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Work in IT for women: The realities of Ukraine

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Abstract

The article presents a study conducted on gender equality in Ukraine in the field of information technology. The problem of gender inequality still exists throughout the world. The purpose of the article is to study the working conditions of women in IT, to discuss the possible use of stereotypes, and to identify the reasons for women's lack of interest in working in this field. Formally, there is no prohibition for women to work in the IT industry. However, there are a number of reasons in Ukraine that affect the possibilities of pursuing a career in this direction. The article analyzes the available statistical data and the results of a survey among representatives of the IT sector. It is worth noting the problem of data collection during the war in Ukraine. The importance of the sphere for the country's economy as a whole and the relevance, demand for specialists, as well as the ratio of women and men employed in this area are considered. Global trends in gender distribution in the field of IT were analyzed. The main stereotypes and situations that constitute obstacles for women

in this area are considered and the features inherent in Ukrainian society are also highlighted. Based on the statistical data of Ukraine the number and structure of female students, including foreigners, in recent years were analyzed. It was revealed that the structure of the gender ratio of men and women in education is changing with the formation of the labor market of Ukraine and the distribution by employment status. The ratio of working women and men is approximately the same, but the structure by employment status is different. In Ukraine the IT sector is largely based on individual entrepreneurs. Despite the martial law, the IT community is actively developing and new companies are being created. Training is actively carried out in paid and free courses. Surveys were conducted among students, and it was found that the beginning of a career in the field of information technology is already determined by certain stereotypes of society. Based on the conducted research, the structural gender relations in the field of IT and the main stereotypes that hinder the development of women in this area are analyzed. Recommendations for overcoming gender inequality in the field of IT in Ukraine are presented. Based on the information received, conclusions were drawn: the number of women and men studying technical and mathematical sciences in Ukraine is approximately the same. But in the future, in professional activities, women in many cases prefer to occupy weaker positions, leaving leading positions to men. The main reason for this dynamic is the generally accepted stereotypes and the actualization of the role of women in other areas.

1. Introduction

The rapid development of scientific and technological progress contributes to the ever-increasing acceleration of the rhythm of human life and society. Rapid changes and globalization of the economy are taking place, which requires very quick decisions. In turn, decisions cannot be made without the use of digital technologies. Digitalization and automation are being introduced and used everywhere, especially in business, because they speed up production processes, allow the use of machines and mechanisms in complex jobs and in places dangerous to human life. Despite the significant growth in the quantitative and qualitative aspect of IT specialists, the growth rate of demand for IT services exceeds the existing supply.

Accordingly, a significant growth rate in the demand for IT solutions leads to an increase in the need for specialists in this industry. At the same time, there is still a shortage of engineering specialists in the IT industry, while the complexity of IT projects and solutions is growing. This leads to the need for constant professional growth of specialists. The IT sphere is developing very actively, and even crises cannot stop the constant shortage of specialists in this field.

2. Theoretical framework of the research

The features of this industry mainly include the ability of people to think logically, to have the necessary knowledge, to be able to use it, high analytical skills, a propensity to find solutions, and creativity. If we talk about the game industry, then a number of employees must still have creativity, good imagination, and the ability to express their thoughts figuratively.

Thus, we can say that there should be no prerequisites for gender inequality in the field of IT, because everything depends only on the personal qualities of a person, his or her knowledge, skills, and experience. And women should feel absolutely confident in this area. Women can be just as experienced specialists, solve complex problems, and effectively distribute tasks as men. It was the same 50 years ago. The number of women programmers has grown exponentially. The very first program in the world was written by a woman, Ada Lovelace (1840s). Rose Barfield looked at the origins of computer programming in her article (Barfield, 2021) and noted that “Lovelace was also the first to suggest that computers could be more than just calculators. Grace Hopper developed LOW-MATIC, the first system that could convert plain English into computer code (1952)”. Scientific researchers analyzed the field of information technology in the UK. Their findings show how the gender structure of IT influences women’s careers in this field. The article also reveals the collective image of women in technical specialties, which makes it possible to analyze directions for reducing gender inequality (Kenny and Donelly, 2020).

