

SUSTAINABLE DEVELOPMENT OF THE GLOBAL LABOR MARKET IN THE CONTEXT OF THE TRANSFORMATION OF THE INDUSTRIAL COMPLEX OF THE DIGITAL ECONOMY

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Abstract

The relevance of the study is due to the fact that the current global labor market is under the influence of the IV industrial revolution (Industry 4.0). The purposes of the study are to assess the risk and impact of cyclical and sudden trends affecting the labor market and, as a result, the forms of labor organization and labor functions of employees. In this regard, authors considers academic theories in the context of conceptualizing the impact of Industry 4.0 on the labor market and labor functions, and identifies long-term trends in the transformation of the professions market. The empirical basis of the study is information prepared on the basis of open statistical data of Rosstat and the Ministry of Science and Higher Education of the Russian Federation, as well as resources of analytical publications and scientific publications, including materials from international organizations, leading consulting companies, global associations, leading educational institutions and other active participants in the global educational environment and labor market experts. The study examined a list of trends affecting organizations, their strategies and business models; describes the impact of trends on the transformation of current professions and the emergence of new ones; the need for skill sets necessary to match these professions has been identified. The scientific novelty of the study lies in the substantiation of the concept shifted in favor of a highly skilled workforce (skills-biased technical change, SBTC) and the theory of displacement of routine labor (routine-biased technological change, RBTC).

Keywords: global labor market, business models, industrial complex, transformation, digital economy.

I. Introduction

The development of a digital economy based on the production, dissemination and consumption of information causes major socio-economic shifts, including in the field of labor relations, while changing the type of professional activity and the nature of labor itself. In the digital economy, the accumulation of material wealth ceases to be the main goal of society, intangible values and interests come to the fore [1]. The new nature of labor is associated with the improvement of the qualifications of workers, their constant training and creative communication. The development of the labor market based on digital technologies leads to the modernization of labor relations: in communication between employers and contractors, there is an active use of

information and communication technologies (hereinafter referred to as ICT) and the formation of new norms of behavior. Until now, the domestic labor market has remained virtually unchanged under the influence of digital technologies, but the accelerating digitalization of the economy poses new challenges for industries and the state that they have not faced before. The problems of employment in the digital economy acquire a new meaning. Human and social capital are considered as key sources of wealth, which requires a conceptual shift in people's consciousness from the position of "profit maximization" to the position of "utility maximization". Thus, the period of the emergence of the digital economy requires a quick response to changes in the labor market, investments in human capital and new ways of its qualitative improvement, adaptation to new conditions, and program measures from the state. The current global labor market is under the influence of the IV industrial revolution (Industry 4.0). The labor market does not exist in a vacuum: it is influenced by many trends, changing strategies and business models, the image of employees, their set of competencies and responsibilities. Trends, in turn, are formed under the influence of social and technological factors. Industrial revolutions are one of the most important technological trends affecting the job market. The concept of the IV industrial revolution was proposed by the President of the World Economic Forum Klaus Schwab at the Hannover Industrial Exhibition in 2011 [3,5]. Initially, the term denoted a project of the German government to digitalize production. However, the term was successfully borrowed by other countries and is now used everywhere. Unlike the III industrial revolution, which implies the automation of only certain processes, Industry 4.0 is to digitalize the entire production and create a single ecosystem in which enterprises, products and consumers are connected and interact with each other using new digital and social technologies [1,8]. Trends like these are causing massive change: certain segments of the workforce become obsolete and abolished, and emerging professions that the labor market is in need of are instantly in short supply. For many workers, this means either the loss of a job or a major change in career trajectory. At the level of organizations and the state, there is a need to overcome emerging personnel and skills gaps through the creation of mass retraining programs. Let us consider the impact of cyclical and sudden trends affecting the labor market and, as a result, the forms of labor organization and labor functions of workers. We live in a challenging era: the situation of the coronavirus pandemic has been superimposed on the ever-increasing pace of technological change. According to the 2021 BCG report, 36% of employees worldwide have lost their jobs or experienced a reduction in working hours [1,2]. This is especially true for areas related to tourism, media, art and creativity. Anxiety and excitement in the face of uncertainty are not only experienced by those whose activities have been affected by the pandemic: more than 66% of employees have the desire or need to change jobs, regardless of their profession, income or geographic location. Anxiety is also rising due to the growing level of automation and digitalization: 41% of employees are more concerned about technological changes and their impact on the workplace than before the pandemic [3,4]. In Russia, half of the working-age population - more than 35 million people - is at risk of replacing labor with digital and automated solutions. 80% of able-bodied Russians are not ready to work in modern markets. Some areas of work become obsolete and abolished, and emerging new professions in which the labor market is in need are instantly in short supply. Therefore, the majority of employees are ready to retrain to ensure their peace of mind in the future, and are already putting considerable effort into this: last year, more than 66% of employees devoted at least two weeks to their own training. Today, many companies are in unique circumstances: employees have a strong internal demand for their own development, which is also synchronized with the need of organizations for constantly learning proactive employees. The most successful companies have been testing retraining programs for several years that preserve internal human resources by providing employees with a smooth transition from one role to another or the opportunity to improve their

