a better ranking in this pillar.

At the end, we also examined the position of women in management. We confirmed on the sample of the EU, that between the share of female board members and the WiD is a moderately strong direct linear dependence. And that on the basis of cluster analysis, 3 strong clusters emerged from among the EU countries.

The focus of future research can also be directed to the influence of other indicators on WiD. It could bring more knowledge and complement this study.

Acknowledgement

This work was supported by the Slovak Research and Development Agency under the contract No. APVV-20-0338 and No. APVV-15-0322.

REFERENCES

[1] Acilar, A., & Sæbø, Ø. (2023). Towards understanding the gender digital divide: A systematic literature review. *Global knowledge, memory and communication,* 72(3), 233 ─ 249. https://doi.org/10.1108/GKMC-09-2021-0147

[2] Aksentijević, N. K., Ježić, Z., & Zaninović, P. A. (2021). The effects of information and communication technology (ICT) use on human development—a macroeconomic approach. *Economies, 9*(3), 1 ─ 12. https://doi.org/10.3390/economies9030128

[3] Bloomberg, J. (2018). Digitization, digitalization, and digital transformation: confuse them at your peril. *Forbes.* Available at: https://www.forbes.com/sites/jasonbloomberg/2018/04/29/digitization-digitalization-and-digital-transformation-confuse-them-at-your-peril/#78e677fd2f2c

[4] Brahma, M., Tripathi, S. S., & Sahay, A. (2021). Developing curriculum for industry 4.0: digital workplaces. *Higher Education, Skills and Work-Based Learning, 11*(1), 144 ─163. https://doi.org/10.1108/heswbl-08-2019-0103

[5] Červeňová, M. (2020). Inteligentný ekologický vývoj a digitálna transformácia ekonomiky. *Finančné trhy, 3*, 1 ─ 10.

[6] Čirčová, V., & Blštáková, J. (2023). Building competence of managers for companies in digital transformation. *Ekonomické rozhľady – Economic Review, 52*(1), 48 ─ 66. https://doi.org/10.53465/ER.2644-7185.2023.1.48-66

[7] Damiani, F., & Rodríguez-Modroño, P. (2022). Measuring Women's Digital Inclusion. A poset-based approach to the Women in Digital Scoreboard. *DEMB Working Paper Series*. https://doi.org/10.1007/s11135-023-01666-z

[8] Digital Agenda, (2023). Available at: https://digital-agenda-data.eu/charts/analyse-one-indicator-and-compare-countries#chart

[9] Eurostat. (2023). Available at: https://ec.europa.eu/eurostat/databrowser/product/view/teqges01

[10] Huňady, J., Pisár, P., Vugec, D. S., & Bach, M. P. (2022). Digital Transformation in European Union: North is leading, and South is lagging behind. *International Journal of Information Systems and Project Management, 10*(4), 39 – 56. https://doi.org/10.12821/ijispm100403

[11] Ihnatišinová, D. (2022) *Digitálny asistent v daňovej správe. Nové výzvy v oblasti*

verejných financií 2022: zborník vedeckých statí. Bratislava: Vydavateľstvo Ekonóm, 1 ─ 8.

[12] Ivanov, D., Dolgui, A., & Sokolov, B. (2019). The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics. *International Journal of Production Research, 57*(3), 829 ─ 846. https://doi.org/10.1080/00207543.2018.1488086

[13] Kiseľáková, D., Šofranková, B., Širá, E., & Fedorčíková, R. (2022). Assessment of the digital economy's level among the EU countries–an empirical study. *Polish Journal of Management Studies, 26*(1), 107 ─ 124. https://doi.org/10.17512/pjms.2022.26.1.07

[14] Krieger-Boden, C., & Sorgner, A. (2018). Labor market opportunities for women in the digital age. *Economics, 12*(1). https://doi.org/10.5018/economics-ejournal.ja.2018-28