Already in 2003, there was a decrease in the number of women in the field of IT. The analysis revealed problems in the realization of women’s opportunities due to stereotypes (Nielsen, Hellens, Wong, 2000). The main ones are: beauty and intelligence are not compatible. Women have a special logic. Mathematics and engineering are male occupations. Also, among the factors of discrimination both in the world and in Ukraine, the most common are: sexism in employment, the gender pay gap, the glass ceiling, gender stereotypes, and prejudices. The results of studies on gender imbalance have shown that the problem exists not only in Ukraine. At the end of 2020 in Ukraine, the percentage of women in IT was almost 25%. However, it should be noted that there is a positive trend and more and more women are entering in this field.

Back in 1999, studies were conducted in the UK on the situation of women in the IT sector. The authors concluded that the IT industry does not exclude women, but does not make efforts to retain them (Panteli, Stack, Atkinson and Ramsay, 1999).

The authors of the article “Women in Engineering as a Research Topic: Past, Present, and Future” conducted an in-depth analysis of the literature on the topic of inequality of women in the field of engineering. Their findings support the thesis that the presence of women in science and technology will help prevent possible violations of women’s rights and reduce gender inequality (Dabić, Vlačić, Obradović, Marzi and Kraus, 2021).

The study aims to identify factors that influence women’s choice to develop a career in the IT field. The goals are to determine what exactly is decisive when deciding to work in one direction or another, and why women leave IT.

3. Research methodology

Official statistical information of Ukraine and other countries was used. General scientific methods were used – generalization, analysis, synthesis. A survey was conducted, the results of which were processed using the grouping method.

4. Main material

4.1. Gender structure in education in Ukraine

Analysis of statistical data shows that women in Ukraine receive higher education almost at the same level as men. At the beginning of the 2020–2021 academic year, the number of women was 606,945 or 53.2% of the total number of students. At the same time, 421,883 people or 50.8% study full-time (State Statistics..., 2023). You can also consider the number of foreign students who received higher education in Ukraine at the beginning of the 2020–2021 academic year. There is a completely different trend in this data. Among the total number of foreign students, which is 67,327 people, women make up a minority of 31.53% (21,226 people). By the end of their studies, the number of foreign female students is reduced to 29.71%. For comparison, in 2021, the total number of foreign students increased to 73,626 people, and the number of women among them reached 33.67%.

Among foreign students who graduated in 2021, women accounted for 30.23%. We consider these changes to be positive, the number of women is increasing and they can exercise their rights to education, even in another country. Based on statistical data, an analysis was made of the number of foreign students from different countries. The following trends of individual countries in sending students to study in Ukraine were noted:

- In 2020, the largest number of foreign students came from India – 16,888 people. Women among them accounted for 36.46%, and among those who graduated, the share fell to 34.64%. In 2021, the share of women in the total number of students from India rose to 38.87%, and on next year graduates decreased to 34.33%.

- The largest proportion of students from Lithuania are women – 80.56%. In addition, the majority of women also complete their studies – 94.12% of the total number of students. In 2021, the figures decreased slightly – to 72.41% and 85.19%, respectively. This may be due to the COVID-19 pandemic, which has limited the movement of students between countries of residence and study. However, if this did not affect the total number of foreign students, then in a number of countries it was the number of women who began studying in another country that decreased.

- The number of students coming from Maldives and Namibia was quite high. Among students from the Maldives, women accounted for 72.55% in 2020 and 71.43% in 2021, and among graduates, they accounted for 100% in 2020 and 50% in

2021. Namibia's performance in relation to female students in Ukraine was 69.44% and 70.97% of total students in 2020 and 69.66% and 50% in 2021, respectively.

There are, however, no female representatives from some countries among students in Ukraine. These countries include those of which few students want to get an education in Ukraine: Gabon (7 students), Bahrain (5 students), Central African Republic (1 student), Chile (3 students), Malaysia (2 students), South Sudan (3 students) (State Statistics..., 2023).

It should also be noted that, according to the statistics, women quite often enter and complete graduate school in technical and mathematical fields.

Table 1. Number of women graduates who completed their postgraduate studies in 2020 and 2021

	The number of postgraduate students – women who completed postgraduate studies			
	All persons		The number of persons who completed postgraduate studies (in %)	
	2020	2021	2020	2021
Total	295	178	70.2	50.7
Of which by field of science:				
Physical and mathematical sciences	12	8	60	32
Technical sciences	51	14	72.9	31

Source: compiled by the authors based on State Statistics.