skills in their current position. The situation of the coronavirus pandemic was superimposed on the ever-increasing pace of technological change, and also spurred the acceleration of the consequences of long-term trends: the disappearance of a number of obsolete professions, the emergence of previously unknown specialties, an increase in the duration of an active career, and much more. In order to contain the spread of the virus since 2020, numerous measures have been taken around the world in accordance with the recommendations of the World Health Organization, from physical distancing, restrictions on freedom of movement and the closure of non-essential businesses and organizations, to the isolation of entire cities in various regions. In response to the crisis and the restrictions associated with it, organizations began to actively introduce new technologies and business models into work processes, which led to the formation of new trends in the labor market. The purpose of the study is to assess the impact of cyclical and sudden trends affecting the labor market and, as a result, the forms of labor organization and labor functions of employees. In this regard, the author considers academic theories in the context of conceptualizing the impact of Industry 4.0 on the labor market and labor functions, and identifies long-term trends in the transformation of the professions market. The scientific novelty of the study lies in the substantiation of the concept, biased in favor of a highly skilled workforce (skills-biased technical change, SBTC) and the theory of displacement of routine labor (routine-biased technological change, RBTC) [5].

II. Methods

We can assume two vectors for the development of the labor market in the context of the digitalization of the economy. The first scenario, an optimistic one, is based on the fact that the labor market in the digital economy is in need of creative people who are able to think creatively. Manufacturing will generally not need people, but they will be needed for the “human-centric” services, as robots in the near future will not be able to replace creativity, invention, design, programming and maintenance of themselves, the organization and adjustment of production. Technologies for online control of robotic equipment will be developed, which will require a large number of online operators [6]. Thus, the introduction of AI and robots in the manufacturing sector should be seen as an expansion of technical capabilities. In addition, digital technologies will enable older workers and workers with disabilities to better integrate into the market, while machines perform dangerous and routine work. People will be able to more actively use their freed time for other work or leisure, for creativity and the provision of innovative services. With the timely development of educational programs and their implementation with the help of the state, the transition from old professions to new ones will become less painful. Personnel of the “digital era” will ensure the production, storage, processing and implementation of information, create unique knowledge, and manage it [7]. New digital technologies have a number of features that positively affect the labor market. First, the use of modern digital job search portals allows candidates to improve their career opportunities by accessing an extensive database of current vacancies. Thanks to the Internet and special web services, the transparency of information about both employing companies and potential job seekers has increased significantly. In the United States, more than 130 million people are registered on the LinkedIn platform, which is a significant proportion of the US working population. In turn, various social networks play a significant role, from which you can get a lot of useful information about employers and employees. Second, digital platforms increase productivity as they more closely match the applicant's profile to the job offer. In addition, they reduce unemployment, as well as reduce shadow employment and job search time. Examples include digital platforms such as Uber and YouDo, whose business models are based on the efficient matching of supply and demand levels in the labor market. Thirdly, the

