Abstract. The ongoing fourth industrial revolution, characterised by the technological singularity, has introduced significant changes in the development scenarios of the global and Russian economy. The changes caused by the new technological mode occur with exponential acceleration, which inevitably transforms the way of life, culture, education model and forms a new system of values, which implies replacing the existing model of human capital with a standard set of highly specialised skills with a new model that promotes the development of flexible skills and abilities on the basis of interdisciplinary approach to learning. In this regard, the article is devoted to the study of transformational forms of employment, its standard and non-standard forms, as well as to the identification of adaptive capabilities of human capital to new forms of employment in the conditions of digital and structural transformation. The methodological basis of the study was the provisions of economic theory and macroeconomic analysis. Based on a comparative analysis, the adaptive capacity of human capital to new forms of employment was evaluated. The research allowed us to classify transformational new forms and types of employment, identify the main features of new forms of employment, identify the main professional skills in demand in the conditions of digitalisation, and propose possible options for the adaptation of human capital in the era of digitalisation.

1 Introduction

Digital transformation and Industry 4.0 conditions and the technological singularity, which is already a reality, do not allow to strategically build one certain model of economic development, as the above-mentioned processes become a trigger of constant transformations. Technological Singularity is a presumed point in time after which the development of technological progress will become so rapid and complex that technology itself will be beyond human comprehension. At the same time, the instability and turbulence of the global and domestic economic space due to geopolitical and biological (SARS-CoV-2 coronavirus infection) factors has led not only to the transformation of the spatial structure of the global and domestic economic system, but also to a rethinking of
civilisational values, in which the key role is given not to artificial intelligence and digital technologies, but to human beings with their skills and knowledge, capable of making another technological breakthrough to solve the problems of the modern world. In this regard, the study of the problem of human capital in the conditions of "Industry 4.0", characterised by the mass introduction of cyber-physical systems in production and new forms of employment, is of particular relevance, as new operational models are formed in the flexible interaction of virtual and physical production systems, and in this context the synergetic effect is based on the gradual erasure of boundaries. In this regard, the most important task on the solution of which the competitiveness of socio-economic systems of various countries depends is the creation of new workers and the adaptation of people to new forms of employment in accordance with the needs of the digital economy. Under these conditions, the development of human capital in terms of the formation of new knowledge and skills, as well as competences adapted to new forms of employment, is the driving force of the digital economy. This, in turn, actualises the study of the transformation of forms of employment in the digital economy. As is known, human capital represents inherited and acquired skills, knowledge, abilities of a person used in the production of goods and services in a certain period of time in order to obtain benefits [1]. It is known that the concept of "human capital" differs from the categories of "human potential", "human resources", etc. Human capital being an asset, formed through investment, is an economic category and can be an object of purchase and sale in the labour market [2].

At present, the main global problem, including the scientific issue, is the blurring of boundaries between physical and virtual environments, when solving it, the task of human capital development arises. This is the task, the solution of which will ensure the long-term competitiveness of this or that economy, the strategically correct solution of which can create an opportunity for advanced development, and this is the sphere in which the competition between humans and artificial intelligence arises. At the same time we realise that so far the capabilities of artificial intelligence are far from those of humans, but the serious development of artificial intelligence has just begun and serious developments in this direction are being carried out in all developed and developing countries of the world. Research devoted to the development of artificial intelligence is actively financed by both government and business. At the same time, in our opinion, insufficient attention is paid to the issues of human capital development and its adaptation to new forms of employment, and the development of human capital was inertia until the pandemic caused by a new coronavirus infection struck and made serious adjustments to the way of life of the world community. This event, which accelerated the digital transformation of socio-economic systems many times over, confronted the world's economies with the need for accelerated transition and the formation of a digital economy. Today, we realise that there is a possibility of a serious leap in the development of the economy, as well as a serious lag behind the global development. As we understand, a leap in economic development depends on strategically correct management decisions at the state level, the key place among which should be the development of human capital and its adaptation to new forms of employment [2].

