# DIGITAL ECONOMY: IMPACT ON THE SOCIO-ECONOMIC TRANSFORMATION

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**Abstract**. Globalization is expanding the scope of employment forms in the labour market. The digital transformation of production effects both the Economy and Employment. The production processes automation requires constant updating of knowledge and increasing the competence of employees, high readiness to adapt to new conditions and mechanisms for the formation of Social and Labour relations. Such changes affect the functioning of society, contribute to the establishment of a new level of quality of life, when people's priorities are changed, the needs for self-realization and intellectual development become a priority by increasing the educational level, qualifications, and improving their own skills and competencies. *The purpose* of the paper is to analyze, define and characterize the impact of digital technologies on the labor market. Digital technologies as well as digital services change the rules of employment and the requirements of competences, knowledge, skills and attitudes of employees. Beginning to promote online work platforms, changing local and global labor markets. *Methodology* of the study is based on Data Mining tools as a methodology and process for identifying large data sets that accumulate on various information resources. *Results* of the survey showed that technological changes, on the one hand, can lead to job displacement and technological unemployment, and on the other hand, increase worker efficiency and increase their wages. These two trends are not necessarily mutually exclusive. With the advent of the digital platforms, some professions are being automated and others are being reorganized. This has led to the emergence of alternative operating mechanisms, in particular the "Gig economy" or Concert economy. Gig economy is a labour relations model based on the short-term contracts or informal

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agreements (Uber, Lyft, TaskRabbit, GrubHub, Postmates). *Practical implications.* The formation of a global digital segment of the labour market is accompanied by economic and social contradictions, which are especially acute in institutionally underdeveloped countries. This situation requires strengthening the state socio-economic development policy in the direction of balancing the processes of transformation of the national labour market and the formation of the digital economy *Value*/*originality*. The shift to a digital economy is a natural process and requires modernization of the employment sector. The new COVID-19 pandemic has accelerated the processes of transformation of the labour market and acted as a catalyst. Due to the fact that most enterprises and government organizations switched to a remote format, employees had to master computer and digital technologies.

## 1. Introduction

Estimates of different representatives of the Scientific community on the impact of the economy digitalization on the labour market differ. Leading researcher of the Institute for Global Development (UK) Rumana Bukht and Director of the Center for Development Informatics (University of Manchester) Professor, Richard Hicks, believe that the digital economy does not contribute to unemployment. In contrast, efficiency in the digital economy is typically higher than in the overall economy. Between 2009 and 2011, digitalization created 17 million workplaces in countries with economies in shift [1]. Employees of the Institute of Industrial Economics of the National Academy of Sciences of Ukraine Pankova O., Novikova O., Kasperovich O. [2; 3; 4], Bliznyuk V., Yatsenko L. [5; 6], Goremykina Yu. [7], Cheromukhina O. [21] note the need to take measures on the government agencies to prevent the growth of unemployment as a result of the economy digitalization.

The rapid development of technology is increasing the interest in the digital economy, as well as its impact on the transformation of the labour market. Increased technology implementation can increase labour efficiency, which subsequently leads to higher wages for employees. Raising wages creates incentives to substitute capital for labour and thus encourages investment in technology. However, it is necessary to make a reservation. Implementation of technology increases efficiency only for those employees who have compatible skills and displaces employees with

replaceable (i.e., automated) skills. This displacement can be observed in a balanced cycle connecting technology implementation, labour share of production, labour demand and wages. When technology implementation reduces the amount of labour required, total wages are reduced, which in turn reduces the incentive to automate production processes.

Another cycle links technology implementation, alternative work arrangements and wages. There, new technologies encourage alternative work arrangements, which can lead to lower wages, which in turn discourages further technology implementation. The final cycle example in this systems map concerns the interaction between alternative work arrangements, social safety nets, and taxes.

As alternative work (Gig economy) becomes more common, the associated voluntary social contribution provision could undermine membership in the social safety net and lead to increased tax pressure on standard employment employees to cover funding shortfalls. All this encourages more employees to use alternative working arrangements. This work cycle has a negative impact on overall wages and household income, regardless of the type of work arrangement, standard or non-standard.