introduction of modern digital tools in all spheres of life contributes to the emergence of new professions and jobs. In the past, a significant proportion of the population initially worked in the primary sector (production of raw materials, such as agriculture and mining). During the first industrial revolution, this trend changed: a significant part of the working population moved into the secondary sector (manufacturing industry). However, from the beginning of the world wars to the present day, there has been a trend towards the development of the tertiary sector (service), which today employs 70% of workers. According to some authors, the fourth and fifth sectors will soon appear, which include information services and services that require high intellectual standards [7]. In preparing the study, the data obtained in the course of our own quantitative study conducted in September 2021 in the format of an online questionnaire were used. The survey involved 211 specialists from Russian organizations from 26 fields of activity responsible for personnel training and development, among which: - 38% - HR directors; - 30% - specialists of training and development departments; - 16% - training directors; - 16% - respondents who are responsible for personnel development, but their positions have a different name (vice president for employee experience management and organizational development, director of internal development, head of HR, etc.). Participants of the survey were asked seven closed-ended questions that dealt with the following topics: skills gaps among employees of organizations; the skills that their retraining programs focus on; forms and technologies used in the organization of retraining programs (the effect obtained through the introduction of such initiatives). In recent decades, the influence of the following long-term trends on the professions market has been noted [2]: - IV industrial revolution and digitalization; - changes in the content of labor functions and a decrease in the share of non-routine operations; - demographic changes, including the increase in life expectancy and the aging of the population; - orientation of business to specialists with a wide range of developed skills and their requirements for organizations; - development of a culture of continuous education. Other trends are developing as a result of sudden crises, including the coronavirus pandemic: - the development of new systems for the division of labor and work formats; - accelerating the pace of automation; increasing the pace of development of electronic commerce; - the need to adapt human resources (HR) and educational processes to the conditions of uncertainty and turbulence. The following trends related to Industry 4.0 [7] affect the work processes of organizations:

- network integration, which allows all elements of the ecosystem to interact with each other;
- intelligent technologies that automatically collect and process information for decision making;
- flexible automation, which provides remote control of production processes.

Thus, the global technological trends affecting industrial production are: 1. Intelligent technologies. Automatically track the occurrence of events and provide information for decision making. 2. Network integration. Provides communication between individual network nodes and improves access to information. 3. Flexible automation. Includes response mechanisms, actual automation and remote control. Advances in technology and automation have a direct impact on the job market. According to OECD estimates published before the coronavirus pandemic, in the next 15–20 years, about 15% of current jobs will disappear due to automation, and another 32% will require retraining due to new business demands [6]. A study by the World Economic Forum points to the elimination of 85 million positions by 2025, while robotization will create 97 million new jobs. The greatest demand is expected for specialists in the field of data and artificial intelligence, content creation and cloud computing [9]. In such conditions, the organization of advanced professional retraining and advanced training programs for current employees becomes a competitive advantage for companies. A number of academic theories conceptualize the impact of Industry 4.0 and indicate long-term trends in the transformation of the professions market. Among such concepts, one can single out the theory of technological progress biased in favor of a highly skilled workforce (skills-biased technical change, SBTC) and the theory of displacement of

routine labor (routine-biased technological change, RBTC). The SBTC theory emphasizes the increase in demand for highly skilled labor and highlights the demand for skills related to digitalization and information technology [10]. The RBTC theory points to the serious impact of digitalization on the labor market. The demand for positions associated with non-routine intellectual tasks is increasing; at the same time, the demand for positions based on easily automated routine (cognitive and physical) actions is decreasing.

