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**INNOVATIVE TECHNOLOGIES AS A NEW SOCIAL  
CHALLENGE IN THE LABOR MARKET**

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***Abstract***

The study aims to identify changes in the labor market resulting from the development of innovative technologies in the modern world. The article covers the following research questions: the disclosure of the essence of labor as an economic category and the definition of prerequisites for the introduction of innovative technologies in the workplace, the analysis of future innovative technologies implemented at workplaces, the study of possible changes in the structure of the labor market due to the digitalization of the economy, the forecast of possible job cuts caused by automation and robotization of industries. In the near future, digital technologies will change the labor market and working conditions throughout the world: automata and robots will replace a number of jobs in the labor market. The main reason for the change in the structure of the labor market is seen in the rapid spread of digital technologies, the automation of production and technological processes, and the ability to work remotely and save costs. A forecast of changes in the number of jobs on the basis of a mathematical model is made. It is proved that in modern conditions, the rapid development of innovative technologies and the digitalization of the economy cause global changes in the structure of the labor market, approaches to the organization of jobs, training requirements, retraining of specialists and their professional development, which determines the need to identify changes in the labor market as a result of the development of global innovative technologies.

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**Keywords:** Innovative technologies, labor market, digitalization, automation, robotization.



## **1. Introduction**

The 21st century is the century of new technologies, new challenges for all spheres of economic life of society. Digital technologies in the near future will change the labor market and working conditions around the world, including in Russia. Today, the traditional office work is changing; over the past 2-3 years, companies have begun to hire employees for remote work. This is due to the rapid spread of digital technology, automation of production and technological processes in companies. Increasingly, large banks, corporations, and IT companies are looking for employees to work remotely as programmers, call center operators, and customer service specialists, while reducing the number of offices and office workers. Many companies create such a business model that allows them to have the smallest number of full-time staff, hiring part-time specialists to work on strictly specified deadlines. Thus, automation and outsourcing are becoming increasingly popular for companies, thus leading to a tendency to hire independent contractors and part-time employees. Under these conditions, new social challenges arise in the labor market due to the development of innovative technologies because automata and robots will force out people, and jobs will remain for only those whom they cannot replace.

## **2. Problem Statement**

In modern conditions, the rapid development of innovative technologies and the digitalization of the economy cause global changes in the structure of the labor market, approaches to the organization of jobs, training requirements, retraining of specialists and upgrading their skills, which predetermines the need to identify changes in the labor market caused by the development of global innovative technologies of the modern world.

## **3. Research Questions**

To achieve the goal of the study, we discuss the following research questions:

- the essence of labor as an economic category and the definition of prerequisites for the introduction of innovative technologies in the workplace;
- the analysis of future innovative technologies implemented at workplaces;
- the study of possible changes in the structure of the labor market owing to the digitalization of the economy;
- the forecast of possible job cuts due to automation and production robotization.

## **4. Purpose of the Study**

The purpose of the study is to identify changes in the labor market caused by the development of global innovative technologies.

## **5. Research Methods**

To identify changes in the labor market caused by the development of global innovative technologies, the authors used the following research methods - the method of induction, deduction, synthesis and formalization. In conducting the study, the authors also used the methods of comparative

analysis and processing of statistical information. The authors relied on the hypothesis that the rapid spread of innovative technologies in the organization of jobs serves as a new social challenge for the labor market.

## 6. Findings

Labor has played and still plays a significant role in the existence and development of human society and each member of the community. Thanks to the work of tens of thousands of generations, modern civilizations have been formed, considerable experience has been accumulated, and a huge potential of productive forces, wealth and benefits for humans has been created. At all times of the development of humanity, labor has been the main type of human activity and the most important production factor; it forms the material well-being of a person, the world view and spiritual state.

The main part of human activity is carried out consciously on the basis of internal motives and needs. At the same time, the conscious part of the activity of people is divided into labor and non-labor parts; researchers consider their correlation during the period of human activity. Three criteria are used to distinguish labor from non-labor:

- 1) in a broad sense, labor activity is creation of material benefits for oneself and for others; at the same time, activities related to the reproduction of vital activity, restoration of working capacity, development of human personality and physical abilities and opportunities (eating, traveling, walking, going to the theater, cinema, medical procedures) are not labor;
- 2) labor itself is a purposeful activity, which results in the acquisition of certain knowledge, skills, abilities, goals that an individual learns from the society; at the same time, aimless activity is not labor since it is the expenditure of human energy that does not give positive results;
- 3) only non-prohibited (legitimate) activities are related to labor; prohibited activities are not labor, as they can be aimed at misappropriating the results of other people's labour and are associated with criminal activities (arms and drug trafficking).