In the structure of graduate students from other countries, women made up 32.5% of the total in 2020 and 33.81% in 2021. In the age group 23–25 years, this figure reaches 54%, but it decreases with age. PhD students (women) over the age of 50 accounted for almost 13% of the total. The analysis of the indicators of training of skilled workers in institutions of vocational education (vocational and technical) in 2021 was carried out. It can be concluded that the attractiveness of professions in this area is gradually increasing. During the year, the number of accepted students exceeded the number of those who completed the full course of study by almost 17%. However, the number of girls among the total number of students is 38.2%.

The structure of the gender ratio of men and women in education continues to change with the formation of the labor market of Ukraine and the distribution by employment status.

Upon admission, the percentage of women and men is the same. Even more women are graduating. However, an analysis of the distribution by technical areas shows that the largest proportion of women is in the chemical engineering and bio-engineering area – 55%. Information technology and electronics, automation and electronic communications are not of significant interest to women when pursuing higher education.

Table 2. Training of specialists in higher education institutions at the beginning of the 2022/23 academic year by fields of knowledge (State Statistics..., 2023)

	The number of persons admitted to higher education institutions for the first time	Number of students	Of them women	% of women	The number of persons graduated from institutions of higher education	Of them women	% of women
Total	245,089	1 052,871	530,206	50	273,119	149,215	55
Mathematics and statistics	1,405	5,996	2,244	37	1,360	580	43
Information technology	26,758	102,561	17,574	17	20,284	3,680	18
Mechanical engineering	6,798	25,362	2,350	9	6,271	778	12
Electrical engineering	6,628	24,263	1,967	8	6,543	758	12
Auto-mation and instrument building	3,669	15,079	1,784	12	3,798	578	15
Chemical engineering and bio-engineering	1,675	8,394	4,648	55	2,193	1,335	61
Electronics, automation and electronic communications	2,985	11,108	1,259	11	3,019	407	13

Source: compiled by the authors based on State Statistics.

4.2. Employment in Ukraine: Men and women

Considering the structure of the employed population in Ukraine by gender. In general, the promotion of gender equality is part of a broad cultural transformation that changes the way traditional societies function and fosters the development of democratic institutions. The affirmation of the value of gender equality ensures the self-realization of people, their right to education and contributes to the economic development of countries (Bidenko, Kyselova, 2017).

The issue of gender equality in the field of labor relations is quite relevant today and should include the following principles (Klymenko, 2021):

1. Equal opportunities and equal treatment of men and women in the field of employment;
2. Equal pay for work of equal value;
3. Improving the balance between work and family life of employees;
4. Equal approach to proposals in case of filling vacant positions.

In 2020, the World Economic Forum published the Global Gender Gap Report, in which Ukraine ranked 59th out of 153 countries (World Economic Forum, 2020). The rating is based on indicators of participation in the political life of the country. The ratio of men and women in the highest positions in the state, the level and availability of education, access to medical care and its level, economic opportunities were considered. The annual dynamics of this indicator show positive changes, but in general it is still far from a good result. However, now in Ukraine, due to the martial law, many men were called to military service and there is a replacement of the personnel of many enterprises. Based on the statistical data of Ukraine, an analysis of the structure of the labor force by gender was made.

In Ukraine, the number of working women and men is approximately the same: women make up 47.44% and men – 52.56% of the workforce. But the structure by employment status is somewhat different. Among women, employees account for 85.9%, and among men – 81.7%. A large proportion of women employees may indicate a lower level of entrepreneurship and the desire to achieve their own goals in it. This may be due to the fact that, because of their social life, it is more difficult for women to bear responsibility specifically in entrepreneurship. Employment reduces the level of responsibility for the results of labor to an individual result, and in entrepreneurship it is responsibility for the overall final result. In addition, this leaves the woman with the opportunity for greater responsibility in other areas of life: family, health, development in addition to a working career. Among employers, women make up 0.9%, men – 1.8%. The share of self-employed men is higher than the share of women and amounts to 16.3%. Therefore, we can conclude that the number of men who independently determine and implement their businesses exceeds the number of women. This is partly due to the fact that women take care of a part of a man's life – family matters – which gives men the opportunity to direct their energies and freed up time to business. Also noteworthy is the difference in the performance of men and women in the category “Freelance family members”. There are 22,000 women and 16,000 men in this category. The survey was conducted among women entrepreneurs (self-employed) in the Odessa region, which revealed the main fears when starting their own business: high risk of losing capital, difficulty of competition, lack of moral support for the family, possible difficulties in fulfilling family obligations. It should be noted that in Ukraine there is a fairly widespread opinion that women should mainly deal with household chores and raising children. Quite often, men take part in these processes to a lesser extent than women, regardless of the tasks performed. However, most of them perceive these cases more as helping their wives due to the fact that they do