With the development of automation, a significant decrease in the share of routine tasks in the duties of employees is expected. In addition, the need to produce highly competitive products and services requires staff to be able to effectively interact with each other and with a potential consumer of an innovative product. As a result, there will be an increase in the number of professions associated with non-routine operations based on high expertise, as well as with such universal competencies as cooperation, communication, critical thinking, creativity and other socio-emotional skills. Therefore, retraining in the field of developing soft skills is becoming an inevitable and important element in adapting organizations to new conditions and preparing employees for a different type of task. Thus, according to a study by WeWork and Workplace Intelligence, 53% of company employees want to work from the office less than three days a week after the end of the pandemic [2,3]. Managers need to think about retraining programs for such specialists now, as new work formats will require them to have more advanced communication and digital skills.

III. Results

The digital economy requires completely new skills and competencies. To leverage digital technologies effectively and scale up business nationally and internationally, organizations need employees with the right mix of technical, business, interpersonal and creative skills. In the current conditions, basic skills (the ability to write correctly, count, etc.) [8] are clearly not enough anymore - you must also have business and interpersonal qualities. Critical to any manufacturing process or service delivery are state-of-the-art technical skills, complemented by leadership-level skills (C-suite level, entrepreneurial) specifically tailored for digital management. For employers, the so-called "soft skills" of potential candidates have recently become a priority: personal qualities and social skills, for example, the ability to work in a team, curiosity, initiative, critical thinking, self-management, the ability to solve complex problems, interact with different people to prioritize. At the same time, as noted by some leaders of large organizations, the role of formal diplomas and certificates of education has significantly decreased. Top companies such as Google, Apple, and IBM, as well as international consulting giant Ernst & Young, do not require college degrees for employment—relevant experience is sufficient. But this is not always mandatory. The main thing that a candidate must do is to show that he really suits the vacancy for which he is applying. New working conditions require new skills – digital [9]. "Digital skills" is generally understood as a set of skills in the use of digital devices, communication applications and networks to search for and manage information, create and distribute digital content, interact and collaborate, and solve problems in the context of effective and creative self-realization, learning, work and social activity in general. The trend towards the formation of new work formats also affects the mobility of employees. More and more specialists prefer to work remotely in organizations whose offices are located abroad or in smaller cities within the country [5,6]. So, in the United States, a large outflow of population in 2020 was observed from New York, San Francisco and Boston. At the same time, small regional cities, such as Madison, Jacksonville or Salt Lake City, have shown large population growth over the past year. With the active introduction of new formats of work, retraining of specialists plays a first role, as organizations need to quickly

train employees in remote team management, skills in working with digital tools, leadership and decision-making in times of crisis. The pandemic crisis has accelerated the process of automation and significantly affected the willingness of companies to adopt new technologies. Before the pandemic, the level of adoption of cloud computing, big data analytics and e-commerce technologies had already taken shape and is holding a high bar. However, companies are now seeing an increase in interest in implementing encryption and cybersecurity technologies, artificial intelligence and robotics.

Artificial intelligence has a higher potential for implementation in the field of information and communication technologies, financial services, healthcare and transport. Big data analytics, the internet of things, and robotics will have wider applications in the mining and metallurgical industries. At the same time, it is planned to actively introduce encryption and cybersecurity technologies in the public sector. An additional factor stimulating the need for retraining is the redistribution of current tasks between humans and robots. Data from the World Economic Forum indicates that by 2025 even more tasks will be automated using robots. Thus, the introduction of new technologies accelerated by the pandemic will help significantly stimulate the economic growth of almost all industries and will create an increased demand for new professions and a set of skills. Early launch of retraining and skills upgrading programs in the company will help to avoid a decrease in the level of efficiency of work processes [10].

