2021

WOMEN IN TECHNOLOGY

KOŠICE REGION
SLOVAKIA

CIPE

female algorithm

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INTRODUCTION

The purpose of this report is to examine the current gender ratio of employees within the Slovak tech sector with a focus on the Košice Region, identify gaps, and highlight opportunities to increase the number of women in ICT (information and communications technology) in five target roles–systems analysts, software developers, graphic designers, ICT sales professionals, and ICT managers. As numerous global studies reveal, neither the current opportunities nor treatment are equal for each gender. We came to the same conclusion based on research and valuable data gathered by TREXIMA Bratislava, experts in data gathering and analysis, and multiple other sources.

The first part of this report examines the gender ratio in specific ICT roles in Slovakia and its Košice Region, in particular, and other European Union (EU) member states. In the second part, an examination of the five ICT roles broken down by age group and salaries uncovers surprising phenomena. The third part combines statistics and qualitative research gathered from interviews with 20 Slovak women in ICT management positions in an effort to identify barriers they face at work and good practices that attract and retain women in ICT leadership roles.

This report shows the effects of gender discrimination in the tech sector and highlights the experiences of women in management roles in the tech sector. It is essential to understand and address the complex web of gender discrimination in the sector to progress in this area. Multiple studies have confirmed that the tech industry lacks women not because they are not "good enough," but as a result of a systemic and pervasive problem that needs attention and an actionable plan. This report lays out creative solutions, offering a template for progressive action on gender discrimination in the industry and identifying new avenues for effective change.

The Slovak government, municipalities, companies, schools, nonprofit organizations, and individuals face a challenge: technology could play a more significant role in the Slovak economy if more people are involved in the sector; women represent untapped potential.

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EXECUTIVE SUMMARY

This report aims to map the situation of women within the Slovak technology industry with a focus on the Košice Region. Combining quantitative and qualitative analysis, it paints a complex picture of the gender and salary gap in five specific ICT roles and barriers female employees face. This report uncovers differences between the situation in the Košice and Bratislava Regions and between the realities faced by male and female employees. It finds that mothers and childless female employees have different managerial experiences, and identifies unconscious bias and work settings as the main barriers companies should address. Finally, it offers practical research–based recommendations for creating more equal work conditions in which all employees can thrive.

Part 1 – Women As the Largest Untapped Reservoir

Despite an increase in the percentage of women employed in ICT jobs, Slovakia remains below the EU average (18.5%) with 15.8%. Yet, women represent 45% of the Slovak workforce—most of them have a university/college education. Women are an untapped reservoir of an educated labor force that is vital for a booming ICT sector in need of specialists.

Part 2 – Five ICT Roles Zoomed In

The percentage of women employed in ICT jobs in the Košice Region (19%) exceeds the national average (15.8%). Yet, there are persistent salary gaps between men and women in the same ICT positions and between the Bratislava and Košice Regions. An in–depth analysis of the five most common ICT roles revealed differences varying from 8% to 34%.
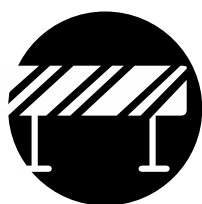
Part 3 – Barriers Experienced By Women in ICT Management

Twenty female ICT managers agreed to anonymously discuss barriers and facilitators in their careers. While there was a clear difference between the managerial experience of mothers versus childless respondents, support received from their partners and families was almost an inevitable factor in the advancement of both groups. They were limited mainly by unconscious bias and work settings in the workplace.

PART 1:

# WOMEN AS THE LARGEST UNTAPPED RESERVOIR

Gendered Technical Labor

The highest ratio of employees in ICT to the country's population is in Finland and Sweden—both above 7%. Also, more than 6% of the workforce in Estonia and Luxembourg work in ICT.

Among the V4 countries, the Czech Republic (4.2%) and Slovakia (4.2%) have better results than Poland and Hungary. Greece (2%) and Turkey (1.3%) have the lowest population ratio in tech jobs (Appendix 4).

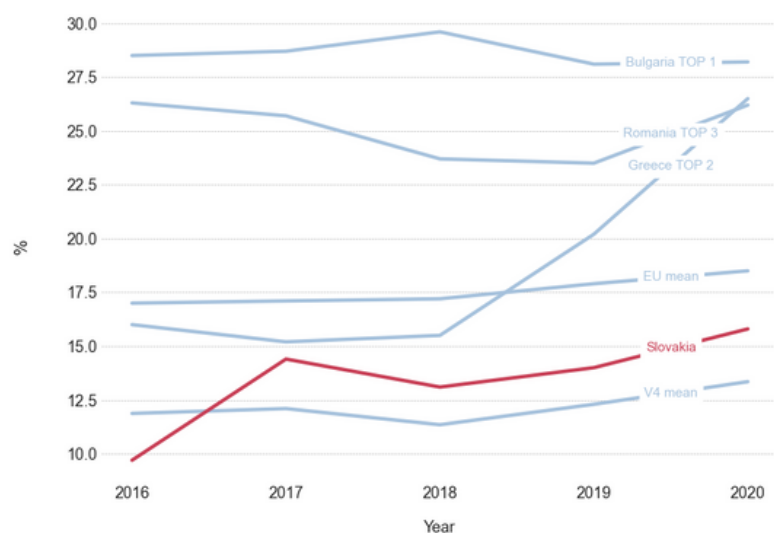**Proportion of ICT Specialists in Total Employment, 2020**
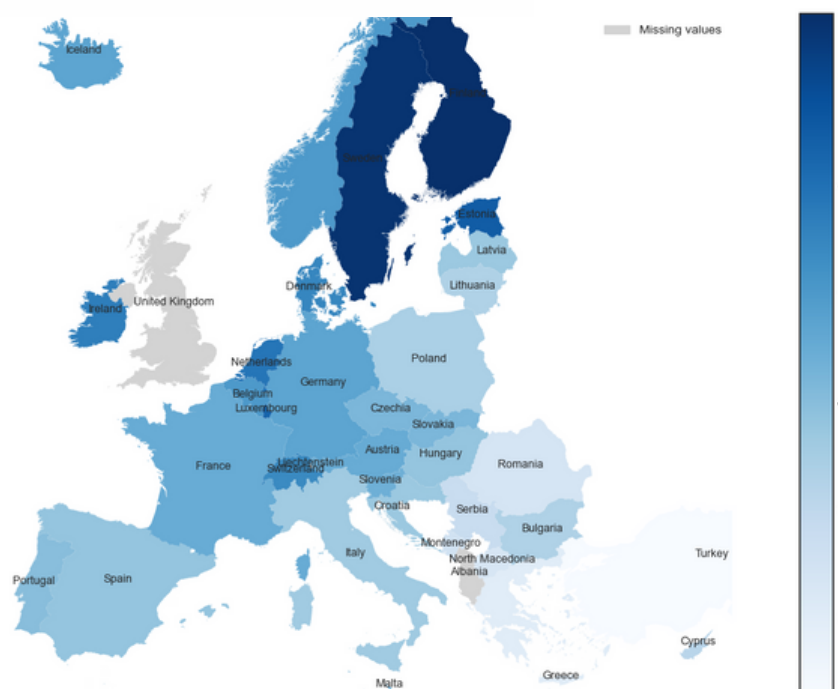
Source: Eurostat 2021a

4,2 %
Slovaks work in ICT field
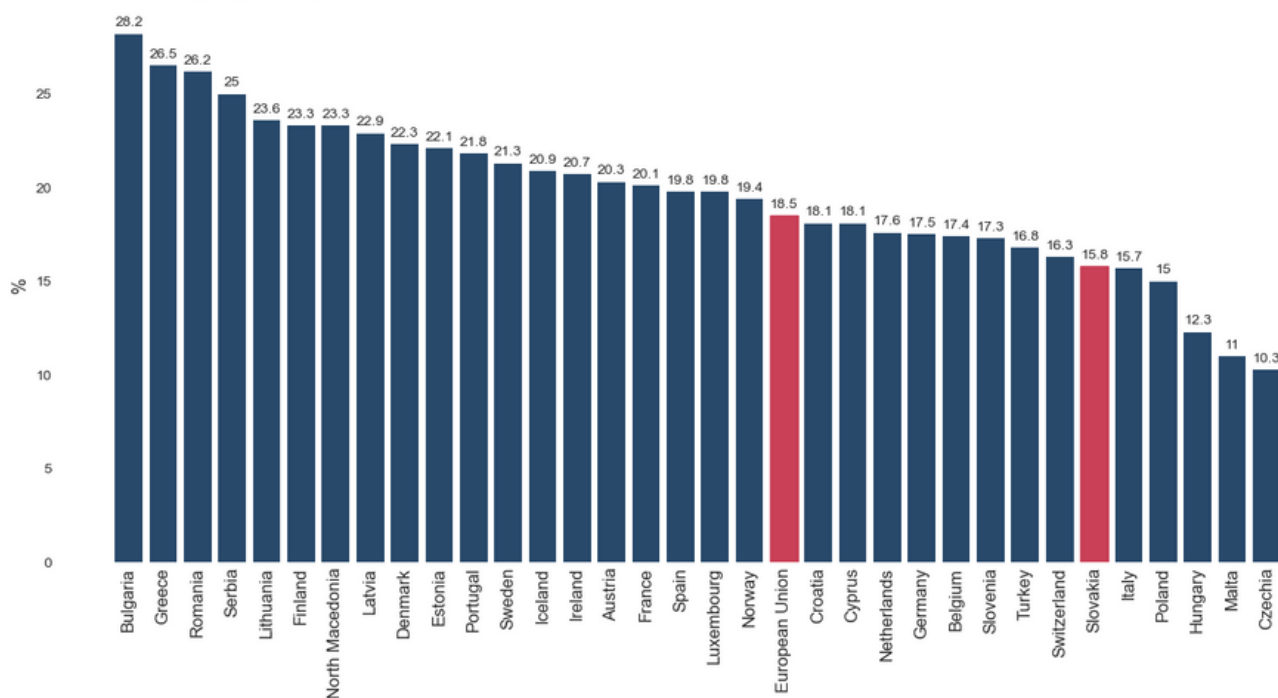
Percentage of Women in ICT jobs

Source: Eurostat 2021b

The most significant progress was observable in Greece, where the proportion of women in tech jobs increased by more than 10% between 2016 and 2020. That has been, however, due to Greek men leaving the ICT sector in large numbers. Romania and Bulgaria have been leaders in the ratio of ICT positions held by women for many years (around 30%). Since 2018, the number of women working in ICT in Romania has decreased by 1,300. The trend seems to be turning since 2020—the number of women in tech jobs increased by 3%. Since the socialism era, Romania and Bulgaria have nourished the tradition of women working in the tech sector and studying at technical institutions.

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Proportion of Female ICT Specialists in
Total Employment, 2020

Despite an increase in the percentage of women in ICT jobs in Slovakia since 2018, the number remains below the EU average. In 2020, the percentage of female ICT specialists in Slovakia was 15.8%, while the EU average was 18.5%. The most significant changes were recorded in Slovakia between 2016 and 2017 when the proportion of women working in tech jobs increased by 2,800—or 4.7%. The results Slovakia achieves in this area are above the average of the V4 countries.
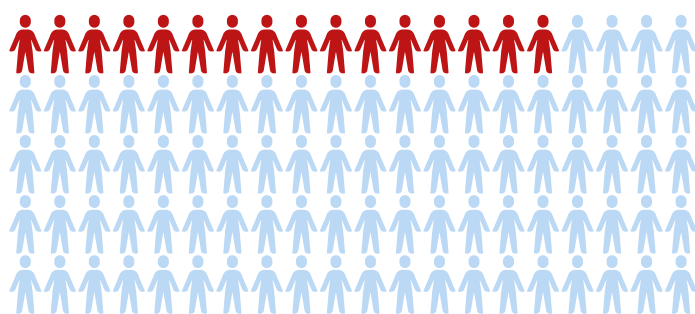
16,900 (15.8%)
WOMEN in Slovak ICT (2020)

89,900
MEN in Slovak ICT (2020)

In 2020, 16,900 women and 89,900 men were working in ICT jobs in Slovakia. The number of women in this sector has increased by 5,800 in the last decade. In comparison, the number of men employed in the sector increased by 37,900 over the same period—a more than 6.5 times higher increase than for women.

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The number of women working in the tech industry in Slovakia has been growing from year to year since 2016. During the last analyzed year, the number of women in ICT increased by 3,400 over the previous year. That is the highest year-on-year increase in the previous 10 years.