## 2. Impact of digital technologies on labor market

The economy digitalization involves the use of artificial intelligence (AI), robotics, cloud computing in the production process, and increases the demand for employees with digital skills. However, the public administration system is not ready for such challenges. Lack of coordination of decisions and actions of authorities at the legislative and executive levels leads to their isolation in the formation of strategies for digital, socio-economic and educational and professional development. The rapid pace of implementation of digital technologies in management and production processes exacerbates the imbalance between the development of the national labour market and the digital economy [9; 21].

Digital technologies require countries to shift to the post-industrial development, where knowledge and information are the main drivers of transformation. The international network of companies offering professional services in the field of consulting and auditing PwC (PricewaterhouseCoopers) has identified three periods for the introduction of automation until 2030.

*Period 1. Transformation algorithm (before the early 2020s):* automation of basic calculations and analysis of structured data. Transforms data-driven sectors.

*Period 2. Penetration algorithm (by the end of the 2020s):* dynamic interaction with technology in organizing administrative office work and making decisions. Using robotics to perform tasks in a semi-controlled environment, such as moving objects in warehouses.

*Period 3. Autonomy algorithm (until the mid-2030s):* automation of physical labour and processes that require a response, in particular in transport and construction.

According to the World Economic Forum (WEF), published in The Future of Workplaces Report 2020, by 2025, automation associated with technological development will lead to the loss of approximately 85 million workplaces, which is 10 million more than in the 2018 report [11]. At the same time, 97 million new workplaces could be created, which is 36 million less than the 2018 report. These trends quite fully reflect the new division of labour between people and machines.

At the country level, there are different opinions regarding the dynamics of workplace creation/destroyment under the influence of the digital revolution. Computerization, robotics and new technologies bring to the fore not a person as the basis of labor potential, but other components. Robots and modern machines can better cope with their duties and perform their work faster and better (smart robots). For the employer, it is more profitable because there is no need to establish contact with machines to discuss various aspects. It is just necessary to monitor it and use it skillfully. The demographic situation in the world shows that the population is constantly growing, and by 2030 its number will reach 8.5 billion people. In order to avoid the problem of unemployment and crime, the population must be employed. In the case when machines replace most of the human labor, it will not be profitable for the employer to pay wages to employees (their work will be completely replaced by robots), because they do practically nothing. Digital transformation has both positive and negative consequences. Digital technologies require the transition of countries to post-industrial development, where knowledge and information are the main tools [21].

According to WEF analysis, the share of workplaces in the United States that are at risk of automation ranges from 9 to 47%. At the same time,

in similar scientific studies concerning EU member states, the gap is even greater: from 7 to 60%. By 2025, almost half of all new workplaces created as a result of digital transformation will require highly skilled employees. Thus, about 40% of employees with lower education will face the risk of automation of their work, compared to 5% of employees with higher education. Increased use of technology will lead to greater demand for digital skills. There will be an increase in demand for positions such as robotics engineers, artificial intelligence specialists and digital marketing specialists.

Technological change and digitization are also increasing the importance of skills as a geopolitical tool. The lack of qualified skills among employees in the local labour market is one of the main barriers to the introduction of new technologies. Therefore, countries whose education and labour systems effectively combat this problem can benefit most from digital transformation while reducing its negative consequences. In this context, according to the World Economic Forum's Global Competitiveness Index, the United States of America, after the United Arab Emirates and Switzerland, has the highest potential for attracting and retaining talented people. The first EU member state in this ranking (Germany) is ten positions lower. The EU is ahead of the US as a study destination for international students, with 45% of all international students in the EU versus 25% in the US. However, most of them do not stay in Europe after graduation. Academic experts estimate that only three in ten highly educated third-country migrants live in the EU, compared with six migrants living in North America. China ranks only 34th, although it is the world's largest source of international students, accounting for about 10% of the total number of international students worldwide.

The consequences of the new COVID-19 pandemic have proven that in conditions of isolation of employees from each other, it is possible to produce goods and provide services. Computerization, robotization, and new technologies bring to the fore not people as the basis of labour potential, but other components. Works and modern machines are better able to cope with responsibilities. They get the job done faster and better. This is beneficial for the employer or manufacturer, because there is no need to establish contact with the machines and discuss different aspects of the work.

The demographic situation in the world demonstrates that the population is constantly growing and by 2030 its number will reach 8.5 billion people. The population needs to be employed to avoid problems of unemployment and increased crime. In the case when machines replace most of human work, it will not be profitable for the employer to pay wages to employees; human labour will be replaced by the work of machines.