Table 3. Employed population aged 15–70 in 2021 by gender and status in employment, excluding temporarily occupied territories (State Statistics..., 2023)

Index	2021	
	Quantity, number of persons	Proportion, %
Employed aged 15–70, total, number of persons	15,610	100.00
Females	7,406	47.44
– employed	6,362	85.9
– employers	67	0.9
– self-employed workers	955	12.9
– working in a family business	22	0.3
Males	8,204	52.56
– employed	6,703	81.7
– employers	148	1.8
– self-employed workers	1,337	16.3
– working in a family business	16	0.2

Source: compiled by the authors based on State Statistics

not have time to take care of all the processes at home and in the family, than as their part of the responsibility to ensure cohabitation.

Another fairly common stereotype that is present not only in Ukraine: A man provides for his family financially, so he does not have to perform many duties in the family. However, quite often a woman's share in the financial support of the family is not much less than that of a man, or corresponds to it. But such examples for society are an exception, not a proof of the unfair distribution of domestic duties. A positive component should also be noted: such injustice stimulates some women to start their own business, helps to define themselves as a self-sufficient person, and allows them to set higher goals and achieve better results. But a significant part of women take such situations for granted due to the lack of moral support in their endeavors from both relatives and society as a whole. In order for the situation to change, the views and norms of society must change, then women can be more confident in their strengths and capabilities.

4.3. Ukrainian women in the information technology industry

Gender stereotypes about the exact sciences and intellectual abilities, the incompatibility of beauty and abilities in the exact sciences are considered the basis for the decline in women's interest in STEM. Such stereotypes already operate at the stage of education: it is widely believed that women do not tend to study technical and mathematical specialties because of their inability to study the exact

sciences. However, analytical abilities, good memory, propensity to analyze and complexity of perception are not gender characteristics, but personal ones. The presence of examples confirming that women can also occupy a significant place in this area is perceived by most of society as an exception, not a confirmation. It is strange that women who refute it by personal example can be subject to such stereotypes. This is explained by the fact that they also consider themselves an exception, a person who has accomplished the almost impossible, and not just a talented and capable specialist in their specialty, of which there can be quite a lot. Such a trend can only be overcome by an increase in female specialists in technical and mathematical specialties. But this process cannot be fast.

In Ukraine, the IT sector is largely based on individual entrepreneurs. According to the statistics of Ukraine in 2019, the number of individual entrepreneurs in computer programming has increased significantly (about 11%) and ranks third among all categories. The growth rate of entrepreneurs in this industry is very high. Compared to 2017, the number of women entrepreneurs in this area has increased by 62%. Such a rapid increase in the indicator indicates a significant interest of modern women in realizing their opportunities in this area. The growth of this indicator is even higher than the general growth rate of individual entrepreneurs. Most of the women entrepreneurs in the information technology industry work in the direction of “Computer programming”. Also, a fairly large part falls on analytical areas.

Research by Dou.ua employees showed that the number of women in the IT field is only 23%, and most often they work as developers, testers, designers, employees of analytical departments, etc. The median age of an IT specialist was 29 years in 2022 (28 years in 2020). Technical specialists are somewhat older than non-technical ones.

When considering the issue of gender balance, it should be noted that quite a lot of women work in non-technical and near-technical positions. In 2022, among technical specialists, 17% of women (in 2021 – 16%), among non-technical – 64% (Dou website, 2022). In the humanities, the largest share of women is in HR (90%), marketing (64%), technical writing (62%), design (46%) and sales (44%). However, over time, the gender distribution should even out (although not very rapidly), because among junior developers the number of women seems to be more optimistic – almost every seventh is a woman. In total, every third woman has the title of junior. The higher the professional level of a female specialist, the smaller their number in relation to men: at the level of senior specialist, there are already half as many women as men. Female developers are 11% in 2019 and 9% in 2022, and 38% each in 2019 among testers and Project Manager (PM), but in 2022 this figure dropped to 34% and 35% respectively (State Statistics..., 2023).