The history of the development of the theory of labor goes back to the great theorists of the world: A. Smith, K. Marx, F. Quesnay, B. Say, D. Ricardo, A. Turgot and others. For example, K. Marx in his economic manuscripts of 1857-1859 wrote that labor itself in the indicated sense is an economic category and is considered as a means for creating wealth in society. It is a starting point of modern political economy (Marx, 1923). A deep and interesting analysis of the modern concept of labor is given in the UN Human Development Report *Work for Human Development* (Analytical statement, 2015). Further development of human society is impossible without the development of new technologies and labor, and on their basis new productions.

Today, labor is becoming a tool for self-expression and self-assertion of an individual and their intellectual, creative and moral dignity. In the last 2-3 years, the concept of labor went beyond the concept of a workplace. This is due to the fact that the rapid development of new technologies is changing the market and working conditions. Modern states and society are becoming extremely important to adapt to the "digital onslaught" and to understand how digital resources and systems can be used to create new jobs and new opportunities for the development of society, at a time when the technological revolution is "crowding out" many workers in traditional professions.

Researchers point out that many workers are still losing out in competition with new technologies and are trying to determine how people will be able to cooperate in the future, rather than compete with innovative technologies, using them (Menshchikova & Sayapin, 2016; Popkova, Sozinova, Grechenkova, & Menshchikova, 2018). For example, Brynjolfsson and McAfee (2012) argue that in recent years, the pace of industrial automation has increased due to the emergence of new technologies, such as robotics, electronic inventory management, computer numerical control machines, voice recognition, e-commerce, biometrics and others. As A. McAfee states, "... while digital progress grows the overall economic pie, it can do so while leaving some people, or even a lot of them, worse off" (Brynjolfsson & McAfee, 2012, p. 10). To find the best way to help them, we must first correctly diagnose the problem. Being optimistic about digital perspectives, we stress that the average worker is losing ground under the onslaught of modern technologies.

If we look ahead into what will happen in the next 10-15 years, we can assume that the machines will replace many jobs, since the market economy requires companies and enterprises to constantly improve production efficiency. According to the latest research of the World Economic Forum (WEF), by 2020, automation and robotization in many sectors of the economy in the global labor market will ensure the emergence of 2 million new jobs but will reduce 7.1 million jobs. New jobs will appear in intelligent and high-tech industries, while a lot of jobs will be reduced in administrative work and the real sector of the economy (Official website of the World Economic Forum). According to forecasts of experts of the International Monetary Fund (IMF), the labor market will be influenced by two groups of factors: the development and introduction of digital technologies and the socio-demographic situation in the world (Official website of the International Monetary Fund). Also, according to the IMF, 65% of children who went to school in 2018, in 15-20 years will receive professions that are currently non-existent. And the reason for this will be the widespread introduction of large numbers, mobile and cloud technologies, the Internet of things. Experts agree that the active introduction of automation and robotization will be beneficial for the economy as a whole, but it will increase social tension and inequality. According to a study by the global institute McKinsey, by 2030 due to the introduction of automated systems and robots, between 400 and 800 million people may lose their jobs (Bughin et al., 2018).

In the next 10-15 years, digital technologies will change the labor market and working conditions throughout the world, including in Russia. Automata and robots will force out people, leaving the jobs of those who cannot be replaced by robots and automata. Even today, the traditional office work is changing, in the next years companies will keep hiring part-time staff to work remotely, which is explained by the rapid spread of digital technologies and the automation of production and technological processes in companies. Increasingly, large banks, corporations, IT companies are reducing the number of offices and office workers, replacing them with robots or transferring employees to remote work. This applies primarily to those employees and specialists who are in demand on a part-time basis or can work remotely - IT specialists, accountants, recruitment managers, sales managers, editors, layout and content of newspapers, magazines and books (Kulikov & Kudryavtseva, 2017).

Today, many companies are working on such a business model that allows them to have the minimum amount of staff in full-time employment and outsource some of the work to part-time staff. After all, it is believed that the most expensive and the least flexible staff in a company are employees in

full employment. Companies have to pay high taxes for permanently employed full-time employees, and to provide social guarantees (social package, medical care and insurance premiums, medical and compulsory insurance). Such an employee costs the company 30-40% more than an equivalent independent operator. Automation and outsourcing are becoming more popular for companies, which leads to a tendency to hire independent contractors and part-time employees (Analytical statement, 2017). Therefore, many countries will have to change labor laws, abandoning the outdated structure of the labor market. For example, in Germany, the labor law reform was carried out; the part-time week and the status of non-permanent employee were legalized and the labor relations between the employer and the employee were specified.

