Human Capital in the Digital Economy

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Abstract: Digitalization is an objective, inevitable and irreversible process, due to the penetration of digital technologies into the life and activities of modern society under the influence of progress in the field of microelectronics, information technology and telecommunications. In the digital economy, the importance of human capital is significantly increasing. The authors investigated the approaches to the interpretation of the concept of human capital presented in economics. The role of human capital in the context of technological structures is considered. Close relations between the level of human capital development and the achieved value of digitalization of the economy have been revealed. However, the continuing gap between these indicators and GDP indicates that in the economy of most countries of the world, the leading positions, in terms of contribution to GDP, are not always occupied by high-tech industries.

1 INTRODUCTION

In the modern economy, human capital is the main strategic development resource that has a direct impact on economic growth and social welfare, therefore, more and more attention in modern economics is paid to the formation and accumulation of human capital. The role of human capital is increasing in the conditions of transition to the digital economy.

"The impressive economic development of Japan, Taiwan and other Asian economies over the past decades clearly demonstrates the role of human capital in ensuring economic growth. Lacking natural resources - for example, they import almost all energy resources - and facing discrimination against their exports from Western countries, these so-called Asian tigers grew dynamically due to a well-trained, educated, hardworking and conscientious workforce using modern technologies" [1].

Investments in human capital today are one of the main directions of state policy in developed countries. It is the accumulation of human capital that can solve numerous problems faced by modern economies: slowing economic growth, increasing unemployment and polarization of incomes of the population.

2 METHODS AND MATERIALS

Since the time of A. Smith, most economists have recognized that the qualification of the labor force is one of the most important competitive advantages of the state. However, the origins of the modern theory of human capital date back to the 60s of the XX century, when T. Schultz and later G. Becker, representatives of the Chicago School of Economics,

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proposed their approaches to explaining the relations between investments in human capital and subsequent wages designed to reimburse the expenses incurred. In the future, the study of the phenomenon of human capital was developed in the works of P. Romer, R. Barro and R. Lucas, who proved that human capital is the determining factor of economic growth.

The theory of human capital is a complex one that combines the conceptual provisions of classical political economy, Marxist theory on the transformation of the workforce; the methodological potential of neoclassical theory, separate principles of institutionalism and neo-institutionalism.

The theoretical and methodological basis of this work was the applied and fundamental works of leading scientists devoted to the analysis of the processes of accumulation and use of human capital in modern conditions.

The authors used system and situational, historical and statistical approaches, methods of comparative analysis, synthesis, deduction, induction, construction of logic circuits and others.

The purpose of the study is to consider the features of human capital development in the context of the structural transformations currently taking place due to the change of technological patterns and the transition to the digital economy.

3 RESULTS AND DISCUSSION

The COVID-19 pandemic at the beginning of 2020 caused the active appeal of all countries of the world to the “cyber” space, accelerating the digital transformation that began several decades ago.

It is no coincidence that in some countries, after the outbreak of the epidemic, Internet traffic increased by 60%, which indicates accelerated digitalization caused by COVID-19. Widespread access to the Internet has allowed many companies and individuals to adapt to the crisis thanks to easy and fast interaction between people and organizations. As a result, many countries managed to pass the first wave of COVID-19, maintaining employment and production. In France, for example, companies that have rebuilt their operations online have managed to maintain from 70% to 80% of the traditional production volume [2].

Governments, as a rule, put digital transformation at the center of their political programs. In addition, governments are paying increased attention to the development of new technologies, such as blockchain technology and 5G infrastructure, and the latter is necessary for the deployment of broadband mobile communications, e-commerce and artificial intelligence applications. We are talking primarily about such countries as Australia, the People's Republic of China, Germany, India and Switzerland, France, Italy, where strategies for the development of blockchain technology have already been approved.

Today, it is obvious that digital technologies will continue to transform our way of life and the way we carry out professional activities.

The term “digital economy” was coined by Don Tapscott in 1997 [3, 4]. In addition, such terms as Internet economy, web economy, electronic economy, new economy are used. In 2001, T. Mezenburg structured the digital economy more clearly, highlighting the following main blocks in it: the electronic infrastructure of enterprises, including software, computing, e-commerce, the increase in the value of traditional industries through the use of digital technologies, the difference in the value of the digital economy's workforce compared to the traditional one, changes in the added value of products and services digital economy [5].