These data allow us to conclude that the beginning of a career in the field of information technology is already determined by certain stereotypes of society (society's gender prejudices about intelligence, abilities for the exact sciences). And

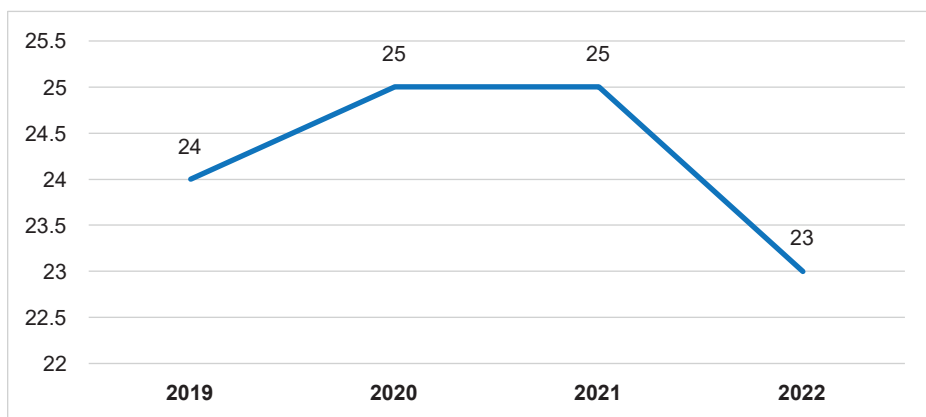


Figure 1. Dynamics of the number of women in the IT field for 4 years (in %)

Source: compiled by the authors according to the dou.ua website of the society of programmers.

the full development of their capabilities, reaching a certain level on the career ladder is also much more difficult for women than for men (taking care of children and home traditionally remains the responsibility of women, and therefore they simply do not have enough time to develop skills and competencies). Military operations in Ukraine further aggravated the situation (Figure 2). Many families were forced to move, experiencing difficulties with housing, material support, and working conditions. A significant part of the women left the country, many were forced to radically change their field of activity. Women's aspirations for self-development and change of profession have also significantly decreased. Many IT resources opened and made their training courses free of charge for residents of Ukraine, but the following became obstacles to using these opportunities: the lack of a financial cushion, the inability to have a main job, power outages.

In Ukraine, the number of women who work in technical positions is declining, especially at the senior level and above. Women are twice as likely as men to name an open-minded team as one of the reasons for choosing a career in IT – 39% versus 20%. The most popular roles among women are HR, QA, Software Engineer. Among students these are Junior Software Engineer, Software Engineer, Junior QA.

Women and men are almost equally interested in high salaries – 60% and 64% respectively. In general, among IT-specialists in Ukraine, 70% of juniors made their choice in favor of this activity precisely because of the high income (as one of the reasons), and among senior and lead such specialists – 53%.

Analysis of the companies active in the IT field shows that in 2020, compared to 2019, the share of product companies increased significantly – from 28 to 35%. The share of outsourcing is 45% (DOU, 2020). In recent years, there have been al-

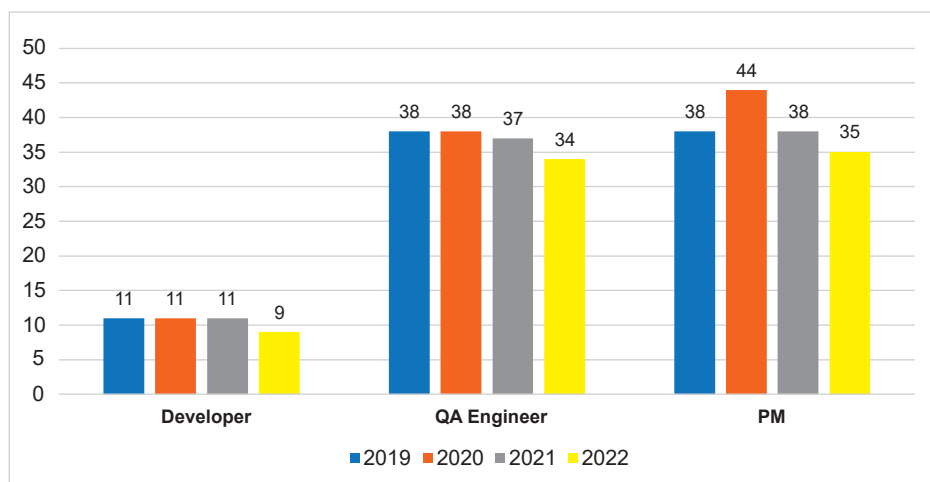


Figure 2. Dynamics of changes in the share of women in the total number of specialists (%)

Source: compiled by the authors based on data from the society of programmers (State Statistics..., 2023).

most no changes in the types of companies: 44% of specialists work in outsourcing companies, 35% in grocery, and 21% in start-ups. In outsourcing companies, the situation with gender balance is better – here the share of women reaches 28%. While in product companies and start-ups it is 23% and 22%, respectively.