[15] Leško, P., Muchová, E., & Repiská, R., (2022). Dual-Model Approach to Measuring Convergence Sustainability in the Visegrad Group. *Politická ekonomie: teorie, modelování, aplikace, 70*(5), 597 ─ 616. https://doi.org/10.18267/j.polek.1360

[16] Mariscal, J., Mayne, G., Aneja, U., & Sorgner, A. (2019). Bridging the gender digital gap. *Economics, 13*(1). https://doi.org/10.5018/economics-ejournal.ja.2019-9

[17] Martincevic, I. (2022). The correlation between digital technology and digital competitiveness. *International Journal for Quality Research, 16*(2). https://doi.org/10.24874/ijqr16.02-13

[18] Mihai-Yiannaki, S., Varnava-Marouchou, D., Konis, E. & Hadjichristodoulou, V. (2020). The success of STEM graduates in entrepreneurship training: a European case study. *Global Business and Economics Review, 22*(1/2), 198 – 211. https://doi.org/10.1504/gber.2020.10026718

[19] Nadoveza Jelić, O., & Gardijan Kedžo, M. (2018). Efficiency vs effectiveness: an analysis of tertiary education across Europe. *Public sector economics, 42*(4), 381 ─ 414. https://doi.org/10.3326/pse.42.4.2

[20] Nedomova, L., & Doucek, P. (2015). Gender aspects in ICT. In *International Conference on Management and Industrial Engineering,* 7, pp. 508. Niculescu Publishing House.

[21] Ochotnický, P., Alexy, M., & Káčer, M. (2020). Driving Forces of Total Factor Productivity in Europe. *Ekonomický časopis - Journal of Economics, 68*(10). https://doi.org/10.31577/ekoncas.2020.10.02

[22] Perifanou, M., & Economides, A. (2020a). Gender digital divide in Europe. *International Journal of Business, Humanities and Technology, 10*(4). https://doi.org/10.30845/ijbht.v10n4p2

[23] Perifanou, M., & Economides, A. (2020b). Gender gap in digital skills in Greece. In *Proceedings of the 20th International RAIS Conference on Social Sciences and Humanities* (pp. 21 ─ 26).

[24] Pisker, B., Radman-Funarić, M., & Sudarić, Ž. (2021). Women in ICT: the case of

Croatia within European union. In *Digital Economy. Emerging Technologies and Business Innovation: 6th International Conference on Digital Economy, ICDEc 2021, Tallinn, Estonia, July 15 – 17, 2021, Proceedings 6* (pp. 3 ─ 15). Springer International Publishing. https://doi.org/10.1007/978-3-030-92909-1_1

[25] Rabatinová, M. (2021). Súčasný vývoj e-commerce v Európe v kontexte pandémie Covid-19. *Nové výzvy v oblasti verejných financií 2021:* zborník vedeckých statí. Bratislava: Vydavateľstvo Ekonóm, pp. 1 ─ 8.

[26] Rosa, R., Drew, E., & Canavan, S. (2020). An overview of gender inequality in EU universities. *The Gender-Sensitive University,* 1 ─ 15. https://doi.org/10.4324/9781003001348-1

[27] Tomčíková, Ľ., & Svetozarovová, N. (2021). Current trends in human resources management as important implications of the global Covid-19 pandemic. *Journal of Management and Business: Research and Practice, 13*(1), 70 ─ 80. https://doi.org/10.54933/jmbrp-2021-13-2-7

[28] Ulicna, D., & Royale, R. (2015). Does the EU need more STEM graduates? *Report (120/01), Danish Technological Institute, Luxembourg.*

[29] Verdugo-Castro, S., Sánchez-Gómez, M. C., & García-Holgado, A. (2018). Gender gap in the STEM sector in pre and university studies of Europe associated with ethnic factors. In *Proceedings of the Sixth International Conference on Technological Ecosystems for Enhancing Multiculturality* (pp. 984 ─ 990). https://doi.org/10.1145/3284179.3284348

[30] European Commision. (2023). Women in Digital Scoreboard 2021. [Data set]. https://digital-strategy.ec.europa.eu/en/news/women-digital-scoreboard-2021