Since the beginning of the Industrial Revolution, employees such as the Luddites (manufacturing employees who opposed the introduction of machines and capitalist exploitation in 19th-century Britain) have feared that they would be replaced by machines and forever out of work. Until now, these fears have been largely wrong. On the one hand, employees who know how to operate machines are more productive than those who do not; automated production reduces both costs and prices of goods and services; consumers spend less money on goods and services; consumption levels increase, which leads to the creation of new workplaces. On the other hand, there are employees who have been displaced by machines and are now forced to look for a new job or improve their skills. In general, automation has a positive impact on business owners, earning higher profits with less labour required. Economic analysts predict new automation with more advanced robotics and artificial intelligence (AI), which will expand the range of tasks and workplaces that machines can perform [11; 12].

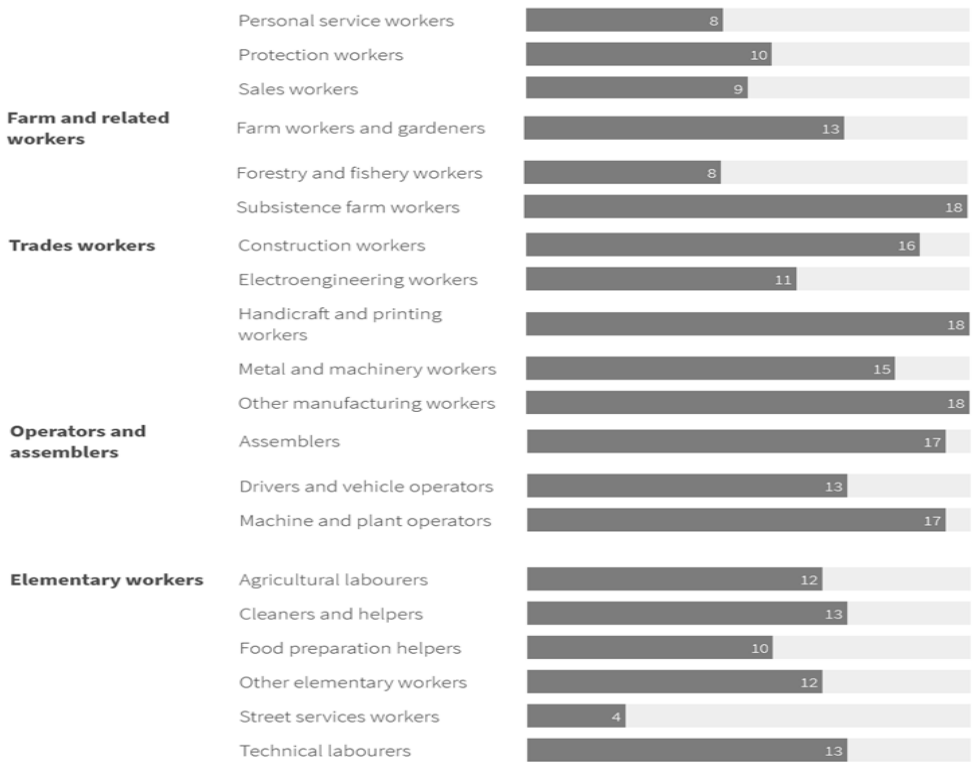
The impact of automation on employment is greater in manufacturing than in service industries due to more routine tasks and less dependence on communication and customer service. In some service sectors, such as logistics and transport, the impact of automation on employment is quite noticeable, and it is also beginning to appear in banking and financial services.

The specialists from the European Center for the Development of Vocational Education and Training (Cedefop) have identified categories of employees with a high risk of automation: operators and assemblers, craft and printing employees, construction employees (all > 15%). The lowest proportion (<5%) is found among street service employees, managers and care employees (Figure 1).

The report by the International Labour Organization (ILO) found that employed young people (under 24) face the risk of losing their workplaces due to automation. All over the world, young people are expressing fears


**Figure 1. Shares of employees with high automation risk by occupation, EU27, 2020 (%)**

*Source: developed by the authors based on Cedefop (2017) report; Eurofound (2018) data*




**Continuation Figure 1. Shares of employees with high automation risk by occupation, EU27, 2020 (%)**

*Source: developed by the authors based on Cedefop (2017) report; Eurofound (2018) data*

that new technologies, artificial intelligence and robotization will deprive them of their workplaces. One of many examples is the automation of the cashier's workplace in a supermarket.