In the context of the pandemic, the automation of industries based on repetitive operations has significantly accelerated [7-8]. The manufacturing and trade industries have 30% more operations that can be automated compared to sectors where business processes are not based on repetitive operations (education or healthcare). In industries with high operational productivity, the automation potential is 1.3 times higher than in other industries. If earlier organizations planned the phased introduction of certain technologies, then as a result of the pandemic, most companies have an urgent need for specialists working with information security, cloud technology security, etc. This need has increased the need for retraining of personnel and determined the priority content of these programs. The market for professions is undergoing significant changes today. According to the World Economic Forum, by 2025 the global labor market will see an overabundance of data entry specialists, secretaries, payroll specialists, auditors and accountants, as well as production workers and administrators [8]. The trend towards a decrease in demand for these professions is generally typical for Russia, where the coronavirus pandemic has significantly accelerated the pace of automation and digitalization of business processes. Therefore, the data on changes in the demand for professions in Russia do not differ much from those in the world. Positions that involve the performance of a large number of routine operations will be automated and forced out of the labor market. At the same time, there is a demand for new technological professions. For example, there is a growing need for IT professionals and professionals in digitalization and automation (for example, operators of equipment with digital program control), artificial intelligence and machine learning, as well as analysts and data scientists. In addition, there is a growing need for managerial personnel, specialists in business conduct and in the field of sustainable development. Cyclical trends and sudden crises not only change the demand for professions, but also affect the skills requirements of existing professions. Technologically more advanced economies require more sophisticated and knowledge-intensive skills [6]. A good example is the evolution of agricultural professions. Initially, the requirements for the heads of agricultural enterprises included mainly an understanding of the peculiarities of growing certain crops. However, the current skill requirements have changed due to the growing demand for skills in data analysis in the field of agro-industrial complex, the development of biopharmaceuticals and innovative technologies, food safety and e-commerce. This is also why the employment of workers and specialists from

countries with less developed economies for similar positions in more developed countries, as a rule, occurs with preliminary retraining. An increase in the number of tasks and an increase in the knowledge intensity of the technologies used are characteristic of all industries, including manufacturing, IT, medicine and education. Now more and more companies require knowledge of programming languages from future engineers, from medical workers - the details of modern pharmaceuticals, and from teachers - an understanding of the principles of operation of digital educational platforms. In such conditions, the demanded specialists of the future need to have a certain set of knowledge and professional skills [7]. The business of a high-tech industrial company can be improved by digital technologies, but not replaced. Not a single production function has disappeared yet - only transactional ones are leaving. Therefore, it is worth talking not about the disappearance of professions, but about their transformation and/or unification. Due to intensive digitalization, automation and robotization, the ability to use artificial intelligence technologies, one person can have skills from 2-5 professions. This does not mean that the concept of a profession is gone. She remained and was enriched with functions that were previously adjacent to her. At the same time, the view on the intensity of labor and the requirements for people with a higher level of knowledge have changed. One of the reasons for the emergence of conditionally new, but in fact a significant change in existing professions, is technological progress. For example, if earlier the diagnosis of malfunctions of locomotives was carried out manually, in fact by tapping and ringing, visual diagnostics, now this requires the skills to read safety devices. Today, a locksmith should not only be able to wield a wrench, but also read instrument indicators, work with equipment [9]. 3D technologies and prototyping technologies will definitely be actively used in our production, so we need the appropriate specialists. In their companies, employees are not faced with disappearing or disappeared professions, however, there is a serious change in the functionality of existing ones. For example, robotization leads to significant changes. All sorts of remotely controlled robots are already actively used in production: drones flying, moving along walls and penetrating hard-to-reach areas, so there is a high need for such specialists. In this regard, there is an urgent need to train both current employees and university students in these skills. Nevertheless, the functional content of some positions will change. For example, the driver of a load-and-dump machine will remain so, but the machine itself will change. The board will become more robotic and automated, and the participation of the driver-operator will be minimal, observant and controlling. A similar situation will be with a number of other professions and specialties. There is a request for cross-disciplinary positions requiring a combination of financial and business analysis, business planning and advanced technical skills. In the context of a pandemic and automation, for almost all changing professions, understanding the remote economy will be important. The report of the Hamburg School of Applied Sciences, supported by the European Commission, focuses on digital and soft skills.