Employment of Men and Women in the Slovak ICT Sector
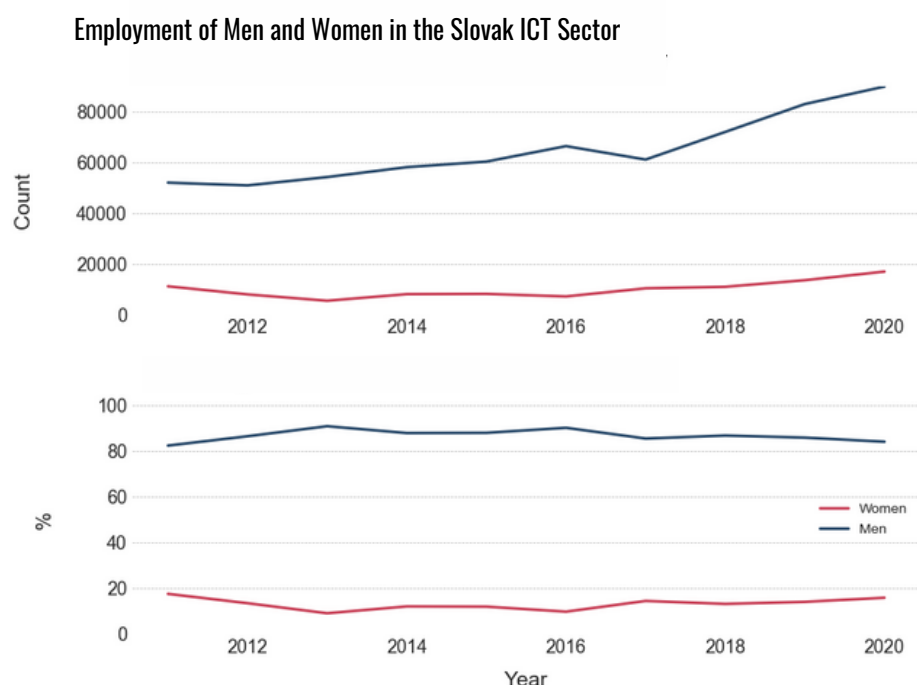
Source: Eurostat 2021b

18.4 %

GENDER PAY GAP SLOVAKIA, 2019

16 %

GENDER PAY GAP IN ICT SLOVAKIA, 2020

11 %

GENDER PAY GAP IN ICT EU, 2020

The tech sector still employs a vast minority of people in Slovakia. During the COVID-19 pandemic, it was one of the few sectors that flourished. Of the 19 sectors monitored by the Slovak Statistical Office, the impact of the pandemic in the form of job losses was felt in 10 sectors (in the third quarter of 2020 it was in 11 industries, and in the second quarter, up to 15 industries). From the beginning of 2020, there was the highest number of layoffs in the Services sector, where 17,100 persons lost their job (16%) and in the Transportation sector with a decrease of 12,400 persons (by 7.3%). On the contrary, as the world shifted to virtual space, employment in the tech sector rose by 13.5% (Statistical Office of the Slovak Republic 2021).

Women make up 45% of the Slovak workforce. Among economically active people, 56% of women have a university/college education, while the same is true for only 43% of men. According to the Ministry of Education, Science, Research, and Sport of the Slovak Republic, approximately 40% of Slovaks work in a field that does not match their field of study.

Women are a reservoir of untapped potential in the ICT field.

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High Technical Potential in the Košice Region

The Košice Region is the second-largest tech hub in Slovakia. Hosting almost 200 companies (Košice IT Valley 2021), it employs 9,323 people in tech jobs, of which 1,804 (19%) are women (TREXIMA Bratislava). Two technically oriented universities in Košice—TUKE, the Technical University of Košice, and UPJS, the Pavol Jozef Safarik University in Košice—produce hundreds of graduates annually. According to the annual report of the Slovak Center of Scientific and Technical Information (CVTI SR 2021), in 2020, 256 students graduated from the Faculty of Science at UPJS, of which 171 (66.8%) were women, and 686 students graduated from the Faculty of Electrical Engineering and Informatics at TUKE, of which 107 (15.6%) were women.

Employment in the Slovak ICT Sector

Source: TREXIMA 2020
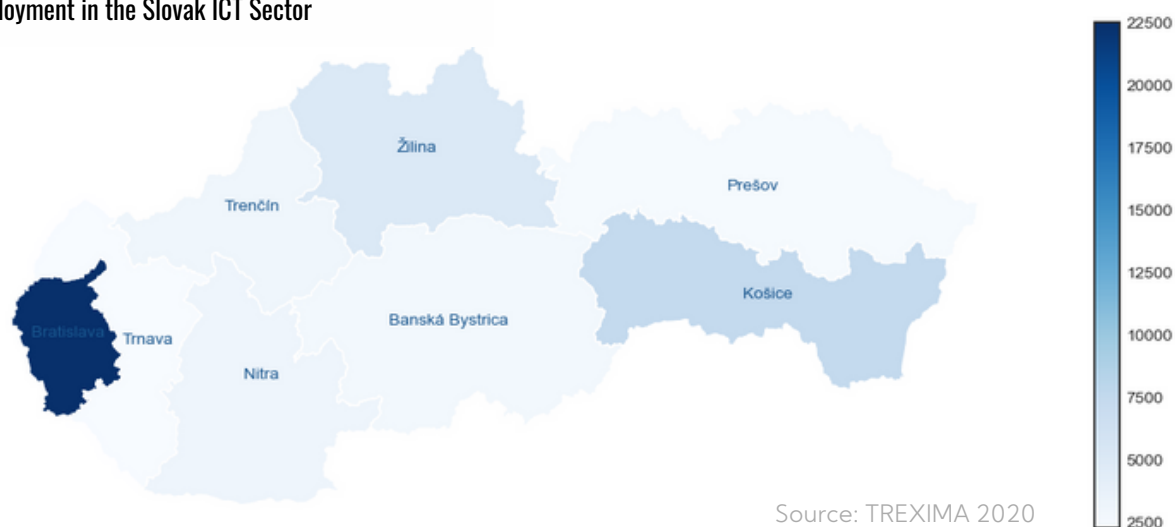
An increase of a more qualified labor force in the ICT industry in the Košice Region would have an impact on:

- National / Regional Economy. According to the 2020 report, Digital Challengers in the next normal, by McKinsey & Company, the ICT sector produces two to three times higher GDP than average industries. The average monthly gross salary in tech jobs in Slovakia is €2,026, almost 80% higher than the national average, which was €1,133 in 2020.
- Companies. According to the National Union of Employers and Ministry of Labor, Social Affairs and Family, companies in Slovakia lack more than 68,000 qualified ICT specialists (Miškerík 2021). More qualified labor would attract new investors.
- Individuals. Employment in the ICT sector in Slovakia provides a vast number of opportunities—the employment potential, geographical and time flexibility, and financial compensation above the average. Women in the tech sector benefit from a 2.4% lower gender pay gap than the national all-industry average. Women in the Slovak tech sector, similar to the Košice Region, earn 16% less than men. In other sectors, this difference is 18.4%.

# PART 2:

FIVE ICT ROLES ZOOMED IN

Women in Tech, the Uphill Battle

Eurostat defines and calculates the number of ICT specialists as a sum of 24 groups of roles with unique ISCO–08 codes (see Appendix 1) that represent employees who can develop, operate, and maintain ICT systems and for whom ICTs constitute the major part of their job (OECD 2004). We mapped the ICT roles in Slovakia accordingly (see Methodology, page 35).

The percentage of women in ICT in the Košice Region (19%) exceeds the national average (15.8%). At the national level, female ICT specialists earn 16% less than men. In the Košice Region, female ICT specialists make 18% less, and the differences vary according to specific roles from 8% to 34%. Salaries in computer network and systems technicians roles are almost equal— women earn 3% less than men. The most significant salary difference is among ICT sales professionals, where the average salary of women is 39% lower than that of men and 43% lower in the Košice Region.

Systems Analysts

Software Developers

Graphic Designers

ICT Sales Professionals
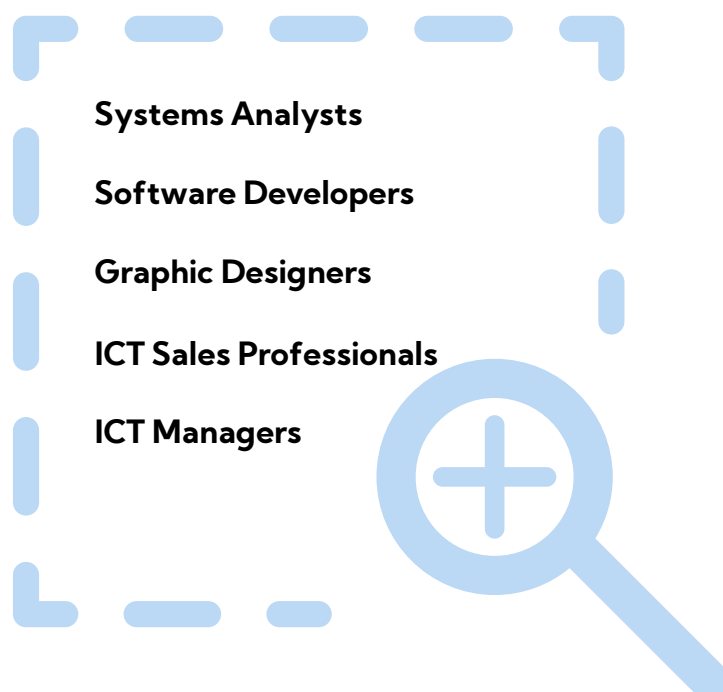
ICT Managers

### Employment of Women in the ICT Sector in the Košice Region 2020
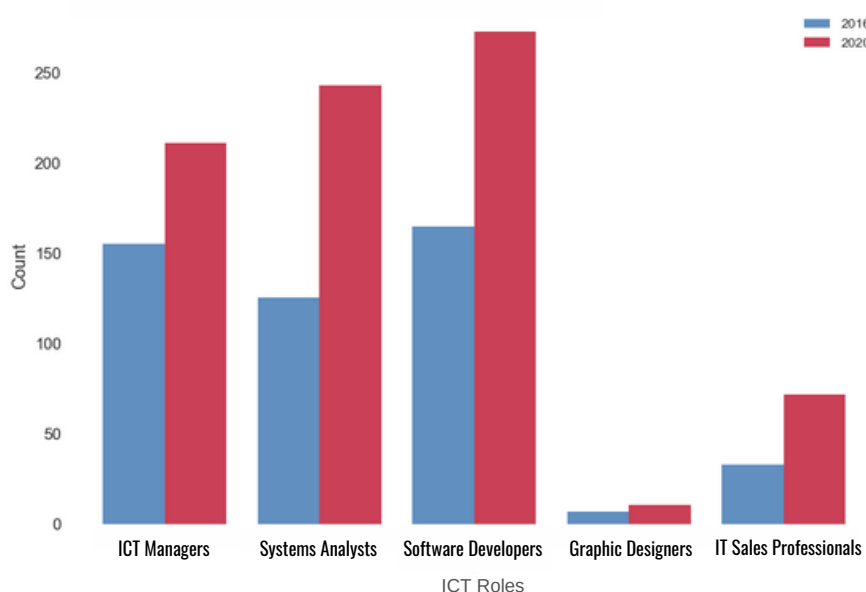
Source: TREXIMA 2020

In this chapter, we examine five types of ICT roles— systems analysts, software developers, graphic designers, ICT sales professionals, and ICT managers. They focus on the level of gender representation, age of the employees, and the average salary in the Košice Region in comparison to the other regions or the country average.

Systems Analysts

There are 7,425 systems analyst jobs in Slovakia as of 2020, 1,236 higher than in 2016. However, the number of positions filled by women is more than two times lower than those filled by men. Even though approximately 372 women have been employed as systems analysts in the last five years, their portion has changed only minimally during this time. In 2020, there were 1,832 women in this role in Slovakia and 243 in the Košice Region.
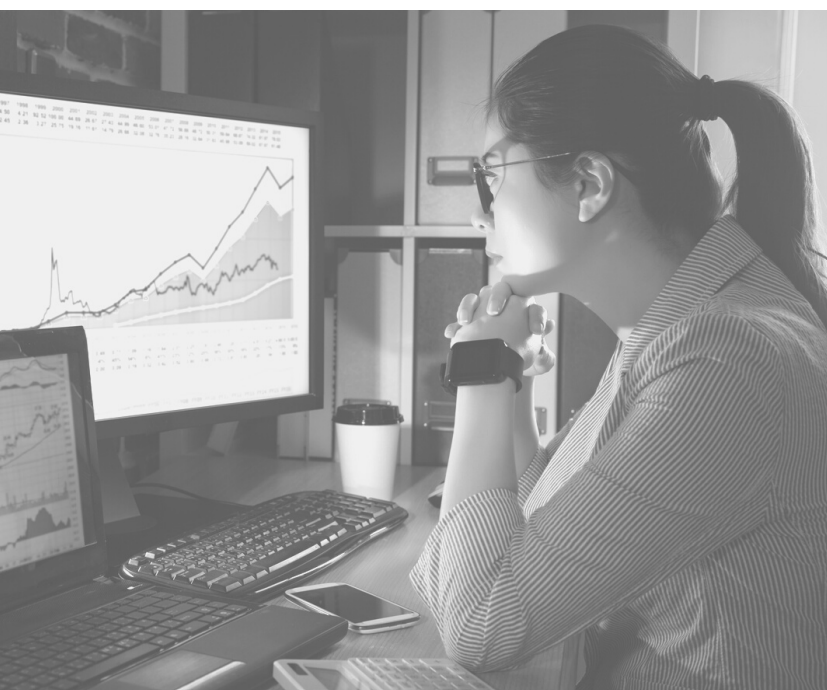

€2,494
average monthly gross salary in 2020

Sixty-two percent of Slovakia's systems analysts are concentrated in a region of the capital, Bratislava. The majority of female analysts are between 30 and 39 years old. Since 2016, the number of female systems analysts has not increased significantly.