According to the American economists Katz and Krueger (1992), in the United States over the past ten years, the entire net increase in employment amounted to alternative labor relations with remote employees and independent contractors, and not full-time jobs. Companies are separating the workplace from the work down instead of creating new jobs. Some jobs are being transferred to several specialists. For example, the position of marketing director was imputed to marketing strategy consultants, professionals, social network contractors and RP agencies. The world is moving towards the situation, in which the employer and the employee may never meet and live in different countries, and there will be no geographical boundaries in the labor market. In other words, it will be possible for the company to hire a remote worker, to control machines and robots from another country.

The employee can perform several jobs simultaneously in different countries, without coordinating with the employer. Consequently, the employer is becoming “conditional” for the employee. It must be admitted that permanent employees will not disappear completely and forever. The company will always need a small number of top managers, valuable specialists and talented professionals who are in demand in this or related industries. Companies will hire them on a permanent basis to provide some stability, continuity and quality of work. In the next 5-10 years, a large number of large companies with the staff of 2-3 permanent employees may emerge, thanks to the introduction of new digital technologies. No offices will be needed, employees will be able to work from home or in general from anywhere in the world.

The development of digital economy will not only change the conditions and organization of labor, but also lead to the displacement of labor by artificial intelligence. This will affect many spheres of human activity: industry, accounting and legal services, banking and financial services. New technologies, automatons, robots will force out many professions, and biometric automated systems will replace the profession of security guards on the labor market in the near future (Plotnikov, 2018). It should be noted that in Russia there are 1.5 million people or 2% of the working-age population of this profession, which will increase the number of the unemployed.

Currently, biometrics makes it possible to secure your accounts in the network in a simple and reliable way: using biometrics (face image, voice recording), people will be able to enter social network mail by unlocking their phone or smartphone. In the near future, a combination of modern mobile technologies and biometrics for personal identification can be installed in office buildings, factories, workshops, and banks. In the coming years, biometric recognition systems will be installed in cities, and it will take several minutes to determine, a thief at a parking lot or a burglar in an apartment.

The biometric system will not make the job of a guard unnecessary, but it will also reduce the number of police officers, investigators. In miniature, a similar system is already working in Singapore, and you can evaluate the pros and cons of such a system.

The jobs of a driver and tractor driver might disappear soon. For example, in China, unmanned shuttle buses and taxis are used, and in Singapore, unmanned tractors and harvesting machines operate on the fields.

Unmanned vehicles have already driven almost 500,000 km on the roads of the United States without accidents. Experts expect that already in 2019-2020, 3.7 million unmanned vehicles will leave the assembly line. Unfortunately, there will be no Russian producers there; these will be two Asian (China and Japan) manufacturers and one European (Germany) (Degryse, 2016).

The choice in favor of unmanned vehicles today is actively discussed by experts. It is estimated that in Russia in 10 years, 8.1 million drivers (5.4% of the working population) can increase the number of the unemployed. In Russia in the six months of 2018, about 70 thousand road traffic accidents (RTA) occurred, and nearly 7 thousand people were killed in these accidents. The most common causes of accidents are rain, snow, and ice, lack of lighting, speeding, driver fatigue, and drunk driving. An unmanned vehicle with artificial intelligence practically does not make mistakes and does not get tired. In 20 years, the traffic police service will not be needed; today it has about 500 thousand employees, the number of trauma units in hospitals will sharply decrease, and their employees will join the unemployed. In industry, automata, robots and artificial intelligence that will control their activities will lead to a massive dismissal of workers. There will be no need for operators of machine tools and mechanisms, assembly workers serving the conveyor. Already today, hundreds of millions of robots are used in factories around the world. Compared to humans, robots have a lot of advantages, they make almost no mistakes and can work 24 hours a day, 7 days a week. This will reduce production costs and increase labor productivity and increase efficiency.

In September 2018, cashier robots started work in supermarkets in the cities of Moscow and St. Petersburg, which, according to experts, will displace 1.5 million workers from the labor market within three years. Scientists from the Novosibirsk academic camp have created a loader robot that collects and loads 400 orders in 1 hour, and a person performs only 10 orders during this time. Today, robots in greenhouses water, monitor temperature and humidity and displace working personnel from greenhouses.