In this regard, given the uncertainty in the development of society and the difficulty of predicting all upcoming changes, we note that the issue of adapting human capital to new forms of employment should be guided by the demographic situation and its trends, as well as the existing structure of the labour market and modern requirements in the conditions of digital transformation of socio-economic systems. Industrialisation in the twentieth century changed the structure of the labour market towards reducing the share of those employed in agriculture. For example, in the USA with the beginning of industrialisation this indicator decreased from 50% to 5%, in Russia according to state statistics in 2020 the rural population is 26% and employment in agricultural production is 21%. These processes have...
In the conditions of digital transformation all over the world, the only differences are in scale and national peculiarities. The creation of new jobs with new operating models due to the digital transformation significantly changes the requirements for qualifications, and any introduction of new technology, depending on the degree of digitalisation and the level of technological sophistication. Society today is already facing new challenges, and the ability of people to adapt to them, the ability to develop their knowledge, skills and competences will determine the future development trajectories of a particular socio-economic system. The processes of automation, digitalisation and transformation in general change the system of social and labour relations, the form and volume of human labour and the labour market itself. Each stage of transition to a new level, inclusion of new information technologies entails changes in social and labour relations and labour sphere. There is a transformation of the traditional format of the labour market, forms of employment and a shift to the formation of completely new competences. New forms of employment are introduced without special rules. Special skills are subject to greater amortisation than general competences.

With the introduction of new information and communication technologies, the content of ordinary, standardised work functions is changing. New tasks for specialists are defined accordingly. New requirements to their qualification are introduced and the previously acquired competences of an employee become irrelevant on the labour market. The process of changes in social and labour relations, in the system of skills and competences of an employee and in the labour market has an accelerated character, as a result of which the existing education system cannot provide the real labour market with the demanded personnel. There are many questions related to the precarisation of employment at the present stage. This process affects more and more spheres of activity. First of all, it concerns jobs related to the fulfilment of complex cognitive and logical tasks, relying on technologies that complement the functions of workers.

The objective of this study is to investigate transformational forms of employment, its standard and non-standard forms, and to develop recommendations for adapting human capital to new forms of employment in the context of digital and structural transformation.

2 Materials and Methods

The materials were the works of foreign and domestic scientists devoted to the problems of human capital development and transformation of employment forms, statistical data of the Federal State Statistics Service and its territorial branches, data and reports of expert agencies and international organisations on the assessment of human capital development and new forms of employment. The empirical base, in addition to the above sources and the obtained scientific provisions on the basis of analysis and generalisation, was made up of materials published in international and domestic publications. The article used comparative analysis, systematic method with an emphasis on descriptive method, which influenced the integrity and validity of the obtained results.

The theoretical and methodological basis of the study is represented by the provisions of classical economic theory, the concept of human capital development, as well as a set of analytical and descriptive methods.

3 Results and discussion

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with digital transformation through the use of computer technologies, trends in the impact of digitalization on the labour market and labour relations were studied by R. Berger, J. Valenduk, P. Vendramin, V.B. Gould, M. Graham, G. Johnson, I. Dosen, N.L. Lyutov, V. de Stefan and others. Domestic scientists E.S. Kopkova and Y.E. Shatilo conducted research on the impact of the digitalisation process on employment and unemployment in the economy, S.D. Bodrunov, D.S. Demidenko and V.A. Plotnikov investigated the impact of automation on the reduction of employment and professional training of specialists [3; 4; 5; 6]. According to R.I. Kapelyushnikov, digitalization transforms the labour market itself and has a strong positive effect of technological progress on employment, especially in service industries and high-tech manufacturing industries. In particular, V.E. Gimpelson and R.I. Kapelyushnikov refer to non-standard employment as all forms of employment [7].

Some researchers considered non-standard employment in the context of the problems of "informal economy". For the first time non-standard employment and its scale in the second half of the 1990s were described in the works of S. Barsukova, T. Maleva, E. Sindyashkina, E. Paneyakh, where almost for the first time estimates of the scale of informal employment were presented and its features were described [6; 7; 8]. The domestic economic literature does not usually distinguish between the concepts of "non-standard employment" and "flexible employment". Many Russian researchers N.T. Vishnevskaya, T.S. Karabchuk, do not consider such a characteristic as employment flexibility. Under flexible employment we understand mutually beneficial relations between employer and employee, providing for flexible working hours, diversity of forms of recruitment and employment, variability of forms of social protection, etc. [9; 10; 11].