Female systems analysts' salaries have increased by €205 a month over five years, but women earn almost a fifth less than their male colleagues in the same job. In absolute terms, the average monthly salary of a female systems analyst in Slovakia is €480 lower than that of a male systems analyst. In this case, same as in other examined roles, despite the increase in the average wage of women, the wage gaps on a national level remain almost unchanged.

Female Systems Analysts in Slovakia, 2016
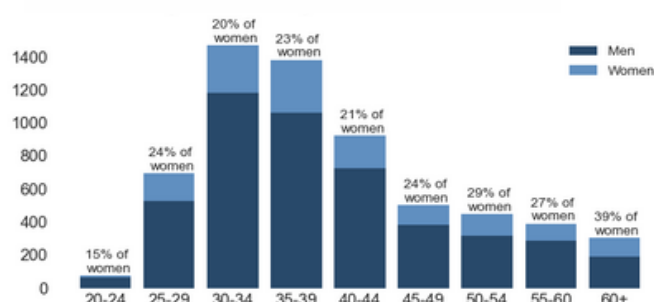
Female Systems Analysts in Slovakia, 2020
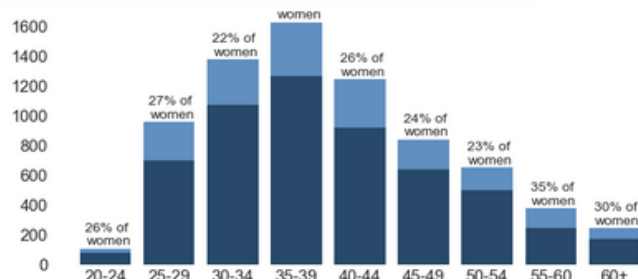
Source: TREXIMA 2020

14 %
Systems Analysts Gender Pay Gap, Slovakia 2020

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The female systems analyst's salary in the Bratislava Region is 27% higher than that of women working in the same position in the Košice Region, which is above the average difference in wages between these regions.
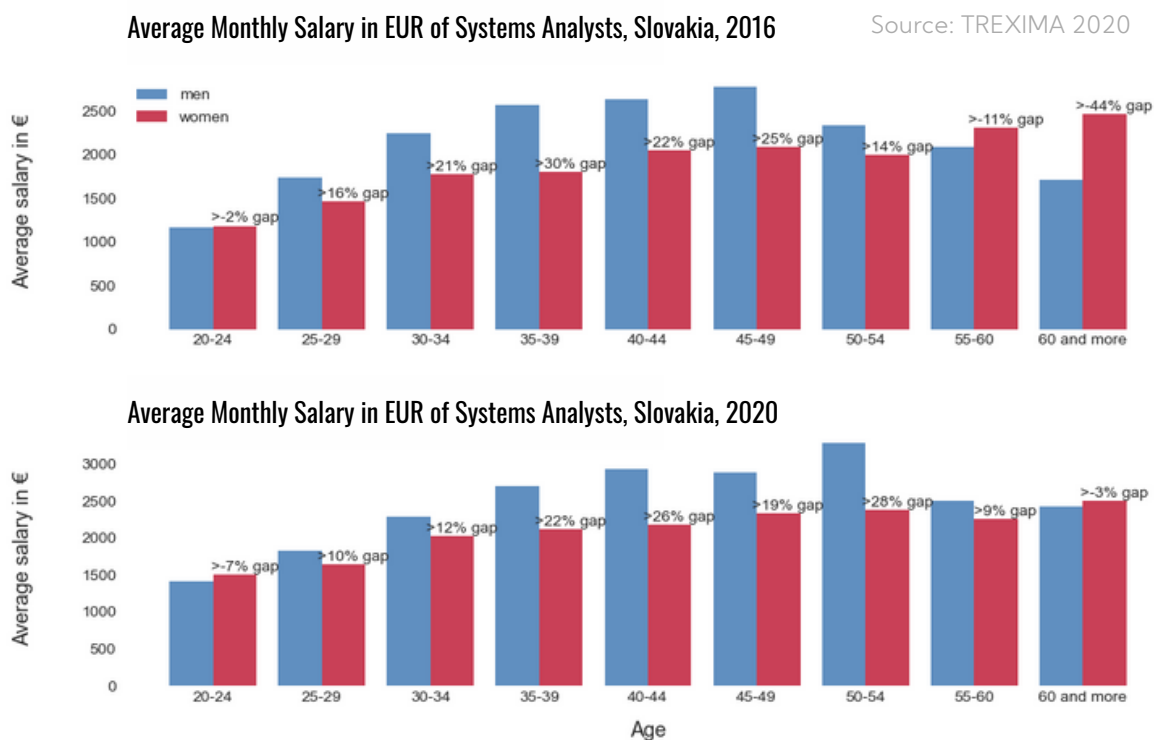
Female systems analysts in the Košice Region earn €1,688 a month, compared to men in the same position and region who earn €2,141. The gender pay gap in the Košice Region is 19%, which is 3% higher than the national average.

It is interesting that female systems analysts earn more at the beginning as well as at the end of their working career than their male colleagues. According to 2016 data, the most considerable wage differences are in the 35–39 age group, a highly productive phase of life, when women's wages are almost a third lower than men's. In 2020, female systems analysts earned their highest salaries between the ages of 55 and 60, at a time when their career is nearing its end. A similar phenomenon is observed in 2016. Interestingly, the salaries of male systems analysts start decreasing after they turn 55.

Average Monthly Salary in EUR of Systems Analysts, Slovakia, 2016

Source: TREXIMA 2020

Average Monthly Salary in EUR of Systems Analysts, Slovakia, 2020

Is the salary difference related to a person's ability to negotiate a higher salary? In their research, Zenger and Folkman (2019) analyzed women and men's self-confidence and leadership competencies. They found that while women's self-confidence began to rise sharply after the age of 40, men's self-esteem slowly declined after the age of 55 (Zenger and Folkman 2019).

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Software Developers

The group of software developers described in this chapter consists of four different roles represented by specific ISCO codes: software developers, application programmers, web and multimedia developers, and software and multimedia developers and analysts not elsewhere classified. Out of almost 12,000 software developers in Slovakia, women represent 15% (1,823), 272 of whom are in the Košice Region. There is a growing trend of women entering software development. In past five years, 30% of newcomers in the field were women.


€ 2,227

average monthly gross salary in 2020

The highest concentration of Slovakia's software developers is in the Bratislava Region, which employs 57% of the country's male developers (5,803) and 63% of female developers (1,147). The Košice Region employs 16% of Slovakia's male software developers (1,643) and 15% of female developers (273).

There was a noticeable increase in the ratio of women in almost each age group in 2020 compared to 2016 in the Košice Region. Within five years, the number of female software developers has increased by more than 430. The most significantly growing age groups are 30–39 years followed by 40–44 years.

Surprisingly, the age group of fresh graduates, 20–24 years, represents only 5% of new female developers within five years. Where are we losing the hundreds of female tech graduates?

Software Developers by Age and Gender, Slovakia, 2016
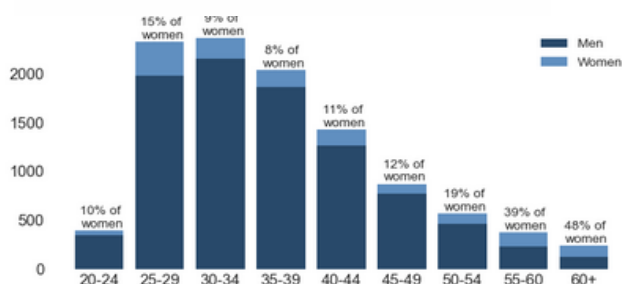
Software Developers by Age and Gender, Slovakia, 2020
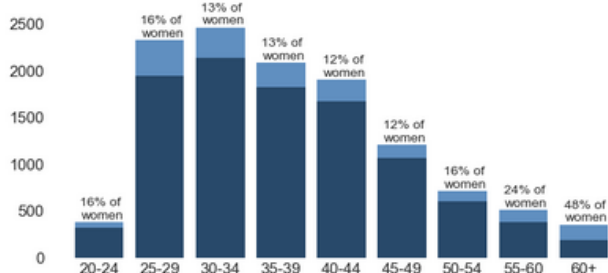
Source: TREXIMA 2020

12 %

Software Developers Gender Pay Gap, Slovakia 2020

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Female developers' salaries have risen by almost a fifth between 2016 and 2020. In 2020, they earned an average of €353 a month more than in 2016. However, the salary of a male developer in Slovakia is still 12% higher. The size of the wage gap widely varies acro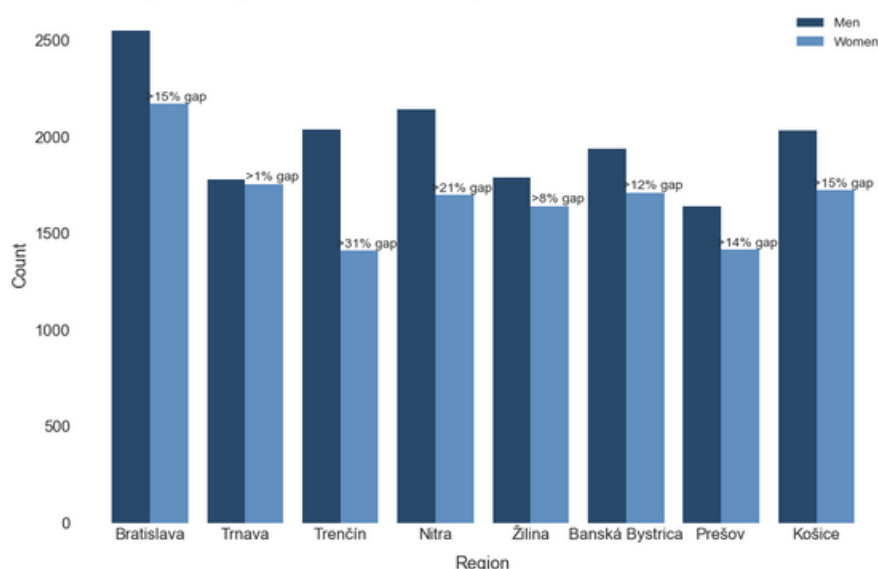ss Slovakia's regions. In the Trenčín Region, female developers earn a third (31%) less than their male colleagues. On the other hand, women's wages are only 1% lower in the Trnava Region.

Average Monthly Salary in EUR of Software Developers in Slovakia, 2020

Source: TREXIMA 2020

The Košice and Bratislava Regions share the same gender wage gap—15%—which is 1% below the national ICT average. Wage differences between the western and eastern regions of Slovakia are also visible. The difference between the Košice and Bratislava Regions is approximately 18%, which is below the all– industries average between these two regions in 2020 (27%).

Compared to 2016, women's wages have increased in all age categories. However, it is important to note that the gender pay gap has also grown in almost every category. On a positive note, it is not just the salaries of experienced developers that have increased, the wages of female developers between the ages of 20 and 24 have also increased by 25% over the last five years.

Average Monthly Salary in EUR of Software Developers by Age, 2016
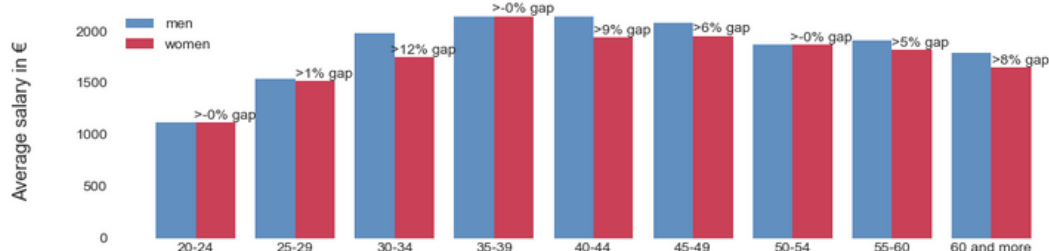
Average Monthly Salary in EUR of Software Developers by Age, 2020

Source: TREXIMA 2020

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Graphic Designers

In Slovakia, four times more men than women work as graphic designers. Between 2016 and 2020, 252 more men were hired as graphic designers while the number of female designers decreased by 66. Consequently, the ratio of women in the graphic design industry in Slovakia is decreasing.


Seventy percent of Slovakia's female graphic designers work in the Trenčín and Bratislava Regions. This creative industry attracts fewer professionals every year—the number of newcomers under the age of 30 has decreased by more than a third in the past five years. The low number of graphic designers above the age of 50 indicates that this occupation is relatively new. This role is among the least paid within the ICT job market with an average salary of €1,401 a month, and the gender pay gap in 2020 was 14% nationally, in the Košice Region this gap is 19%.