Within 10 years, 1 million loaders and about 200 thousand greenhouse workers will be able to join the unemployed. One can name a lot more jobs, which will not be in the near future: watchmen, concierges, postmen, logisticians, packers, foreman, inspectors, etc.

Also, from July 2018, a single biometric system intended for remote opening of accounts, deposits, and receiving loans began to work. Using biometric solutions, Rostelecom subsidiaries Vision labs and PTlabs announced the beginning of the development of Paperless Bank, an innovative solution. If such a model is implemented, the number of bank employees will be just 2 or 3 people. In general, biometric solutions will allow creating a repository of control biometric templates for remote bank employees to authorize their access to information systems and confirm the authority to conduct transactions from anywhere in the world. The introduction of biometric recognition technologies in the bank will allow

customers to use many services at a new level, customers of the bank will be able to practically serve themselves, and smart robots will prompt, give advice and answer questions.

Currently, the State Duma is considering a draft law on smart electricity metering systems, which will include Smart Meters, capable of transmitting remotely indicators, and sensors, which allow monitoring the operation of power grids quickly and reporting on failures 24 hours a day. It is planned that after January 1, 2020, all new buildings will be equipped with intelligent electricity metering systems. As a result of this project in Russia, more than 200 thousand different controllers will lose their jobs.

In the coming decades, 3D printers will be widely distributed and become especially popular. Today, such printers allow you to print parts for small industries, spare parts for car repairs. Scientists successfully carry out experiments on the reproduction of living tissues: if it is necessary to replace the venous vessel, then the doctors in the clinic will be able to print these fabrics on a printer and replace them. Thus, it is possible to produce anything. Technology 3D printers will change the current understanding of many production processes, and accordingly, many specialties will undergo a major upgrade. In the next five years, 3D printers will be able to print not only small items, but also large objects, such as the construction of houses. And in the future, the foreman will have to master a wider range of knowledge and skills, or this profession will not be needed, and a highly qualified specialist will appear in place of the foreman, who will be able to manage complex engineering equipment, control production and economic processes with the help of an IT program, and enterprises will be able to reduce costs, using one or more of such qualified professionals.

All this will change our current understanding of the economy, consumption and distribution. Professions will not disappear in one day or even a year, but those who live today will be able to observe this. By 2030, in Russia the market of the unemployed can replenish 10-12 million people (Sitnikov, 2017). According to a WEF study (Official website of the World Economic Forum), global trends indicate that big data annually allows the world to reduce office workers by 6.06%, and specialists engaged in maintenance, repair, and installation of equipment by 8%; the number of jobs in industry will be reduced annually by 3.6%, while in transport it will be about 1%. But on the other hand, the factor of using big data increases the number of jobs in mathematics and computing technology by 4.6%, in the financial sector by 1.34%, and sales by 1.25%, in management by 1.39%. It should be noted that employment will be reduced in sectors with a large proportion of unskilled labor, and it will increase in the sectors where management of complex technological and economic processes is required. The global tendency is such that there will be 3-4 times more jobs to cut than to create new ones.

The study showed that one of the notable trends in the second decade of the 21st century is the reduction in the number of jobs in connection with the digitization of the economy and other areas of the use of human labor. It should be noted that the trend of reducing the number of jobs will continue because of automation and robotization of production and other areas where human labor is used, and more and more people will lose their jobs every day (Menshchikova, 2018).

Using a complex logarithmic function, one can calculate how fast the number of jobs in a particular profession will be reduced.

Let the number of people employed in the textile industry  $S$ , and due to automation and robotization of production, the number of jobs is reduced annually by  $\mathcal{P}$ %, then a year later there would be employed:

$$S_1 = S - \frac{S\mathcal{P}}{100} = S \left(1 - \frac{\mathcal{P}}{100}\right),$$

that is, the initial number of employees will decrease by  $\left(1 - \frac{\mathcal{P}}{100}\right)$  times, the next year the number of employees will be:  $S_2 = S_1 \left(1 - \frac{\mathcal{P}}{100}\right)$ . Having substituted the value  $S_1$  in the equality  $S_2$ , we obtain:

$$S_2 = S \left(1 - \frac{\mathcal{P}}{100}\right) \left(1 - \frac{\mathcal{P}}{100}\right) = S \left(1 - \frac{\mathcal{P}}{100}\right)^2.$$