Generalisation of theoretical studies allows us to identify the following forms of flexible employment: part-time employment; flexible working hours; reduced working week; remote employment, temporary employment; work outside the office (usually at home) with or without the use of information technologies.

The conducted research allows us to identify the following as new non-standard forms of employment: outsourcing (outsourcing - the use of external services by the employer), outstaffing (outstaffing - taking personnel out of the staff schedule), crowdworking (crowdworking - the performance of certain parts (sections) of work by different performers in different areas), freelance (freelance - the performance of work on request without reference to a specific employer), copywriting - innovative employment [13; 14]. The logic of the study leads us to the need to determine the essence of non-standard employment and its difference from standard employment. Standard employment should be understood as full-time employment at an enterprise or organisation under the guidance of an employer, on the basis of an open-ended employment contract, supported by relevant social and legal norms. Non-standard employment, in turn, represents all forms of employment that, to a greater or lesser extent, do not fulfil the characteristics of standard employment. Non-standard employment, as it seems, fully contributes to the increase of labour flexibility, functional individualisation and development of non-standard forms.

In the scientific literature on this problem, there is no single approach to the definition of the essence of the category of non-standard employment. Thus, on the one hand, non-standard employment is an optimizing means in the emerging situation in the labour market, in the conditions of crisis of the socio-economic system, and on the other hand, there is the development of social and labour relations through the processes of digitalization. According to the ILO classification, there are standard (full), non-standard and freely chosen forms of employment. The main features of full employment are: work for a single employer providing decent living conditions; work in an organisation; standard workload of a working day (week, month). The absence of one of the presented features of standard employment is considered as non-standard employment.
Employment indicates non-standard or flexible employment. Forms of flexible employment include: part-time employment, temporary employment and work at home. This form of employment is characterised by uncertainty and instability. The spread of this form of employment depends on many factors: the sector of the economy, the gender and age structure of the labour force, the state of the business environment. Part-time employment is part-time labour. Temporary employment includes employment in which it is possible to accept a worker for a certain period of time (conclusion of a fixed-term labour contract, an agreement to perform a certain amount of work), seasonal work, casual work, etc. The basis of non-standard employment is the rational use of working time, which gives more advantages to the employer, while for the employee the situation worsens in terms of job security and the level of remuneration. Underemployment, as a phenomenon characteristic of the transitional economy, was caused by a drop in the volume of production in the country, and the only advantage for the employee in these conditions was the possibility of keeping a job. Working at home implies a form of employment in which the worker is engaged in labour activity at home, allowing for rational use of working time. It was one of the first forms of non-standard employment characterised by flexible working hours. Its negative sides were: risk of professionalism loss, impossibility to build a career in the organisation, social isolation. In modern times, this form of employment has changed into alternative telework due to the development of communication systems. For the first time in Russia this term was introduced by G.E. Slesinger [15]. There are various forms of telework. At the same time, flexible working hours have been preserved, and new advantages have appeared, such as the opportunity to combine professional activity and training, reduced control from the management, the opportunity to work for categories of citizens who cannot work in the usual mode, communication with colleagues and management via Internet resources.

This situation is taking place in many countries, and structural changes are taking place in the labour market, where traditional forms of employment are combined with new forms of labour organization. The main features of new forms of employment are: cooperation through digital platforms, organisation of work activities (remoteness from the workplace and use of information technologies). There is a strong demand for specific skills in the digital sphere, including computer programming, big data analysis and working with specialised software. The employee's universal competences (“soft skills”), especially stress resistance and group work (interpersonal communication) are becoming in demand [16; 17].

The main professional skills in demand in the future include: a systemic way of thinking; customer-oriented communication; programming and the ability to work with artificial intelligence at its various levels; the ability to navigate uncertainty in work; mastery of several languages (intermediate level); communication between related industries; teamwork in projects; multiculturalism.

Generalisation of theoretical and empirical studies, allowed us to categorise transformational-new forms and types of employment, which are shown in Figure 1.
Interdisciplinary professions at the intersection of several disciplines are becoming in demand. That is, they will replace or supplement existing ones. In the near future, we may see the following professions: online therapist, IT architect, digital linguist, time manager, biopharmacologist, robot developer, agrocyberneticist, etc.