€ 1,401
average monthly gross salary in 2020

Graphic Designers by Age and Gender, Slovakia, 2016
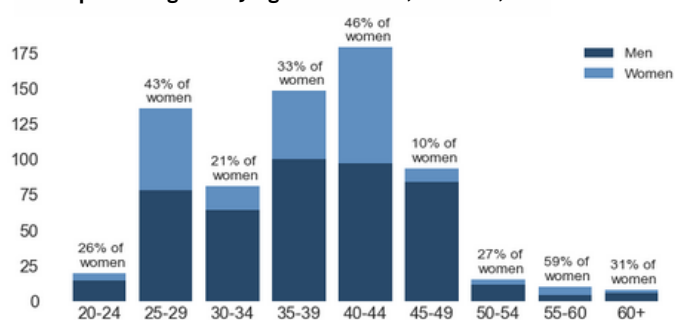
Graphic Designers by Age and Gender, Slovakia, 2020
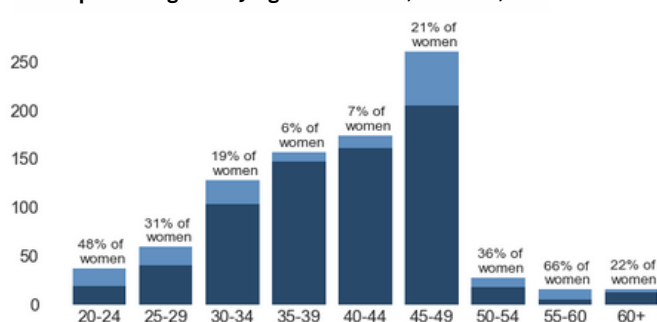
Source: TREXIMA 2020

Graphic designers represent an enormously positive change in wage inequality of all the analyzed groups. Over the past five years, the wage gap between male and female graphic designers has reduced by 4%. Graphic design is also the only one of the monitored jobs where women's wages grew faster than men's, namely by 17%. The monthly salary of female graphic designers has increased by €185 since 2016. Graphic designers in the Bratislava Region earn 18% more than graphic designers in the Košice Region.

14 %
Graphic Designers Gender Pay Gap, Slovakia 2020

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ICT Sales Professionals

According to the latest available data, in 2020, 1,008 persons were working as ICT sales professionals in Slovakia. The percentage of women in this less technical and more soft-skill-oriented role is 40%, which is one of the highest among all the ICT roles. The ratio of women in the field has also slightly increased due to a decrease in the number of male ICT sales professionals. The concentration of ICT sales professionals is extremely disproportionate—more than two-thirds of all positions are situated in the Bratislava Region.

ICT Sales Professionals by Age and Gender, Slovakia, 2020

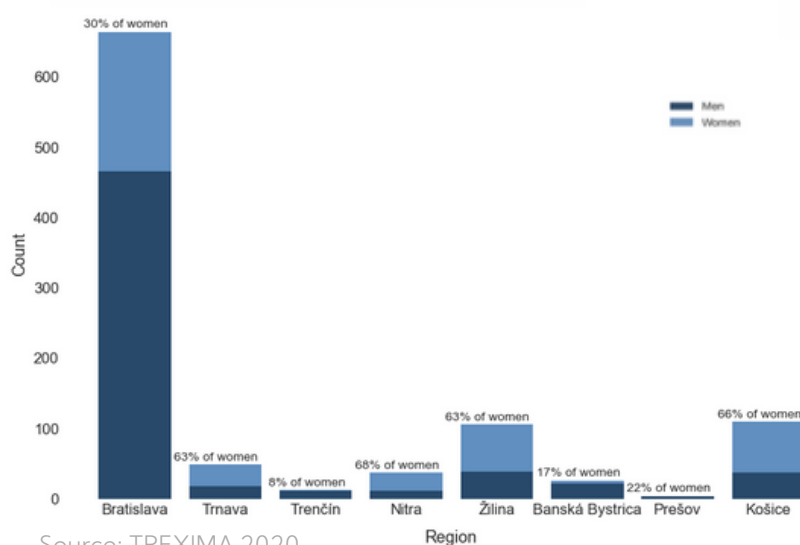Source: TREXIMA 2020

As displayed in the graph, female ICT sales professionals represent more than two-thirds of all ICT sales specialists in the Kosice region. Analyzing gender structure by the age category, the most significant share growth occurred among women aged 30 to 39 since 2016.

€ 2,786
average monthly gross salary in 2020

The wage gap between men and women working as ICT sales professionals has widened by 11% nationally over the past five years. Men's wages have increased by 27% over this period, which in absolute terms is €700 a month. Although the wages of saleswomen also increased, the change in their salaries was four times lower.

The gender wage gap in the Košice Region is 43%. That is 4% higher than the national average and more than twice as high as the cross-industry national average. The average monthly gross salary of ICT sales professionals in Slovakia was €2,786 in 2020, almost 60% more than the average in the Košice Region.

39 %
ICT Sales Professionals Gender Pay Gap, Slovakia 2020

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ICT Managers

Almost four times more men than women work as ICT managers in Slovakia. According to the latest available data from 2020, 143 more women have stepped into management positions since 2016. However, the percentage of female ICT managers has increased by only 1% in the last five years. The reason is the fact that almost three times as many—417—male ICT managers filled this position during the same period.

ICT Managers by Gender in Slovakia
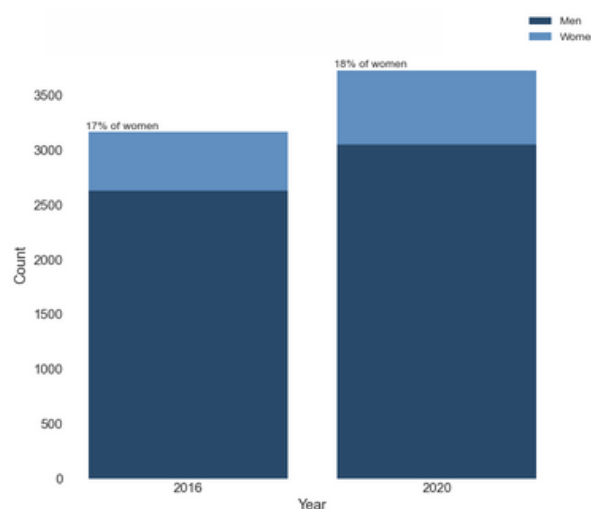
Source: TREXIMA 2020

In 2000, Slovakia had twice the share of women in company management in general, compared to the OECD average (22% vs. 10%). Still, in 2018, it reached only an average value (24% vs. 22%) because the representation of women in management has grown significantly in other countries (PwC Slovakia 2020). The Slovak ICT industry, with only 18% of female managers, still has a long way to go.

ICT Managers by Gender and Region, 2020
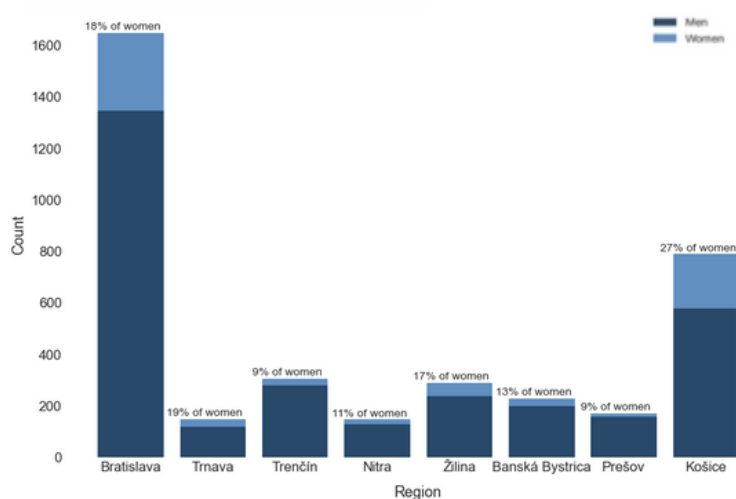
Source: TREXIMA 2020

Data at the regional level reveal that female ICT managers are underrepresented in each of the regions. Most IT managers work in the Bratislava (1,649) and Košice (789) Regions. The Košice Region has the highest ratio of female ICT managers (27%), 9% above the national average. The highest percentage of female ICT managers in Slovakia is in the age group of 25 to 29 years.

However, there are relatively few women in managerial positions in the given age range. In higher age groups, the number of managers increases, but management positions are filled by men more often than by women. This has resulted in a declining share of women under the age of 54 in IT management between 2016 and 2020. Above the age of 45 years, fewer female employees hold managerial positions in comparison to the age group of 35 – 44 years. The ratio of female managers in the age group of 20 to 49 years has increased in 2020 compared to 2016.

€ 3,513

average monthly gross salary in 2020

ICT Managers by Gender and Age, 2016

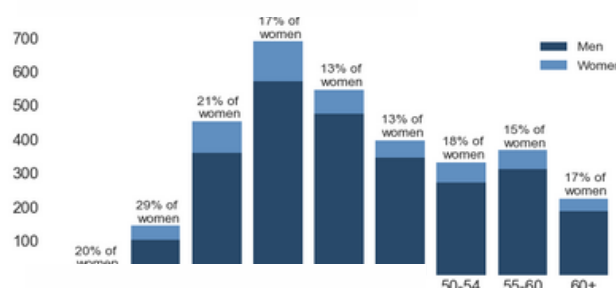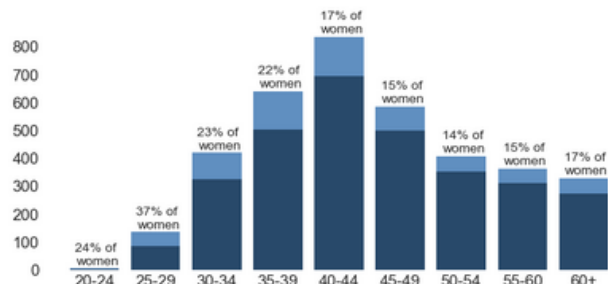### ICT Managers by Gender and Age, 2020

Source: TREXIMA 2020

The wage gap between men and women in managerial positions in ICT has narrowed by 4% over the past five years. The reason is the faster-growing salaries of female managers, which grew by 4.9% between 2016 and 2020. The average salary of female ICT managers has risen by almost 14.6% over the last five years but is still nearly a fifth lower than a man's salary in the same position. The difference between the average salary of a man and a woman in this role was more than €666 a month in 2020. In other words, the value of €1 for female ICT managers is 82 cents.

The most significant wage gap is in the Žilina Region, where women in managerial positions earn the least compared to other regions, which was 36% lower than men in 2020. The same industry, the same position, the same work, but at the end of the month, women's wages make up only two-thirds of what their male counterparts receive in the Žilina Region. The above-average wage disparity is in all regions, with the exception of the Bratislava and Trnava Regions.

Average Monthly Salary in EUR for ICT Managers by Gender, 2020

Source: TREXIMA 2020

On a positive note, women's wages grew in every category, except for 30-34-year-old managers. The most significant (one-third) wage growth is visible in the group of 50-54- year-old managers. The increase in the salary of female managers in this category by more than €1,000 narrowed the pay gap.

18 %
ICT Managers Gender Pay Gap, Slovakia, 2020

It is interesting to note that the difference between salaries of ICT managers in the Bratislava and Košice Regions is almost 30%, which is much higher than the average salary difference of the ICT specialists in Košice and Bratislava Regions (12%). The gender wage gap for ICT managers in the Košice Region is 23%.
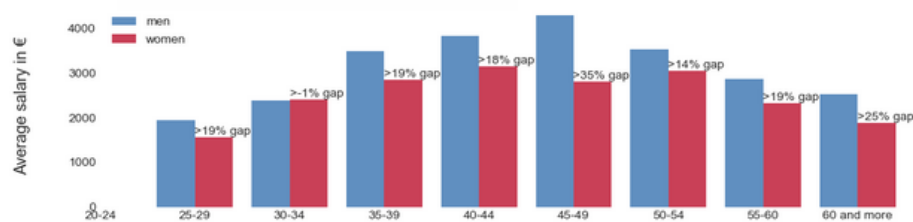
Average Monthly Salary in EUR for ICT Managers by Age and Gender, 2016

Average Monthly Salary in EUR for ICT Managers by Age and Gender, 2020
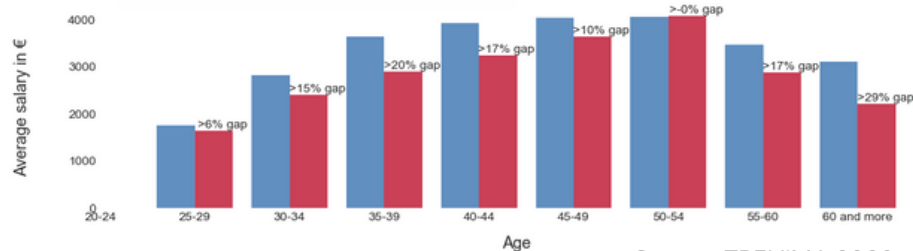
Source: TREXIMA 2020

Average Monthly Salary in EUR for ICT Managers by Gender and Region, 2020
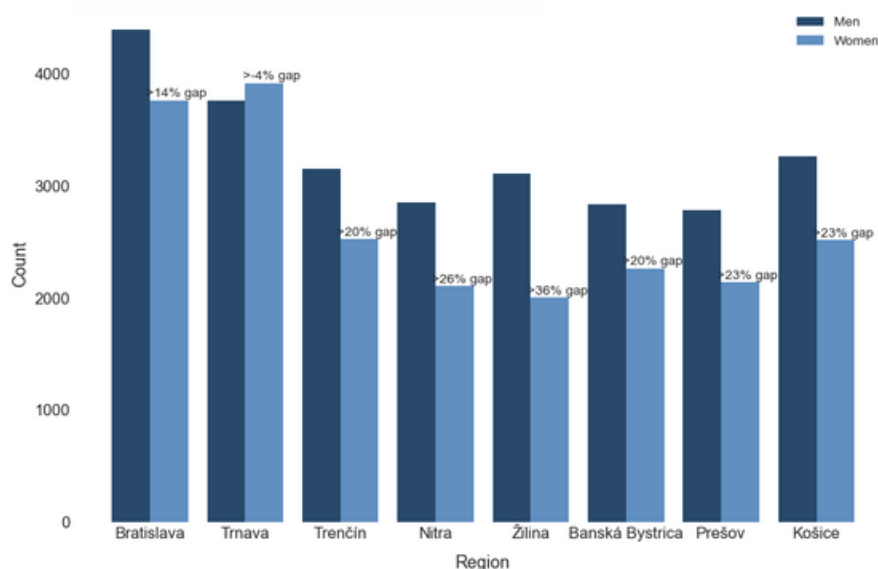
Source: TREXIMA 2020

Female ICT managers in the Košice Region earn 42% less than is the national average in this position.