The topic of digital economy has become especially popular among Russian scientists only in recent years, since 2014. The concept of digital economy and the mechanisms of transition to it are considered in the works of such domestic authors as G.N. Andreeva, S.D. Bodrunov, S.Y. Glazyev, A.V. Keshelava, etc.

The digital economy is an economy that arises as a result of the merger of the real and virtual worlds, i.e. existing in a hybrid world, the distinctive feature of which is the ability to carry out all operations in the real world through the virtual one. The fundamental conditions for its functioning are high efficiency and low cost of information and communication technologies and the availability of digital infrastructure.

In the digital economy, data presented in digital format is considered as the main factor of production. As a result of their processing and analysis, the efficiency of various types of production, technologies, equipment, storage, sale, delivery of goods and services is significantly increased.

Digital technologies have provided a significant expansion of the information base, reduced information costs and led to the creation of information products. This contributed to a faster and easier search for information, its analysis and exchange, there was a strengthening of cohesion and the development of cooperation between all participants in economic activity.

Digital transformation penetrates into all spheres of the economy and society, forming a complex network of interconnections, overcoming formally existing borders between countries. In this regard, there is a need to review and modernize the State policy implemented at the national level. Currently, it is necessary that it should be integrated, flexible and focused on overcoming traditional isolation. Digital transformation can change the way government agencies work – at the local, regional and national levels through the use of digital technologies to stimulate innovation in public policy, increase efficiency and focus, conduct a thorough impact assessment and wider involvement of citizens and stakeholders.

The structure of capital itself is changing, and the intellectual component is taking more and more weight. This means that in the digital economy, human capital becomes the leading factor of production.

According to the OECD definition, human capital is “a set of knowledge, qualifications, skills and individual characteristics that contribute to the creation of personal, social and economic well-being. Human capital can be interpreted as an intangible asset that can provide increased productivity, innovative development” [6].

J. Stiglitz defines human capital as “a set of accumulated skills and experience that increase the productivity of workers” [7]. P. Samuelson and V. Nordhaus add that it represents “a stock of technical knowledge and qualifications that characterize the workforce of the nation and society as a result of investments in education and professional development throughout life” [8].

Growth theories have not paid due attention to human capital as a factor of economic development for a long time. Thus, for the neoclassicists, the contribution of the labor factor to the production of GDP was determined solely by its quantity. This is convincingly evidenced by the Cobb-Douglas production function [9].

Thus, the contribution of labor is measured by the amount of labor, while the influence of other characteristics: education, qualifications, experience is not taken into account. The factor of production labor is considered as an undifferentiated homogeneous labor force.

However, the Cobb-Douglas function proved unable to explain the pace of post-war economic growth, and already in the 50s many economists began to point out its limited nature. As a result, R. Solow, winner of the Nobel Prize in Economics, introduces another factor of production into the production function: the level of technology development, in turn, determined by technological progress, scientific knowledge, innovation, and creative abilities of workers [10].

Scientists J.-J. Carre, P. Dubois and E. Malinvaud come to the same conclusion, analyzing the economic growth in France in the period from 1950 to 1975. In their opinion, the high growth rates in France (on average 5% annually) are due to an increase in the contribution to production of this factor [11].

Human capital becomes the main factor of production at the fourth and fifth technological levels [12]. The fourth technological order (from 1930 to 1970) is based on the use of an internal combustion engine, production processes acquire a serial and mass character. Accordingly, the importance of highly skilled labor increases. At the stage of the fourth technological order, the role of science and education increases, and investments in human capital gradually begin to exceed investments in material production.

The fifth technological order (from 1970 to 2010) is characterized by the use of microelectronics, individualization of production and consumption, overcoming environmental restrictions. The information and communication sphere is gaining a high rate of development, the main production, economic and social processes are being informatized. The need for specific human capital is increasing.

The worker type of the fifth technological order can be characterized as post-industrial, whose work is based on obtaining and using new knowledge, creative and innovative approach to information processing, intellectualization of processes.