The number of employees that will be in  $n$  years can be written as equality:  $S_n = S \left(1 - \frac{\mathcal{P}}{100}\right)^n$ . This equality can be solved using the logarithmic function:

$$\frac{S_n}{S} = \left(1 - \frac{\mathcal{P}}{100}\right)^n, \quad n = \log_{\left(1 - \frac{\mathcal{P}}{100}\right)} \frac{S_n}{S} = \frac{\lg \frac{S_n}{S}}{\lg \left(1 - \frac{\mathcal{P}}{100}\right)}.$$

If we assume that 200 thousand workers were employed in the textile industry and the number of jobs annually will be reduced by 6%, then we can calculate how many years later the number of employees will decrease by two times:

$$S_n = 200000 \left(1 - \frac{6}{100}\right)^n = 100000 = 200000 \left(1 - \frac{6}{100}\right)^n, \\ \text{r.e. } 1 = 2 \left(1 - \frac{6}{100}\right)^n, \text{ or } 0.5 = \left(1 - \frac{6}{100}\right)^n.$$

$$\text{This equation can be solved using the logarithm of } n = \log_{0.94} 0.5 = \frac{\lg 0.5}{\lg 0.94} \approx 11.1.$$

Thus, in about 11 years, the number of people employed in the textile industry will be halved. Using the exponential and logarithmic function, it can be calculated that by 2035 in Japan, robots will perform up to 50% of all work, in the USA and in the UK, 47% and around 35%, respectively.

According to forecasts published by MS Kinsey Hobal institute experts (Bughin et al., 2018), by 2055, half of the existing jobs in the world will be eliminated thanks to automation and production robotization. More than 1.1 billion people will lose their jobs and lose a salary of between \$ 16-20 trillion.

The rapid introduction of automata and robots into production and other spheres of human activity will generally be beneficial for the economy, but it will increase social inequality and increase stratification in society. Automation and robotization of production will lead to an increase in labor productivity and a rapid growth in total world gross domestic product with a real decrease in the number of people producing it. It should be recognized that automation will actively contribute to the rapid enrichment of the owners of these machines and will also lead to even greater inequality in society.

In the 21st century, the global trend will be a growth in the uneven distribution of income between the poor and the rich. Due to the further spread of artificial intelligence, the poor will become even poorer.



According to the Israeli historian Yuval Noi Harari (Harari, 2016), “the introduction of robots into work processes will lead to the division of humanity into two classes: the class of “powerful superhumans” and the class of “useless” people. The social consequence of automation will be an unlimited increase in the number of unnecessary people whom the world community will be able to feed but cannot provide with work. For humanity, this will create an extremely uncomfortable psychologically habitat; people will feel that they are not needed by society.

Even today, in different countries, measures are being proposed to combat the growth of unemployment from the effects of automation and the robotization of the economy. For example, in Finland, since January 2017, an experiment has been conducted on the payment of unconditional mandatory income of 650 euros per month to 2,000 citizens. A similar experiment was also conducted in Switzerland. Certainly, compulsory income guarantees earnings to all who could lose their jobs, including from automation and robotization of labor. In the US, there is a state program to retrain all those who have lost their jobs due to automation or production robotization. In 2016, deputies of the European Parliament proposed to impose a special tax on the owners of robots, which would go to social payments to all those who lose their jobs due to the introduction of robots.

The task of any country is not to try to urgently take measures to combat unemployment during the technological leap, but to foresee such a development of the situation in the labor market and to start working on a program to retrain current employees, think about how to change the tax and labor law. For example, an individual built a production department using a 3D printer, purchased technological equipment and ten robots to work on this equipment, and hired a specialist living in the United States to manage these robots using the Internet technology. A reasonable question arises - who and how will pay tax? In the conditions of emerging digital economy, automation and robotization, it is important to provide new ways of development in industry, commerce, law, medicine, and research. The main task should be to ensure that humanity does not compete with machines but competes with the help of machines. In this vein, the programs of universities and business colleges should be aimed at preparing students for a successful career in the digital economy of the future, and not at preparing students for full-time employment. The faster higher education institutions restructure their training programs to meet the demands of the digital economy, the faster the labor market will respond to the needs of the economy. It is not worthy that in the next 3-5 years, the functional responsibilities of state and municipal employees, who will perform their work duties, not necessarily in the office, will change; many of the civil servants' responsibilities (public services, property registration, driver's licenses, passports, etc.) will be taken over by banks and IT companies, but today it is difficult to say whether it will be banks, IT companies or some conglomerate of them.

## **7. Conclusion**

Thus, the study confirmed the hypothesis that the rapid spread of innovative technologies in the organization of workplaces is a new social challenge for the labor market, which is caused by global changes in its structure, approaches to the organization of jobs, training and retraining requirements, and improvement of professional skills.

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