If women earned the same as men, their total income in OECD countries could increase by more than 3.2 trillion eur—an increase of 21% on average in their total income (PwC Slovakia 2020).

Female Founders

Globally, a woman was behind every fifth start-up that was created in 2020. This number may seem small, but in 2009, women were at the head of only every tenth start-up. In 2020, start-ups set up exclusively by a woman or a group of women have received only 36 billion dollars in investments globally. That is about 3% of the total amount of money that investors poured into start-ups in 2020. In 2016, 24% of Slovak start-ups were founded or co-founded by women (KPMG 2016), which is higher than the global number five years later. Unfortunately, the percentage of women on the start-up scene and related investments are currently not monitored and published in Slovakia.

PART 3:

BARRIERS FACED
BY WOMEN
IN ICT MANAGEMENT
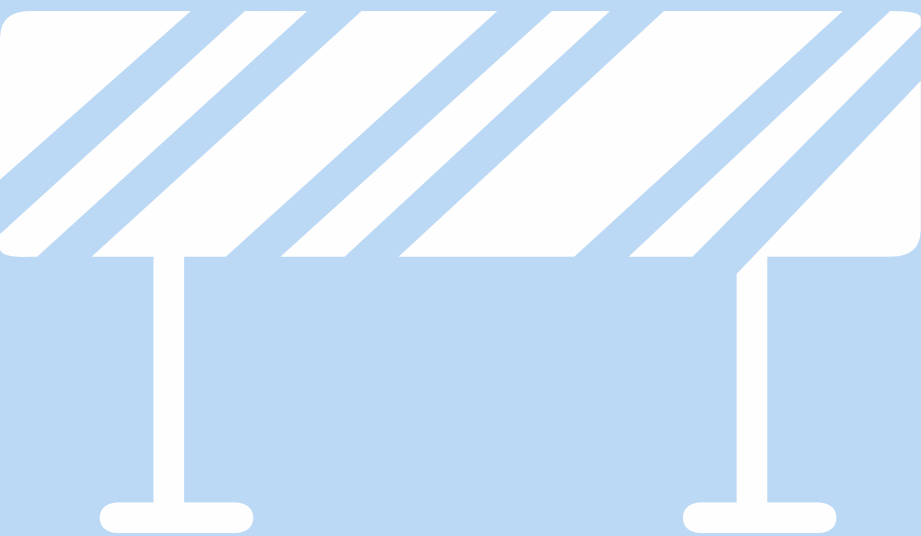
Behind the Visible

Another piece of the puzzle is to look at the problem of gender inequality in the workplace from the inside. A survey conducted within this research addressed perceptions of women in ICT Management in two areas: career challenges (or barriers) they had to overcome to access the leadership roles and the main facilitators of their career progress. Twenty women working in ICT management roles in Slovakia were asked about their work environment, work–life balance, support system, perception of gender equality of opportunities. Their answers were compared with quantitative findings and research discoveries. Overall, we discovered two big groups of barriers limiting women's progress – personal and professional.

Types of Barriers Female Managers Face

based on Tiao 2006
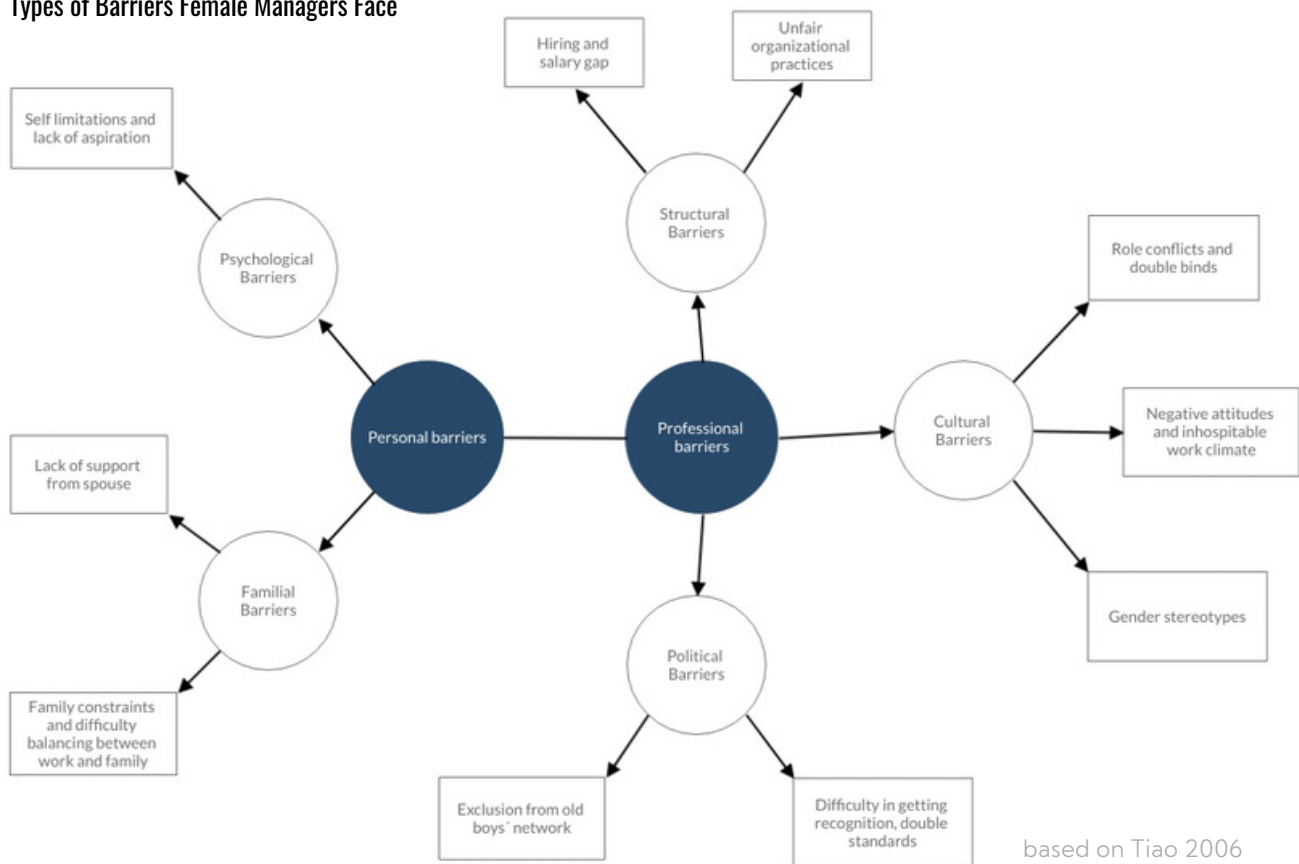
We asked our participants about barriers they had to overcome during their journey. Their answers were analyzed with content analysis, and four main groups of barriers were identified (see the complete list in Appendix 3). The expectation was that ICT managers would not be able to identify barriers if they have not had to overcome them. As expected, the most frequent answer was that no barriers were present, followed by organizational barriers and gender–based barriers. Psychological barriers also play an important role—most often a lack of self–confidence. Sexual harassment, the superiority of men, or "men's clubs" in ICT were also cited by survey respondents among gender–related barriers.

The average age of the women in the sample was 35 years, with the youngest respondent being 27 and the oldest 47. Respondents are in most cases responsible for a team of up to 20 people, but the sample also contained managers responsible for 50 to 100 employees. Fifty percent of our respondents are married women and 55% are childless.

Self-Limitations
and Low Self-Confidence

Although previous research indicates that self-limitations, lack of aspiration, and low self-confidence are among the most pervasive barriers holding women back from reaching leadership positions, this was not the case in the survey of women in ICT management positions. However, low self-esteem is a common factor frequently affecting women in a world of work.

" My current employer supported me in my career growth by providing opportunities to attend various courses that developed my managerial skills that contributed to building and developing the abilities and skills needed for further career growth. Unfortunately, my previous employers did not provide me with such opportunities.

ANONYMOUS FEMALE ICT MANAGER , SLOVAKIA

ICT managers who participated in the survey did not lack self-esteem. Supportive partners and families are important for their careers. These female managers felt most limited by prejudices and inappropriate work settings provided by the employer.

Among the reasons for their success, they emphasized their personal qualities and abilities the most. Among the traits that contributed most to their success, they named determination, diligence, and responsibility. The biggest advantage they think women can bring to their field is a unique point of view. The answers to several questions show that female managers perceive themselves as in control of their destiny and capable professionals.

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Impact Beyond The Workplace

While the process of women's advancement into top-level leadership positions remains unclear, one of the prices that women pay for success in the profession is already apparent. More than a decade ago, researchers lamented that 'nearly one-half of the women who stay in academe remain either single or childless' (Hensel 1991). The ratio is not far from this survey result. Half of the respondents are married, 55% are childless, and only one respondent has three kids.

Selected Demographics of Participants
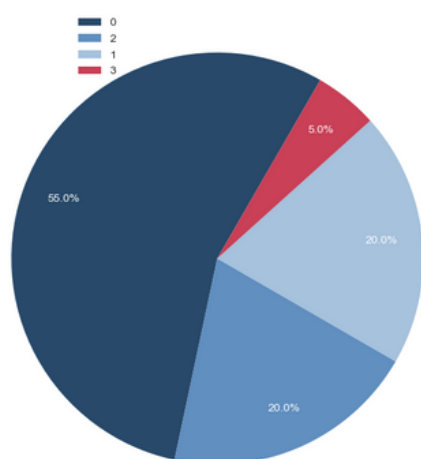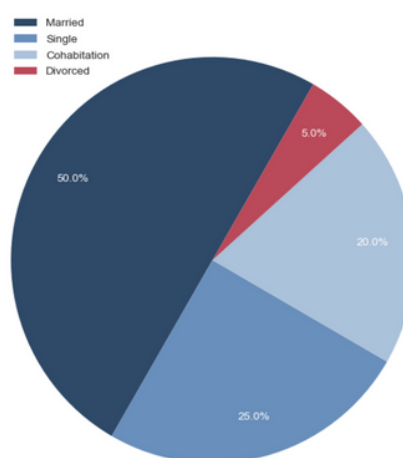
Source: Survey by Female Algorithm, 2021

According to 2011 data, 10% of women in Slovakia are childless at the age of 35. This percentage does not change much among older women (SODB 2011). In our sample, up to 55% of women are childless. The findings could explain the disproportion between childlessness in the average population and our selection of women in top positions.

Even six years after their first child's birth, mothers' wages are 33% lower than if they had no children, according to analysis by the Institute of Financial Policy (IFP) (TASR 2021). The gender pay gap already exists before the first child's birth, but this gap widens once the woman becomes a mother. Based on data from 2006, the IFP illustrated that the wage gap between mothers and fathers widened from 29% in the year before the birth of a child to 60% in the fourth year after birth. Even 13 years after childbirth, the differences had not returned to pre-parenting levels. In the case of fathers, experts notice only a minimal impact of parenthood on the number of months worked and thus their income levels.

Given that women today are still the preferred caregivers for children and the elderly in their families, they continue to struggle between work and family; their careers are also more likely to be interrupted when schedule conflicts occur.

Responses from successful Slovak ICT managers have shown that mothers have a different managerial experience than childless women. Mothers perceive the work environment as more unfair and segregating than childless women. Barriers related to gender—motherhood, pregnancy, and various prejudices about women's abilities— were the most frequently cited.

Caring for their family also interfered with women's work–life balance by reducing the time mothers devote to self-development or relaxation. However, with all its pitfalls, motherhood probably benefits women's personal development because self-confidence and self-limitation beliefs in mothers were not as significant an obstacle as in childless women.