In its analytical report, McKinsey found that from 400 to 800 thousand employees around the world could lose their workplaces by 2030. Professions such as salespeople, security guards, and receptionists are at risk [14; 15]. McKinsey has projected future scenarios of worker displacement by automation through 2030 (Figure 2), including global trends such as rising health care costs for an aging population; increased investment in technology, infrastructure, buildings and energy; marketization of domestic work that is not yet paid, such as childcare and cooking.

To maintain their comparable advantages, people need to learn how to manage, consult, decide, think, communicate and interact. The process of digitalization and automation of production requires employees to improve their skills, forcing leading companies to implement *reskilling* and *upskilling* programs aimed at retraining and acquiring new knowledge and skills by employees.

According to the analytical data from the International Labour Organization (ILO, International Labour Organization), by 2025, 85 million workplaces could be displaced due to changes in the division of labour between machines and people. According to the expert estimates from the World Economic Forum (WEF), by 2025, half of all employees will require retraining due to the technological progress. Employees can remain in the same positions, but will be forced to update their skills by 40% [16].

### 3. Impact of automation and artificial intelligence on employment

The impact of automation and artificial intelligence (AI) on future employment is the subject of research by scientists at Boston University (USA) and analysts at the School of Economics at Utrecht University (Netherlands). In 2019, they published the scientific work "Automation: A Guide for Policymakers." Scientists are convinced that the introduction of automation in the manufacturing sector entails unemployment, and in industries related to the provision of services, it creates new workplaces. The study is based on a complementary assessment based on data from businesses (36,000 firms) in the Netherlands that have automated their production or are planning to do so due to the impact of this process on employment (Figure 3).

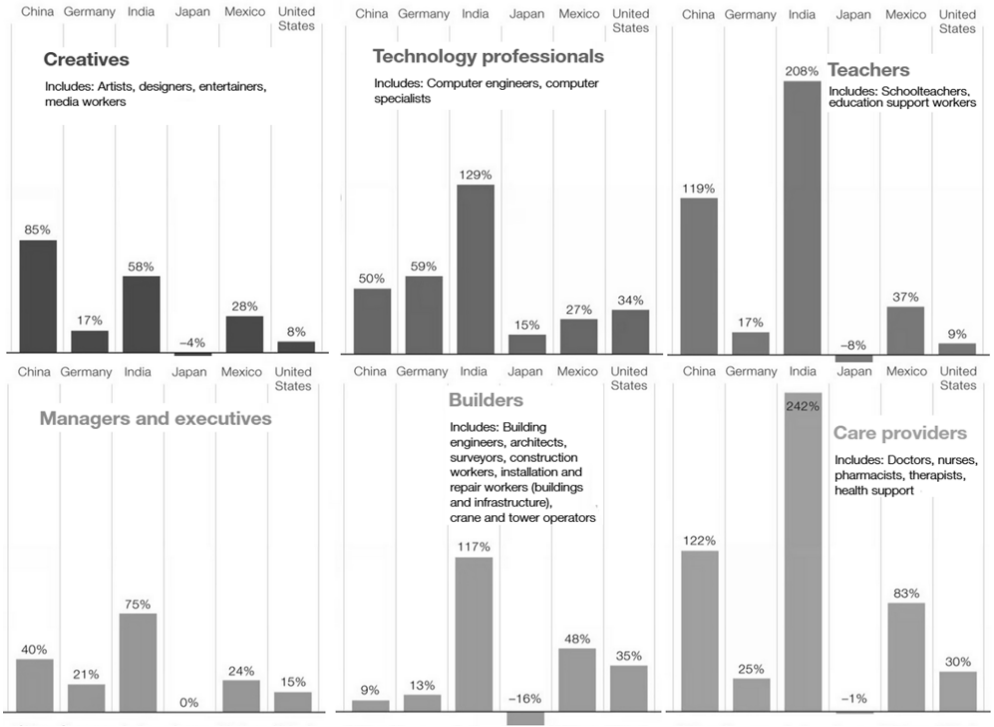
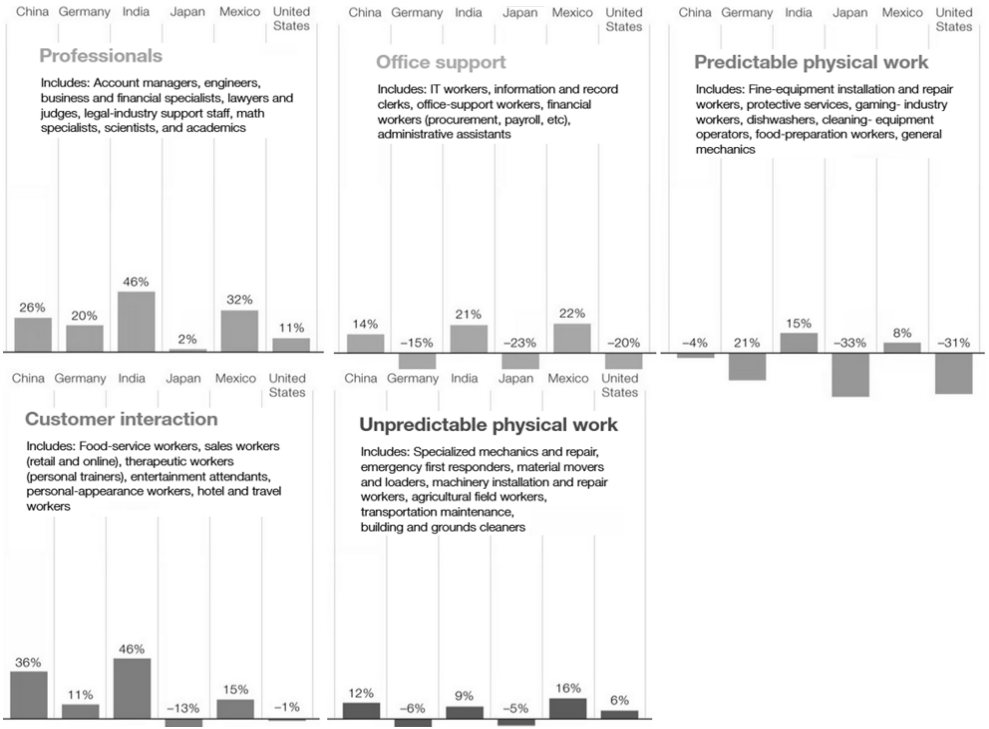