For the transition to the digital economy, it is necessary, first of all, to train highly qualified personnel; for this purpose, it is necessary to introduce educational programmes in the most relevant areas. Organise joint training centres with leading technology companies to develop joint training programmes. Study the digital talent gap for enterprises. Creating an inclusive labour market with the opportunity to acquire digital skills for more vulnerable groups will require significant training efforts. The requirements of the modern labour market should include: continuous professional development, professional skills, perception of innovative solutions, mobility and formation of the ability to work in a team. The system of labour market regulation (compliance with the balance of jobs and labour resources) [18].

Consequently, we can say that the emergence of new flexible forms of employment is a mechanism of self-regulation and adaptation of the population to new external changes in the environment. The model of employment relations in the transforming environment should harmoniously combine both standard and non-standard forms of employment to ensure coordinated, balanced development that meets the needs of both the individual employee and the system as a whole.

4 Conclusions

The study of transformational forms of employment, its standard and non-standard forms, as well as the assessment of the possibilities of human capital adaptation to new forms of employment in the conditions of digital and structural transformation, allowed:

1. To classify transformational, new forms and types of employment due to the precarisation of employment, primarily concerning professional activities related to the

![Diagram](https://doi.org/10.1051/e3sconf/202343107032)

**Fig. 1. Classification of employment forms**

<table>
<thead>
<tr>
<th>Standard (full-time)</th>
<th>Atypical (flexible employment)</th>
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<tbody>
<tr>
<td>New forms of employment</td>
<td>temporary, home-based, part-time employment</td>
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<tr>
<td>Outsourcing, outstaffing, crowdfunding, freelancing, copywriting, telecommuting</td>
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performance of complex cognitive and logical tasks, relying on technologies complementing the functions of workers.

2. To identify the main characteristics of new forms of employment characterised by:
   - collaboration through digital platforms, organisation of work activities remoteness from the workplace, and the use of information technology;
   - the formation of a growing demand for professional skills in the digital sphere, including computer programming, big data analysis, and work with specialised software;
   - the demand for universal competences (“soft skills”), especially employee stress resistance and group work (interpersonal communication).

3. To reveal the main professional skills in demand in the context of digitalisation, characterised as: systemic way of thinking; customer communication orientation; programming and ability to work with artificial intelligence at its various levels; ability to navigate uncertainty; proficiency in several languages (intermediate level); communication between related industries; teamwork in projects; multiculturalism.

4. To propose possible options for adapting human capital in the era of digitalisation:
   - Adaptation of human capital to the new realities on the basis of transformation and formation of a system of continuous education with the possibility of mastering digital competences, creative and other necessary skills that allow to reveal human potential in the digital economy;
   - professional retraining, implemented through additional professional education, which will make it possible to fill the shortage of personnel in the labour market during digitalisation.

As a result, we note that the development of new professional competences to maintain competitive skills and knowledge in a specialist throughout the entire working life is possible with the transformation of the educational system focused on the formation of competitive human capital of the digital economy.

The adaptive capabilities of human capital to new forms of employment in the modern world are becoming the most important driver of success in the development of the digital economy. At the same time, it is clear that there is a need for new technologies for the development and adaptation of human capital, which can be formed and implemented by the education system. In this regard, there is a need for a state programme for the development of the education system, which would allow universities and business organisations to interact effectively in order to train the necessary highly qualified personnel.

References


International Economics

Educational Trajectory in the Conditions of Labour Market and the Transport Sector

S. A. Putilov, M. A. Bugaenko, D. V. Timokhin

Labour Market and the Transport Sector: Toward an Integrative Framework

A. V. Putilov, M. V. Bugaenko, D. V. Timokhin


Impact of Digital Technologies on Labor Market and the Transport Sector

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Regional growth and concentration and participation in

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Digital Transformations in the Transport Sector

A. A. Tarasyev, R. Delogu, G. V. Pulina, D. D. Horváthová Suleimanová, J. Čorejová

Diffusion of industrial robotics and inclusive growth:

V. A. Koksharov