Interestingly, a childless woman was more likely to say that she did not perceive any obstacle during her career. Motherhood in Slovakia represents a significant barrier to career advancement for women. Cultural expectations, which result in little time for self-study and self-development that are crucial in a dynamic and rapidly evolving ICT sector, limit mothers.

Barriers Faced by Mothers vs. Childless Women at Work
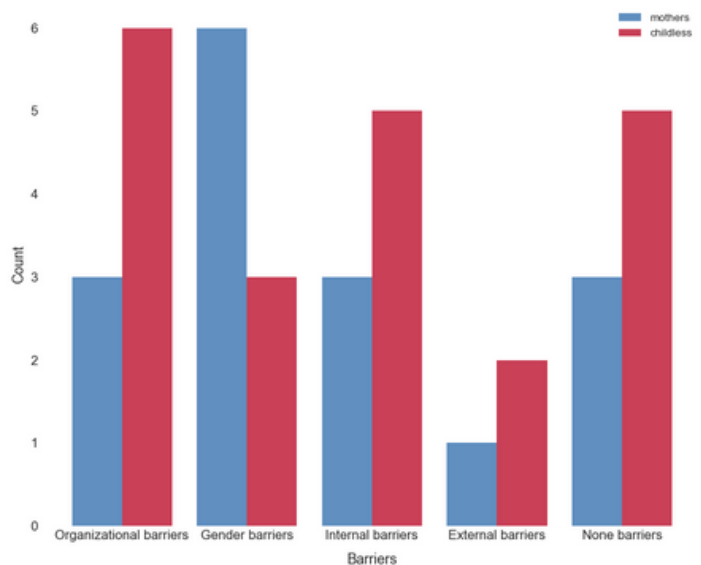
Source: Survey by Female Algorithm, 2021

> ❝ You can't do everything – drop the cooking/cleaning requirements, order a menu, call cleaning service. Don't be afraid to ask for help, talk about your feelings, set things up so that you are happy.
>
> ANONYMOUS FEMALE ICT MANAGER , SLOVAKIA

Center for International Private Enterprise

The respondents in a relationship were asked about the number of hours a week their partner spends on household duties. The average response was 4.1 hours with a range of 0 – 10. A similar amount of time – 3.8 hours – women ICT managers within this sample spend with household (see the Daily schedule graph).

Household Chores Done by Husband (hours per week)

Source: Survey by Female Algorithm, 2021

Daily Schedule of Female ICT Managers (hours per day)

Source: Survey by Female Algorithm, 2021

International statistics show that women, on average, spent six more hours than men on unpaid childcare every week, according to research by UN Women. Based on this survey, having an equal distribution of household chores is one of the common factors our respondents cited.

On average, mothers manage to maintain a work–life balance a little better than childless women. At first glance, this finding is a paradox. However, similar results in other research papers point to a particular protective nature of motherhood. The hypothesis is that mothers need to strictly guard the time between work and the rest of their duties, making it easier for them to maintain a work–life balance. On the other hand, childless women do not have to draw such strict lines between their work and personal life, so they may overlap.

Work-Life Balance of Female ICT Managers (Mothers vs. Childless)

Source: Survey by Female Algorithm, 2021

Center for International Private Enterprise

Daily Schedule of Female ICT Managers (Mothers vs. Childless, Average in Hours)

Source: Survey by Female Algorithm, 2021
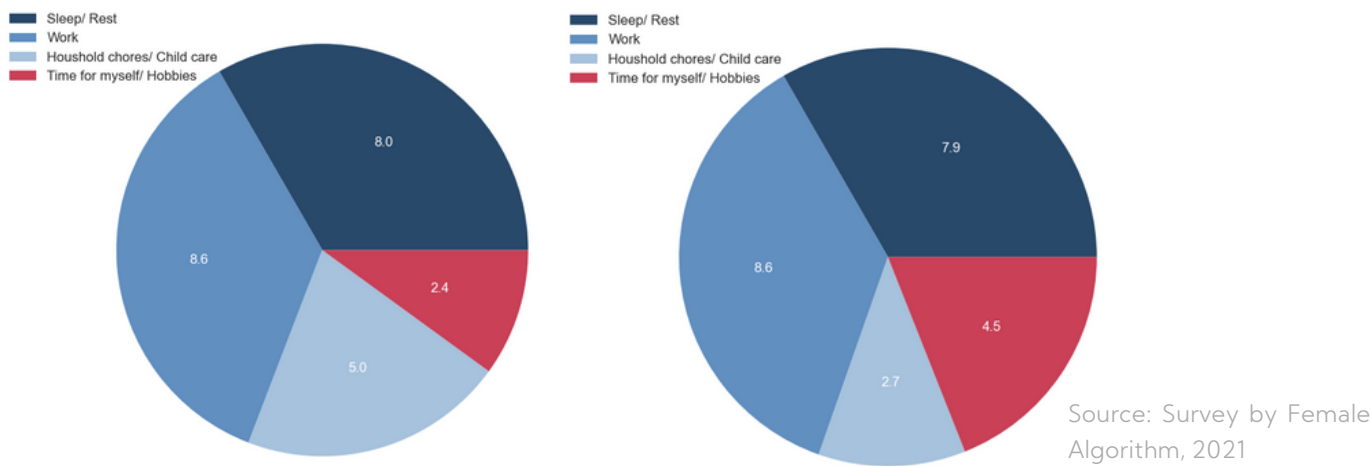
Interestingly, both mothers and childless women work the same amount of time, the difference being how they divide the rest of the time. Childless women spend more time alone and their hobbies, while mothers spend most of their remaining time caring for the family and doing housework. One of the common prejudices against working mothers is that they will not devote enough time to their profession. However, the data suggest that they work just as long as childless women and make compromises in other areas.

Personal Traits That Facilitate Career Advancement

A personality type can be an obstacle, but it can also be a stepping-stone to career success. The respondents were asked to list their personal traits that helped them succeed the most at their jobs. Each woman listed three traits. By content analysis, the answers were classified into 10 categories.

Determination was an essential feature among seven out of 11 childless women (64%) and four out of nine mothers (44%). Hard work was also perceived as more important by 6 childless women (55%) than 3 mothers (33%).

As an important feature, being communicative is mentioned more often by mothers (four out of nine women) than childless women (two out of 11 women).

Surprisingly, empathy was mentioned as a vital trait by almost half of childless women but no mother.

Category	Count
Determined	11
Hardworking	10
Responsible	7
Communicative	6
Flexible	5
Emphatetic	5
Persistent	4
Positive mindset	4
Reliable	3
Fair	2

Source: Survey by Female Algorithm, 2021

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Supportive Work Environment

Women in top management positions at ICT companies globally operate in a predominantly male world. Women in leadership positions are not only in the minority but also are often viewed as "outsiders." Therefore, they are challenged with complex institutional barriers of great magnitude. Many researchers cite negative attitudes toward women as leaders and inhospitable climate as one of the main professional barriers women face. The masculine culture is particularly evident in careers associated with the "hard" areas of science, technology, engineering, and mathematics (STEM) (Tiao 2006).

Our survey respondents were asked to describe how they perceive their work environment, and their answers were highly positive. Working in a supportive environment is another critical determinant the female ICT managers have in common.

Perception of Work Environment by Female ICT Managers (Semantic Differential)
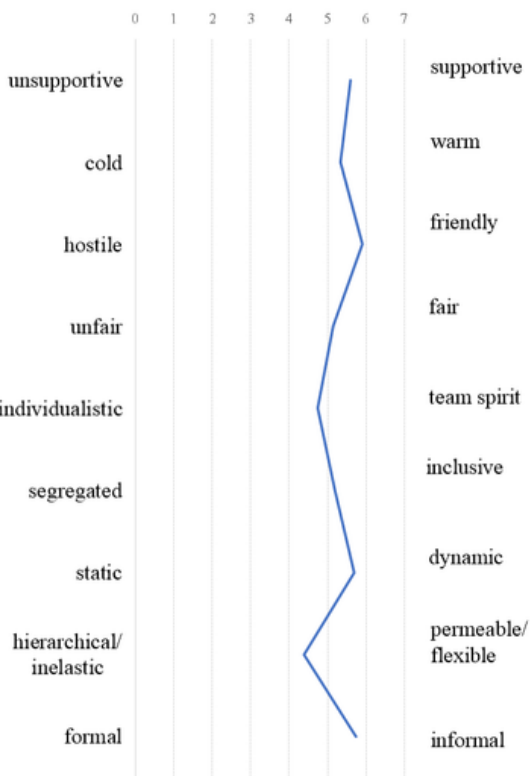
Source: Survey by Female Algorithm, 2021

Female managers described their work environments as friendly, dynamic, and supportive. The average score closest to the negative pole was recorded in the pair—hierarchical/inelastic vs. permeable/flexible. Low-permeability hierarchical borders are an already identified barrier to women's entry into managerial positions. It is assumed that the respondents overcame most obstacles, which could be why they described their current work environment positively.

Most women (15) perceived the opportunities for promotion as the same for men and women. The level of support depends on the specific employer. Twenty-five percent of women surveyed said they had to fight hard for their career growth and often be better than men.

> " Every certification and career shift was a hard fight to win. The competitive struggle is an everyday reality. So I try to be a role model in sharing and supporting my colleagues.
>
> ANONYMOUS FEMALE ICT MANAGER , SLOVAKIA

female algorithm

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Advantages and Disadvantages of Being a Female ICT Manager

In terms of benefits, two out of 20 respondents saw no help in gender, and two reported only one perceived benefit. By content analysis, there were identified the most frequently recurring advantages from the remaining 34 answers.

Advantages of Being a Female ICT Manager	Count
Uniqness, different perspective	7
Empathy, more effective building of relations	6
Better time management and multi–tasking	5
Improved behaviour inside a team when diverse	4
Effective solving of problems and conflicts	4
Fewer female competitors	2
Positive discrimination	2
Other	4

Source: Survey by Female Algorithm, 2021

According to women, the most significant advantage that they bring to the ICT industry is a unique perspective, including an innovative and creative approach, and original ideas.

Another advantage they cited was empathy and an emphasis on higher EQ, which women use for better relationship development with business partners or internally in teams.

The third most common advantage mentioned was their time management and ability to multitask, allocating work more efficiently and achieving more. According to the respondents, the presence of a woman or women in purely male teams enhances the culture in the company. It also contributes to the effective resolution of issues and conflicts.

Regarding disadvantages, 65% of women considered gender bias in the ICT industry to be the most substantial disadvantage, which often results in an underestimation of their skills and lack of trust. Women have often described how much more difficult it is for them to enforce anything in purely male teams and how their hard skills and technical knowledge are being questioned.

The second most common disadvantage cited was the category identified as family responsibilities, which is seen as limiting the prospects of a woman's career advancement. Because of their family responsibilities—not only to children, but also parents and grandparents—women often cannot move to other countries for more lucrative offers or work long hours.

66

Being a woman is a gift. Women have the ability to listen. Listen to their team.

ANONYMOUS FEMALE ICT MANAGER , SLOVAKIA

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Advantages of Being a Female ICT Manager	Count
Predjudices, discrimination	16
Family responsibilities	7
Lack of self–confidence, drive	4
Sexual harassment, sexism	3
Other	5

Source: Survey by Female Algorithm, 2021

The third most common disadvantage cited by 20% of respondents was a lack of self–confidence and drive. Answers reflected a self–limiting belief (e.g., women ask for a lower salary during interviews) or mentions of how much more above the average a woman must be.

One woman out of 20 respondents faced sexual harassment and two sexism during their careers.

Feminine vs. Masculine

Describing their style of management, 50% of respondents said they led their teams in a style that we could characterize as feminine (according to characteristics already described by multiple scientists—Kiamba 2009; Growe and Montgomery 1999; Schaef 1985). In their answers, women emphasized their focus on relationships, providing support to their team, or consensual leadership. Only 25% of women have a team leadership style where male characteristics prevail, such as focusing on goals or rigor. Twenty percent of women had a mixed style, with aspects that fell under both categories.

"Sometimes I encounter prejudices about whether I can understand a topic as a woman if it is a technical problem.

ANONYMOUS FEMALE ICT MANAGER , SLOVAKIA

These differences can often be to the detriment of women, as their typical facilitative approach is perceived as softer.

Leadership style roots in the more profound expectations and stereotypes that prevail about women and men. There are also several cognitive biases associated with this issue—such as likeability bias, where women are expected to be nicer and more conformist, and assertive women are generally unpopular. But if women are not assertive, they are considered less capable.

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CONCLUSION

1. Unequal treatment based on gender is evident in each monitored role.

Companies in Slovakia lack more than 68,000 qualified ICT specialists. The majority of women have university/college degrees, representing 45% of the Slovak workforce. Yet, the percentage of women in the ICT sector in Slovakia (15.8%) is below the EU average (18.5%). Women in Slovakia thus represent an untapped reservoir of the potential workforce for ICT roles. The percentage of women in ICT in the Košice Region (19%) exceeds the national average (15.8%). Yet, there are persistent salary gaps between men and women in the same ICT positions and between the Bratislava and Košice Regions. An in-depth analysis of the five most common ICT roles revealed that gender differences range between 8% and 34% for specific roles. The closest to equal salaries in Slovak ICTs are in the roles of computer network and systems technicians, where women earn only 3% less than their male counterparts. The most significant salary difference is among ICT sales professionals, where the average salary of women is 39% lower than men nationally and 43% lower than men in the Košice Region.