IV. Discussion

In the coming decade, entirely new professions will emerge that will require a different set of unique skills. Under the influence of radical technological breakthroughs in the 21st century, a significant number of new professions have already emerged. For example, the invention of the airplane became the basis for the emergence of such professions as a pilot or flight attendant. The emergence of genetic engineering has led to the emergence of geneticists, reproductive physicians [3]. Thus, innovative scientific and technological changes can create demand for previously unknown professions. New professions are professions that have emerged as a result of a radical change in technology in the production of goods and the provision of services and require special

knowledge, skills and abilities to perform new types of labor operations. The formation of new professions is influenced not only by technological innovations, but also by social ones. The introduction of payment systems using plastic cards has given rise to an entire industry of workers associated with this activity. The development of insurance medicine led to the emergence of the profession of a health insurance agent [4]. The emergence of network forms of interaction between people has served as a source of such highly paid professions today as a blogger or a broker on an electronic exchange. Special foresights can be used to predict new professions. Foresight (from the English foresight - "foresight") is a social technology that allows you to create a forecast for the development of an industry, region or country. There are various skills foresight technologies. The Skills Technology Foresight methodology includes three special foresight sessions: - technology foresight aimed at building a vision for the future of the industry and professionals working in it, or revising an existing vision; - forecasting skills based on technological foresight; - recommendations to the education system, policy makers and labor market stakeholders aimed at closing the gap between future demand and supply of skills. The work of each session takes place in groups, where, with the help of a moderator, experts representing an industry or foresight subject collectively create an integrated map of the future using special cards. Since 2014, under the auspices of the Agency for Strategic Initiatives, using the Skills Technology Foresight methodology for the purposes of vocational guidance and the choice of educational trajectories, the Atlas of New Professions has been developed and updated. Using this technology, Russian specialists and experts predicted the emergence of 300 unique professions in 27 industries [8]. Forecasts about the professions of the future can additionally be made on the basis of an analysis of existing scientific and technological trends and directions for the development of the labor market. An analysis of existing materials on the topic of new professions suggests the emergence of the following popular areas in the coming decades.

One of the most common types of employment in the digital economy is working from home instead of moving to the office during the working day. In addition, the following types of work have appeared: during vacations (on a train, on an airplane, in a hotel), for a foreign employer without going abroad (for example, the work of offshore programmers), etc. The development of labor relations in the digital economy leads to the replacement permanent staff by temporary workers, and many jobs can be performed thousands of miles from the office and even across national borders. A notable trend in recent years has been the very rapid growth in the number of freelance freelancers. Thus, in the United States alone in 2017, there were 57.3 million people working in freelance mode (including part-time jobs), which is 36% of the working population of the country [9-10]. As a result, the new labor relations contribute to: - a significant reduction in transaction costs (rental of office space, recruitment, transportation costs); - introduction of flexible labor organization and flexible staff; - increase in labor productivity (due to the elimination of obstacles to work that exist in the office); - increasing motivation (increasing trust between the employer and the employee); - Improved customer service (24/7, no overtime pay). In the digital economy, not only the nature of labor is changing, but the entire system of labor relations. If in the traditional economy there are vertical economic relations of management / subordination between the employee and the employer, then in the digital sector the manager is no longer so much a boss as a person coordinating the work of people, sometimes located at a great distance from each other. Accordingly, vertical connections are replaced by horizontal ones, while the employee's dependence on the head of the company is significantly weakened [8]. An increase in the independence of an employee forms a special kind of partnership between him and the manager, requiring a corresponding increase in trust. The specialist himself forms a portfolio of orders, agrees on the scope and timing of the work, as well as the amount of his own remuneration. The qualification and authority of the performer provide him with a constant

replenishment of the portfolio of orders. Therefore, there inevitably arises a rejection of the “one job for a lifetime” philosophy and a desire to independently form and manage a portfolio of works. It is also important that digital employment provides new opportunities for both residents of cities and residents of the “outback”: workers who were previously forced to move from the provinces to the capital in order to be present at the central office, today can live in any locality that has access to the Internet.

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