87% of women in IT have a higher education diploma, compared to 82% of men. However, women are less likely to have higher education, which is associated specifically with programming – 41% (61% for men). Another 5% study in higher educational institutions. Most students among Game Developers (15%), Data Science (11%) and Security (9%) specialists, as well as developers (6%). Approximately 2% of IT professionals have a PhD, with higher numbers among Hardware Engineers (9%), Data Scientists (7%) and CTO/SEA (6%) (State Statistics..., 2023).

As for stereotypes of expectations from work in the IT field, research shows that the differences are not so significant for men and women. (Kuhn and Joshi, 2009).

Most of the women – Individual entrepreneurs in IT are concentrated in Kyiv, namely – 25%. This distribution occurred because Kyiv is the center of business activity and according to a study by the IT Ukraine association and the Good Regulation Office (BRDO), about half of the industry's companies are registered in Kyiv. Kharkiv, Dnipro, Lvov and Odessa, as traditional business regions, had rather large IT representations, therefore, these regions are also leading in terms of the number of female sole proprietors. According to a study by YouControl specialists, gradual growth also occurs in the western regions (Ucontrol, 2023):

- 43% in Volynskaya;
- 41% in Ivano-Frankivsk;
- 32% in Ternopil;
- 31% in Khmelnytsky.

There are two main reasons for these territorial shifts in the location of IT organizations. The first reason is the spread of business across all regions due to the natural development of the IT sector in Ukraine. The second reason is related to the war on the territory of Ukraine – entrepreneurs from the eastern regions, as well as potentially dangerous regions, are transferring their business to safer regions of the country. After the end of the war, the territorial distribution may again change due to the outflow of IT business to the former territories or those where doing business will be possible.

5. Conclusions

The study showed that the number of women studying technical and mathematical sciences in Ukraine is not inferior to the number of men. However, in their professional careers, women in many cases prefer to take on lower positions, allowing men to take the lead. The main reason for such dynamics is widely accepted stereotypes.

It should be noted that neither employers nor society address this problem. However, this is important for job seekers and limits women's rights to self-realization. Hidden infringement of rights based on gender, which has no tendency to be limited, is potentially dangerous for society. Since at any moment this trend can begin to grow progressively.

The influence of stereotypes on women leads to the fact that women consciously do not want to occupy higher positions in order not to take on such responsibility, even if this guarantees financial benefits. Exposure to the influence of public opinion, fear of possible condemnation by others, and the understanding of their inconsistency with the generally recognized image of a woman in society as a wife and mother, lead to the fact that a woman sacrifices her desires and talents, concentrating on those professions and positions that will maximize her time for housekeeping and family care. This stereotype is actively fed, therefore, in order to reduce the effect of its impact, it is necessary to change the attitude and norms of society in assessing women and their place in modern Ukrainian society, in understanding the rights and opportunities of women who go beyond the boundaries accepted now.

The influence of stereotypes on men is expressed in the fact that, as employers, they are consciously and unconsciously somewhat biased against hiring women in certain areas of the IT field. There is disbelief in the knowledge and abilities of a woman, doubts about her conscientiousness and dedication to work. As a result,

women's resumes are initially treated somewhat differently than men's, that is, signs of discrimination can be detected even before a real interview, which allows you to evaluate a specialist more fully than after reading the resume. There are ways to eliminate bias at the stage of application and resume review – “blind” review, which will give a more effective result if the employer focuses on the professional qualities and abilities of candidates. Moreover, if at this stage the applicants are at the same level, then in the same way “blindly” you can assign test tasks for professional suitability as an indicator of future results in work. In Ukraine this method is not widespread enough, which leads to deliberate bias in hiring.

Problematic issues remain regarding the ways and means of monitoring the situation when hiring. It is the task of the state to introduce and stimulate the use of methods that can balance the rights of men and women when hiring. It would also be necessary to express the position of gender equality more clearly.

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