2. There is a disproportionate number of childless women among women leaders compared to the general population.

In the general population, 10% of women are childless at the age of 35. In this research sample, up to 55% of female leaders are childless. This finding could relate to the hypothesis of barriers to work-life balance. Family responsibilities were cited as the second-biggest disadvantage associated with the female gender and the second-biggest obstacle in a career. An inflexible work environment and a lack of part-time job options in managerial positions force women to choose between career and family.

3. Gender-related barriers impact mainly mothers, while organizational and internal barriers have a stronger influence on childless women.

Mothers have a different managerial experience than childless women. Mothers perceived the work environment as more unfair and segregating. Barriers related to gender (motherhood, pregnancy, and various prejudices about women's abilities) were the most significant. Caring for the family also interfered with mothers' work-life balance by leading them to sacrifice the time childless women devoted to self-development or relaxation. However, with all its pitfalls, motherhood probably benefits women's personal development because self-confidence and self-limitation beliefs in mothers were not as significant an obstacle as in childless women.

4. Childless women are less likely to perceive barriers in their careers than mothers.

Many of the barriers that women had to overcome, according to previous research, were either not perceived by our respondents or could have been overcome without conscious reflection. Interestingly, the childless woman was more likely than a mother to indicate that she did not perceive any obstacle during her career. Motherhood in Slovakia represents a significant barrier to career advancement for women. Cultural expectations, which result in little time for self-study and self-development that is crucial in a dynamic and rapidly evolving IT sector, limit mothers.

5. Five of ICT Managers experienced sexual harassment.

One of the 20 respondents confirmed sexual harassment as the most severe obstacle. Sexism was an issue for two other respondents. In Slovakia, the debate on sexism does not receive as much attention as it should. At the same time, sexism is prevalent in the highest spheres of the ICT sector, as the responses to our questionnaire showed. Companies in the ICT sector should pay more attention to educating employees on diversity, inclusion, and appropriate behavior in the workplace so that none of their employees feel unsafe.

6. Female ICT managers do not lack self-esteem. Support received from their partners and families is an almost inevitable factor in their professional advancement. They are limited mainly by unconscious bias and work settings in the workplace.

Most of our respondents did not suffer from low self-esteem. Among the reasons for their success, they emphasized their personal qualities and abilities, such as determination, diligence, and responsibility. The biggest added value women said they could bring to their field were their unique and different views. The leaders perceive themselves as creators of their destiny and capable professionals. They said they are mainly limited by prejudices and expectations arising from gender stereotypes.
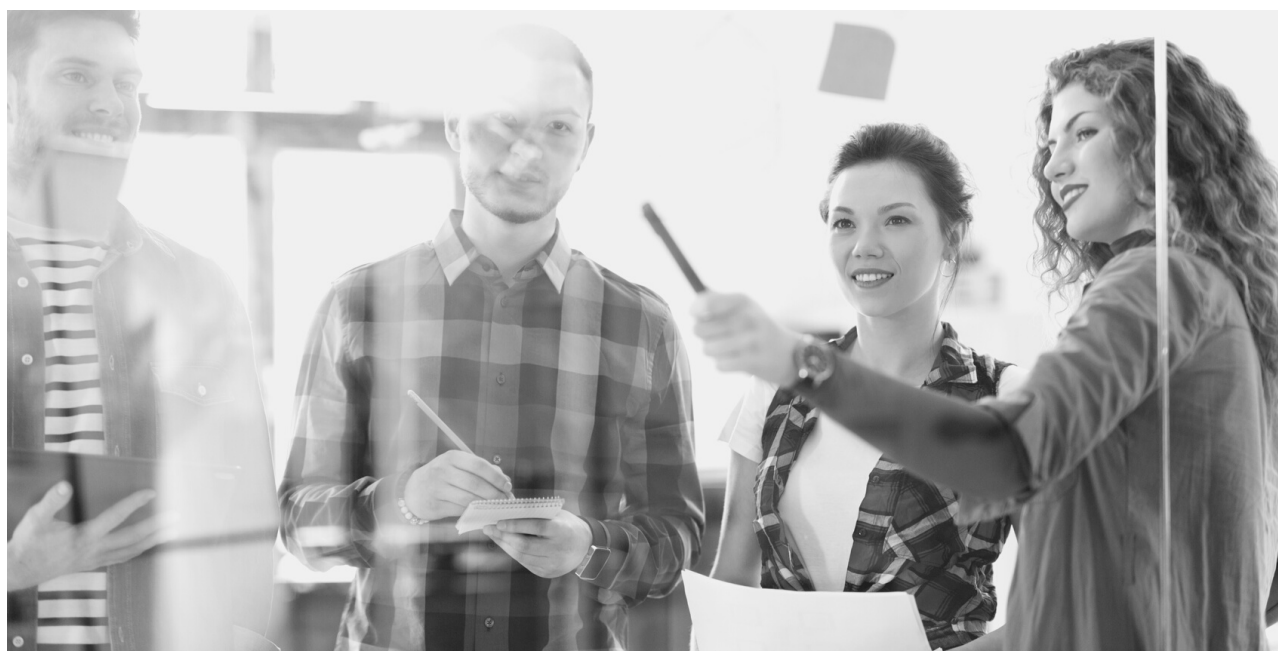
RECOMMENDATIONS

There is a proven business advantage behind gender diversity in ICT, including in its management positions. There needs to be a collective effort from the tech industry to create alternative entry routes into the profession. More women in Slovak ICT means prosperity for the country, including the Košice Region.

To companies

- Increase the availability of apprenticeships, partnerships with universities, and offer shadowing and work experience opportunities at all ages.
- Eliminate penalties for career interruptions, e.g., by restructured retirement plans.
- Give former employees alumni status. Analogous to an active retirement, alumni status would help women who have left or are not engaged in their careers to stay in the loop. They might be tapped for advice and guidance, and the company would continue to pay their dues and certification fees so they could maintain a professional standing.
- Create flexible work hours/settings. Too many women are working full time, and this is proof that companies, corporations, and institutions still have space to increase the flexibility of women's employment.
- Provide company kindergartens/supporting childcare. Mothers/parents who know that their child is close and cared for are able to devote themselves to their work more. This will save time parents would typically spend on the way to and from kindergarten.
- Provide workplace mentorship which boosts careers, skills, and retention and is of benefit to all. If not possible, at least provide frequent, specific, and actionable feedback. Research done at Stanford University has confirmed that vague feedback is holding women back in the workplace.
- Address unconscious bias in the workplace. Include diversity and inclusion education in employees' training plans to help address sexism, discrimination, and microaggressions. Make sure inclusion is part of your company's processes (e.g., hiring checklists, performance reviews, etc.).
- Pay people based on their skills, potential, and not gender. Apply for Equal Salary Certification (in Slovakia provided by PWC, https://www.pwc.ch/en/services/people-organisation/equal-salary-certification.html).

To municipalities and government

- Publish regular reports listing the detailed ICT job market opportunities and forecasts. Multiple groups would benefit from such information: educational organizations when preparing their education plans, schools when opening new specialized fields of study, parents who influence their children when they choose their career directions, young people considering their career options, employed people keen to re-qualify themselves, potential investors, and more.
- Support nonprofit organizations that are focusing on digital education.
- Open an active dialogue between companies, universities, high schools, educational institutions, and the public. Allow knowledge and best practice exchange. Create communication channels and foster cooperation.
- The Košice Region should prioritize increasing the number of people in general in ICT as this is one of the most profitable, expanding industries with substantial future potential.
- Ask regional ICT clusters for recruitment forecasts and granular statistics (e.g., demand for software developers according to programming languages) and publish them regularly.

To women

- Ask for an appropriate salary, considering the average for a specific industry. Help close the gender gap with your courage to ask for what you deserve.
- Find an optimal work-life balance setup. Seek a supportive partner, communicate your household chores/childcare expectations openly.
- Know your strengths. Do your best, recognize your limitations, have a positive outlook, establish quality support systems, have confidence, use your strengths and advantages, and take assertive actions.
- Find a mentor. Seek out connections a couple of levels ahead of you and show that you are worth their time. Ask for advice on something specific and then follow through on it. Often the mentor relationship exists before either the mentor or mentee recognizes it as mentoring. Mentorship boosts careers, skills, and retention and can help you to navigate your career.
- Break gender stereotypes by supporting other women instead of competing with them.
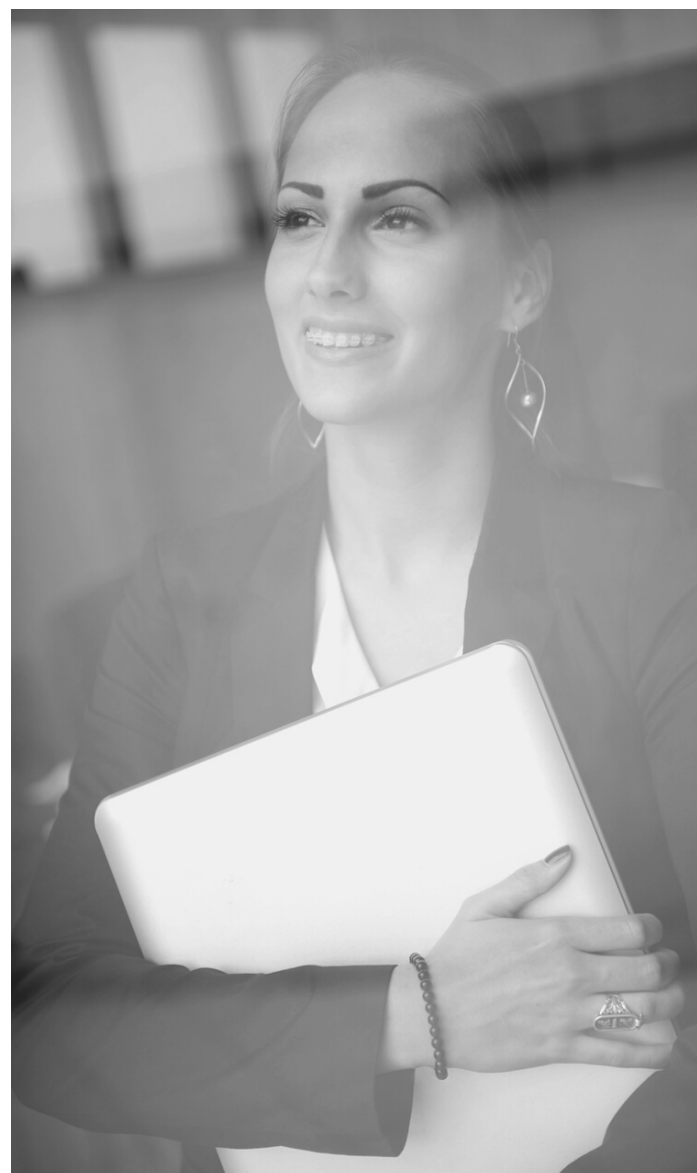
METHODOLOGY

Methodology of Literature Review

The objective of this study, which is based primarily on a review of the literature published within the past decade, was to gather input on the significant trends and findings defining gender and related intersectional issues in the ICT sector with a focus on labor and skills, women's participation in governance, and decision–making and workplace conditions.
The scoping survey gathered sources from partners and their extended networks and reviewed background literature of potential relevance to augment the survey findings

Methodology of Data Gathering & Analysis

The methodology for Parts 1, 2, and 3 was chosen to reflect both qualitative and quantitative aspects of the data collected.
In Part 1, we used data obtained from Eurostat. Based on Eurostat's methodology in the analysis of ICT specialists in employment, the job positions to be focused on in Part 2 were determined. The research was expanded to two other positions: research and development managers (ISCO–08 code: 1223) and electrical engineers and energy specialists (ISCO–08 code: 2151). The names of the individual positions correspond to the International Standard Classification of Occupations–08 (ISCO–08) classification, which provides a system for classifying and aggregating occupational information. All data were obtained from TREXIMA, Bratislava.

In Part 2, the selected five groups of jobs were closely examined. Researchers focused on analyzing systems analysts, graphic designers, and ICT sales professionals. The group of examined developers was created by combining four job positions of the ISCO–08 methodology. It includes software developers, web and multimedia developers, application programmers, software and multimedia developers, and analysts not elsewhere classified. Last, but not least, a special focus was put on the analysis of managerial ICT positions: ICT service managers (ISCO–08 code: 1330) and research and development managers (ISCO–08 code: 1223). See complete tables in the Appendix. Quantitative data were analyzed using libraries for statistical analysis and data visualization in the programming language Python.