**Figure 2. Employment growth and decline by occupation, % change labour demand, midpoint automation**

*Source: developed by the authors based on McKinsey Global Institute (2018) report*




**Continuation Figure 2. Employment growth and decline by occupation, % change labour demand, midpoint automation**

*Source: developed by the authors based on McKinsey Global Institute (2018) report*

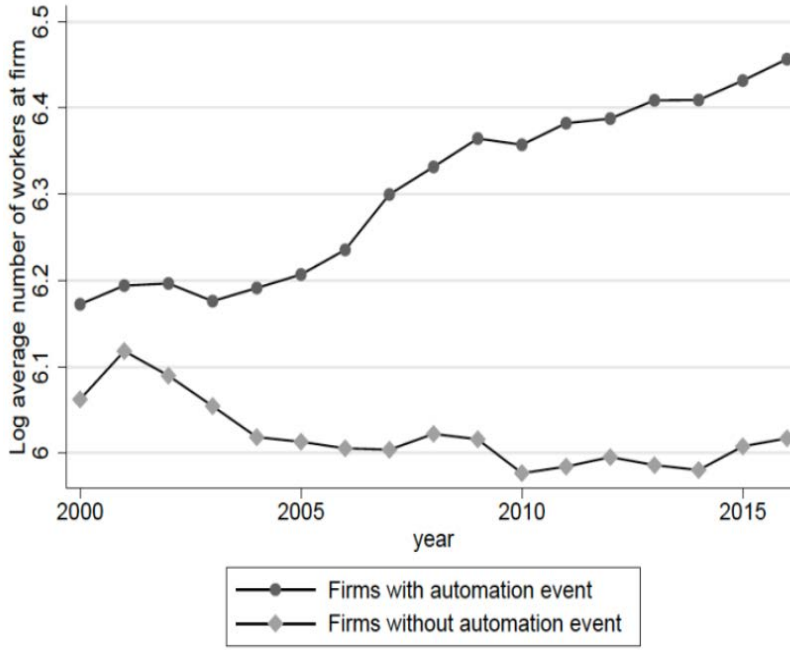



**Figure 3. Employment at firms making major automation investments and not, Netherlands**

*Source: developed by the authors based on Casey M. article (2020) data; Bessen J., Goos M., Salomons A., Berge W. article (2020) data*