In Part 3, the qualitative part of the study, researchers sought to uncover barriers faced by women and facilitate conditions to help them advance in their careers. Research articles were reviewed to identify the most common barriers women face globally, assuming similarities in Slovakia. A questionnaire created indirectly inquired about those main barriers and facilitating conditions. The survey was sent to 48 women in senior managerial positions in the ICT sector in the Košice Region. Twenty women responded— a response rate of 42%. A content analysis was used for open questions and a quantitative approach for questions with numerical output. The results were then coded and analyzed independently by a team of researchers, controlling for reliability.

AKNOWLEDGEMENTS

Authors

LENKA HLINKOVÁ is the CEO of Female Algorithm, a Slovakia–based nonprofit organization focused on gender equality and inclusion in ICT and management. She is the author of the first Slovak motivational and educational book for women interested in tech, Female Algorithm. Hlinková has a master's degree in economics and 14 years of experience in software project management. Over the past six years, she has served as a corporate consultant on DE&I issues. She is a member of the Gender Equality Expert group at the Ministry of Labor, Social Affairs and Family of the Slovak Republic.

MIROSLAVA KUĽKOVÁ is currently a junior research fellow at the interdisciplinary VITRI Centre of Excellence in Prague. She earned her doctorate at Charles University in Prague in the field of international relations. She has conducted independent field research, where she interviewed 26 high–ranking politicians in the Balkans and participated in an international research project in Kosovo. She is a specialist in qualitative research design, which she taught at Charles University. She cooperates with the nonprofit Female Algorithm, where she lectures on diversity and inclusion and critical thinking.

SIMONA ŠIMOVIČOVÁ is a Ph.D. student at the Faculty of Economics of the Technical University of Košice (TUKE). In her dissertation thesis, she deals with the issue of gender equality, specifically in public administration. She also volunteers with the nonprofit Female Algorithm, where she coordinates projects related to DE&I.

MIROSLAVA SÜČOVÁ VERNARSKÁ is a data scientist. She has been working mainly on projects dealing with hypothesis testing and predictive analytics. Her background is in academics. She received her Ph.D. in psychology on the intercultural and social aspects of figurative language. Altogether, her experience makes her a specialist in data understanding and visualization, statistical analysis, and the building of predictive models. As a part of the nonprofit Female Algorithm, she is mainly responsible for the analysis of data from various sources, data visualization, and research in general.

Project Funding and Major Data Source

www.cipe.org   www.zenskyalgoritmus.sk

female algorithm   Center for International Private Enterprise

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APPENDIX 1

ICT Specialists in Slovakia vs. Košice Region, 2020

ISCO code	Occupation	SVK	SVK Men	SVK Women	Kosice region	KE region Men	KE region Women
2511	Systems analysts	7425	5593	1832	1348	1104	243
7421	Electronics mechanics and servicers	5334	4716	618	719	553	166
2151	Electrical engineers and energy specialists	5187	4698	490	546	481	65
2522	Systems administrators	4877	4230	647	1406	1201	205
2512	Software developers	4814	4276	538	993	893	99
2514	Application programmers	4258	3624	635	515	466	48
3511	ICT operations technicians	4107	3278	829	756	476	280
2519	Software and multimedia developers and analysts not elsewhere classified	2681	2067	613	383	261	122
1330	ICT Service managers	2518	2089	428	731	533	199
3513	Computer network and systems technicians	2253	2048	204	198	171	27
2523	Computer network professionals	2213	1972	241	218	202	16
2529	Database and network professionals not elsewhere classified	1807	1436	371	167	122	45
2153	Telecommunication engineers	1489	1300	189	53	47	6
1223	Research and development managers	1211	961	250	58	45	13
2521	Database designers and administrators	1182	833	348	467	347	120
3521	Broadcasting and audio-visual technicians	1172	1026	146	75	62	13
3522	Telecommunications engineering technicians	1110	1100	9	88	83	5
2434	ICT sales professionals	1008	608	400	109	38	72
3512	ICT user support technicians	950	809	141	52	38	14
2166	Graphic and multimedia designers	880	714	167	40	29	11
3114	Electronics engineering technicians	806	752	54	23	23	
7422	ICT installers and servicers	677	555	122	176	172	4
2152	Electronic engineers	385	374	11	148	140	8
2513	Web and multimedia developers	225	188	38	26	23	3
3514	Application programmers	66	52	14	10	5	6
2356	Information technology trainers	40	13	27	19	5	14

Source: TREXIMA 2020

Note: 24 ICT roles mapped based on Eurostat 2021b methodology, 2 roles were added by Female algorithm, see the Methodology on page 35.

Center for International Private Enterprise

APPENDIX 2

ICT Specialists by Average Wage in Slovakia vs. Košice Region, 2020

ISCO code	Occupation	SVK	SVK Men	SVK Women	Kosice region	KE region Men	KE region Women
1330	ICT Service managers	€3,721.6	€3,871.0	€2,950.5	€2,536.2	€2,676.4	€2,145.3
1223	Research and development managers	€3,303.9	€3,388.3	€2,976.2	€3,655.3	€3,861.2	€2,887.7
2434	ICT sales professionals	€2,786.2	€3,297.6	€2,001.8	€1,629.7	€2,277.0	€1,294.9
2153	Telecommunication engineers	€2,610.3	€2,659.6	€2,244.6	€2,342.3	€2,323.6	
2512	Software developers	€2,596.2	€2,632.1	€2,273.3	€2,242.9	€2,278.0	€1,924.5
2523	Computer network professionals	€2,590.4	€2,638.2	€2,195.3	€2,210.6	€2,247.2	
2511	Systems analysts	€2,493.9	€2,607.7	€2,127.7	€2,068.7	€2,141.0	€1,687.9
2529	Database and network professionals not elsewhere classified	€2,399.6	€2,502.8	€1,997.0	€2,017.9	€2,215.0	€1,465.0
2519	Software and multimedia developers and analysts not elsewhere classified	€2,340.0	€2,443.5	€1,976.5	€1,850.7	€1,990.7	€1,524.9
2514	Application programmers	€2,181.5	€2,219.8	€1,953.7	€1,864.0	€1,878.4	€1,725.1
2521	Database designers and administrators	€1,986.0	€2,161.3	€1,586.4	€1,383.1	€1,442.6	€1,228.0
2151	Electrical engineers and energy specialists	€1,985.4	€2,018.8	€1,642.8	€1,806.5	€1,839.3	€1,560.8
2152	Electronic engineers	€1,880.0	€1,879.2	€1,907.5	€2,085.3	€2,102.4	
2513	Web and multimedia developers	€1,789.8	€1,802.7	€1,721.0	€1,917.7	€1,982.8	
2522	Systems administrators	€1,780.0	€1,807.9	€1,593.0	€1,366.8	€1,377.0	€1,303.2
3512	ICT user support technicians	€1,778.7	€1,808.3	€1,594.2	€1,436.4	€1,391.4	€1,541.8
3513	Computer network and systems technicians	€1,688.5	€1,693.6	€1,636.1	€1,562.5	€1,557.8	€1,590.0
3514	Web technicians	€1,617.5	€1,683.0	€1,366.5			
3114	Electronics engineering technicians	€1,580.6	€1,611.5	€1,025.8	€1,700.9	€1,700.9	
2356	Information technology trainers	€1,570.3	€1,682.1	€1,509.6	€1,464.3		
3511	ICT operations technicians	€1,455.4	€1,513.4	€1,172.4	€1,149.8	€1,262.6	€900.3
3522	Telecommunications engineering technicians	€1,443.1	€1,443.0		€1,607.8	€1,616.1	
2166	Graphic and multimedia designers	€1,401.3	€1,435.0	€1,231.0	€1,151.8	€1,225.4	€997.4
7421	Electronics mechanics and servicers	€1,301.6	€1,335.5	€1,015.2	€1,244.7	€1,330.7	€911.5
7422	ICT installers and servicers	€1,232.6	€1,253.2	€1,132.8	€1,245.7	€1,247.0	
3521	Broadcasting and audio-visual technicians	€1,154.7	€1,162.5	€1,096.8	€980.8	€992.1	

Source: TREXIMA 2020

Note: 24 ICT roles mapped based on Eurostat 2021b methodology, 2 roles were added by Female algorithm, see the Methodology on page 35.

APPENDIX 3

Barriers Female ICT Managers Face at Work, Slovakia, 2021

Barrier	Definition and examples	Count
No barriers		16
Organizational barriers	Barriers connected to the organization, a system of company, or employer. Barriers that could be removed by the company's actions. Examples: 'Inadequate and too various workload', 'Big pressure from my employer', 'Delaying salary raise'.	15
Gender-based barriers	Barriers connected to specific position of women: pregnancy, family care, biological differences, but also gender biases and prejudices. These barriers come from the external world. One cannot change them by her own activity. Examples: "Expectation of my family when my child was born," "small children," "sexual harassment".	13
Internal barriers	Barriers coming from human mind and personality. These barriers can be changed by one own action. Example: "Low self-confidence", 'Doubts about my own capabilities', 'Fear about the future'.	11
Regional barriers	Barriers connected to Slovak environment and regional differences. Those are outside the scope of the organization. Examples: "...in poor regions (which are all regions except Bratislava in Slovakia), limited or zero possibilities for alternatives or different job",	3

Source: Survey by Female Algorithm, 2021 (see the Methodology of Data Gathering and Analysis, page 35)

APPENDIX 4

Proportion of ICT Specialists in Total Employment, 2020
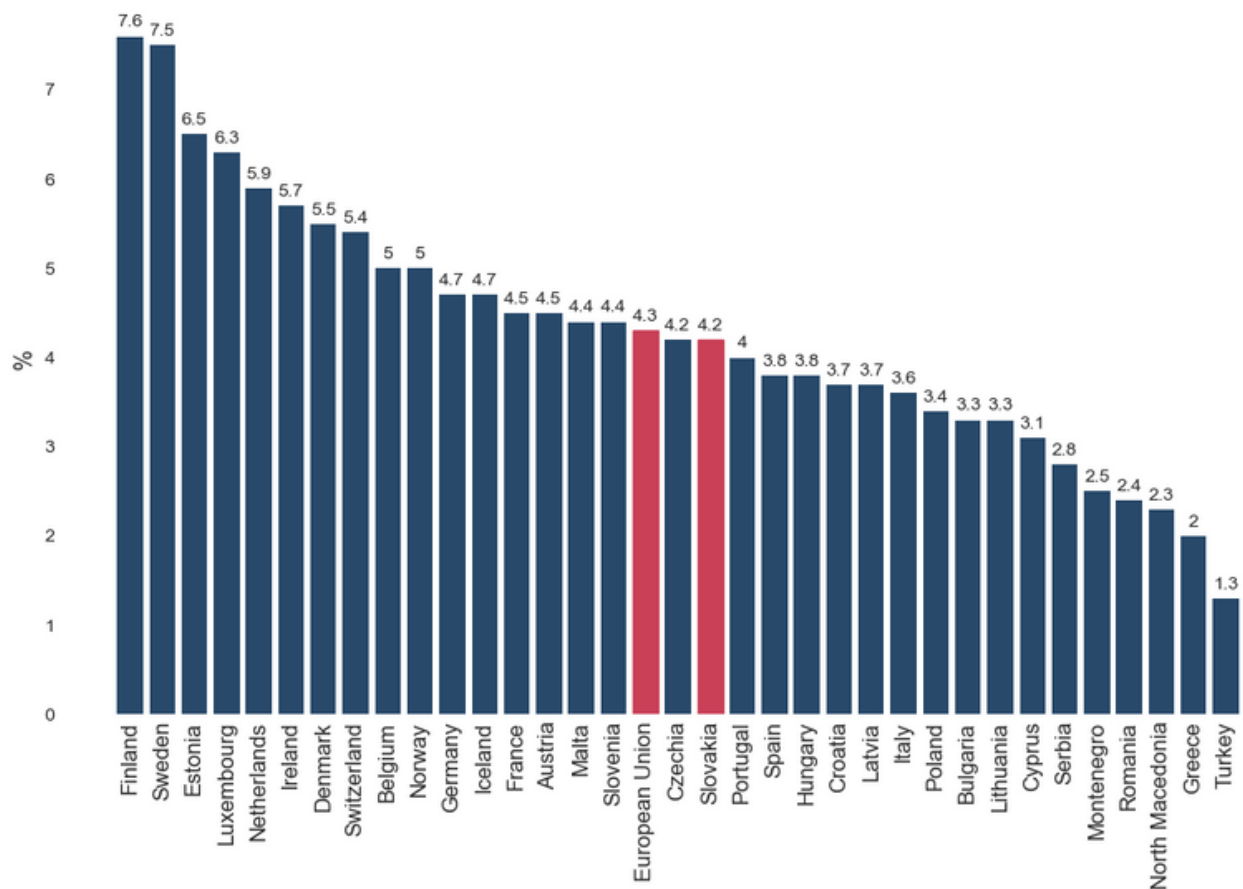
Source: Eurostat 2021a

EDITORIAL

Authors: Lenka Hlinková
                                Miroslava Kuľková
                                Simona Šimovičová
                                Miroslava Sűčová Vernarská

Copy Editor: Ashish Sen

Graphs and Data Visualisations: Miroslava Sűčová Vernarská

Graphic Design and Layout: Lenka Hlinková

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