Firms that have implemented automation demonstrate dynamic quantitative growth in personnel, and conversely, firms that have not automated their production are stagnating. Summarizing, we can draw the following conclusions:

Firstly, there is no direct evidence that employees in firms lose their workplaces after production automation;

Secondly, however, we observe higher rates of job switching among employees during automation;

Thirdly, older employees in automated companies may change the scope of their work or become self-employed, retiring early after leaving the automated enterprise.

While these short-term measures may not reflect long-term employment outcomes as technology continues to improve, they provide evidence that firm owners need to pursue strategies to reduce the risks to employees as they move from one job to another. Examples of successful strategies include unemployment insurance, expanding access to education and training, and providing relocation benefits.

Specialists from the Hungarian Loránd Eötvös Research Network analyzed the distribution of employees by probability of automation (Figure 4).

As shown in Figure 4, employees in agriculture (69%) and industry (61%) are most vulnerable to automation, while employees in the service sector (31%) are less vulnerable. Let us take into account that the service sector has a high proportion of administrative and intellectual professions that require a high level of qualifications and responsibility, as well as professions that require the personal presence of an employee or individual service. A similar distribution of susceptibility to automation is shown in the labour markets of Finland and Norway.

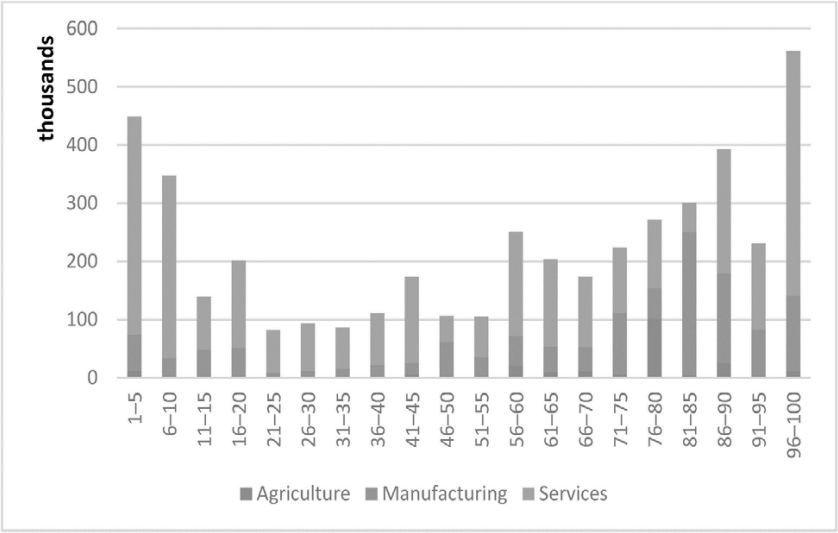



**Figure 4. Breakdown of employees by susceptibility to automation and industry per person**

*Source: developed by the authors based on Illessy M., Huszar A., Mako C. article (2021) data*

Let us examine the distribution of Hungarian employees according to their propensity to automate by gender (Figure 5).

In Hungary, the propensity for automation by gender is almost the same (a little higher for men – 45%, for women – 43%). Finland and Norway show the same results. However, Hungarian experts say that many professions traditionally performed by women in Hungary and elsewhere are difficult to automate, especially in the fields of education, vocational training, nursing and care.

Professor of economics, Nir Jaimovich, from the University of Zurich, Itai Saporta-Eksten from Tel Aviv University, Yaniv Edith-Levi from the University of British Columbia (Vancouver, Canada) and academician Henry Xu from the University of California (USA) in the article "Macroeconomics of Automation: data analysis, theories and policy" investigated the impact of automation on the labour market [20]. The authors emphasize the need to:

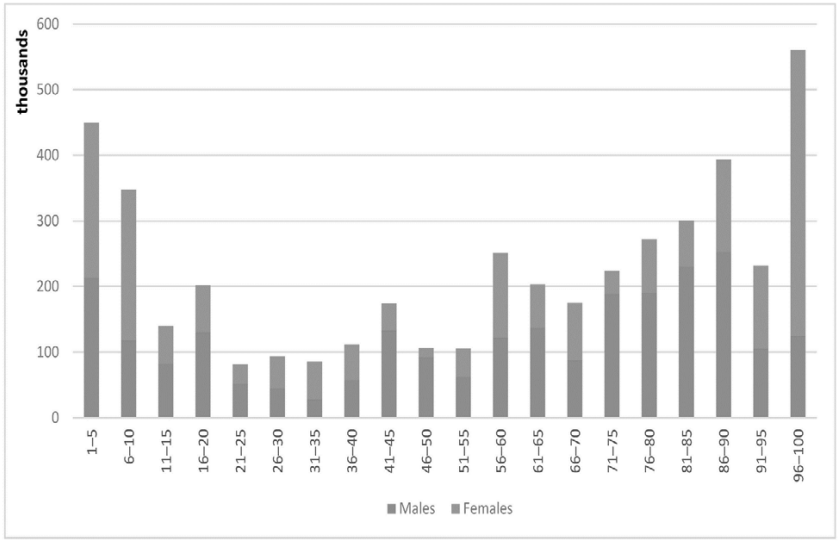



**Figure 5. Breakdown of employees by susceptibility to automation and gender per person**

*Source: developed by the authors based on Illessy M., Huszar A., Mako C. article (2021) data*

– Implement the program for retraining low-skilled employees and raising taxes on highly-skilled employees, which will ensure overall economic growth and labour efficiency;

– Increase the unemployment insurance, which redistributes more income towards low-skilled employees and thus reduces inequality and leads to higher wages for low-skilled employees employed;

– Implement the universal basic income scheme, which is based on the redistribution of higher income towards low-skilled employees, will help reduce inequality; employed low-skilled employees will receive higher wages;

– Reduce the labour tax rates for low-skilled employees, which activates their participation in the labour market and reduces transfers; reduced transfers do not lead to loss of tax revenues.

## 4. Conclusion

In the conclusion of this study, it is important to identify strategies for adapting social and labour relations to the technological challenges of today. To prevent the risks of digital transformations, it is advisable to focus on such strategic areas of labour market development:

– Implementation of state incentive programs by using administrative and financial levers to create new types of workplaces. The possible solution should be to support areas of the economy where the human factor is almost impossible to replace with a robot or neural system.

– Legislative slowdown of the spread of technologies. This strategy is far from forever involving the implementation of new laws against technology, but many existing laws can be used to inhibit automation processes. For example, laws prohibiting fully autonomous vehicles from operating on public roads hinder the development of self-driving taxis and trucks and protect drivers from losing their workplaces for a while.

– Preservation of the structure of the social and labour sphere in state and regional medium-term and long-term strategies of socio-economic, industrial, innovative, digital development. To compensate for short-term risks, it is necessary to use institutional mechanisms of state regulation, in particular, to carry out budgetary financing of retraining programs for employees who are most susceptible to digitalization; to expand the mechanisms of social protection, including employees of non-standard

(non-standardized) employment forms; to stimulate social responsibility of business in the digital segment.

– Reforming the education system in accordance with the requirements of the digital working environment, wider use of digital media in education.

– Acceleration of the social adaptation of the population to the challenges of the digital economy, which consists in the mandatory constant improvement of the qualification level and promotion of new skills in the interactive space of the digital ecosystem. Active policy on the labour market, continuous training. Thus, with the advent of digital platforms, some professions are being automated and others are being reorganized. New alternative employment forms are used, in particular flexibilization – flexible remote or unstable employment; innovative models of labour relations are established, such as the gig economy, which is based on short-term contracts or informal agreements. The COVID-19 pandemic acted as a catalyst for the modern transformation processes of the labour market, in the conditions of which the remote work format forced employees to master computer and digital technologies. The impact of digitalization on the labour market prompts the world's leading companies to support proactive training of personnel at risk of dismissal, to stimulate intra-company mobility of employees with additional payment for the development of additional specialties, and to conclude inter-company agreements on the joint use of labour force in case of changing labour market conditions. In the long term, a fundamentally important tool for unemployment insurance and expanding access to education should be the mutual recognition of educational diplomas and comparability of qualifications by EU countries, as well as the diversification of the educational process using franchise programs, dual education.

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