Currently, there is a transition to the sixth technological order (from 2010 to 2040), the key factor of which is nanotechnology, solar and nuclear energy. The sixth technological order is the “economy of free earnings”, which proceeds against the background of digitalization of economic processes, the creation of digital platforms.

The employee type of the sixth technological order is characterized as innovative with the ability to innovate, self-study, creativity, entrepreneurship. Lifelong learning is becoming the dominant trend.

In order to measure and cross–country compare the human capital development level, in 2018 the World Bank proposed a Human Capital Index measured on a scale from 0 to 1, where 1 is the maximum value.

Table 1: Indicators of countries by the level of human capital development, the level of digitalization of the economy and GDP.

	Country	Region	GDP, trillion dollars	Human Capital Index, country rating	Human Capital Index, value	Information and Communication Technology Development Index, country rating	Information and Communication Technology Development Index, the value of the indicator
1.	USA	North America	25035	24	0.76	16	8.18
2.	China	Asia	18321	25 Macau, China 46 China	0.76 0.67	26 80	7.8 5.6
3.	Japan	Asia	4300	3	0.84	10	8.43
4.	Germany	Europe	4031	11	0.79	12	8.39
5.	India	Asia	3468	115	0.44	134	3.03
6.	Great Britain	Europe	3198	15	0.78	5	8.65
7.	France	Europe	2778	22	0.76	15	8.24
8.	Canada	North America	2200	10	0.80	29	7.77
9.	Russia	Europe	2133	34	0.73	45	7.07
10.	Italy	Europe	1996	19	0.77	47	7.04
11.	Iran	Asia	1973	71	0.59	71	5.58
12.	Brazil	South America	1894	81	0.56	66	6.12
13.	South Korea	Asia	1734	2	0.84	2	8.85
14.	Australia	Oceania	1724	7	0.80	14	8.24
15.	Mexico	North America	1424	64	0.61	87	5.16
16.	Spain	Europe	1389	32	0.74	27	7.79
17.	Indonesia	Asia	1289	87	0.53	111	4.33
18.	Saudi Arabia	Asia	1010	73	0.58	54	6.67
19.	Netherlands	Europe	990	9	0.80	7	8.49
20.	Turkey	Asia	853	53	0.63	67	6.08

21.	Chile	South America	310	45	0.67	56	6.57
22.	Romania	Europe	299	67	0.60	58	6.48
23.	Czech Republic	Europe	295	14	0.78	43	7.16
24.	Peru	South America	239	72	0.59	96	4.85
25.	Kazakhstan	Asia	224	31	0.75	52	6.79
26.	Algeria	Africa	187	93	0.52	102	4.67
27.	Kuwait	Asia	183	77	0.58	71	5.98
28.	Morocco	Africa	142	98	0.50	100	4.77
29.	Ecuador	South America	115	66	0.60	97	4.84
30.	Senegal	Africa	27	121	0.42	142	2.66
31.	Gabon	Africa	22	110	0.45	114	14.41
32.	Haiti	South America	20	112	0.45	168	1.72
33.	Afghanistan	Asia	20	133	0.39	159	1.95
34.	Guinea	Africa	19	141	0.37	166	1.78
35.	Burkina Faso	Africa	18	144	0.37	162	1.9
36.	Lebanon	Asia	24	86	0.54	64	6.3
37.	Botswana	Africa	18	119	0.42	105	4.59
38.	Mozambique	Africa	17	148	0.36	150	2.32
39.	Benin	Africa	17	127	0.41	161	1.94
40.	Laos	Asia	16	111	0.45	139	2.91
41.	Jamaica	South America	16	85	0.54	98	4.84
42.	Mongolia	Asia	15	51	0.63	91	4.96
43.	Madagascar	Africa	15	140	0.37	169	1.68
44.	Guyana	South America	14	99	0.49	124	3.44
45.	Congo	Africa	14	120	0.42	171	1.55
46.	Chad	Africa	12	157	0.29	174	1.27

To assess the level of digitalization achieved by the country, the Information and Communication Technology Development Index can be used. The ICT Development Index is a combined indicator calculated on the basis of 11 sub-indicators (Internet access, cellular communications, tele systems, radio systems, IT infrastructure development, etc.).

We investigated the relations between the level of human capital development (Human Capital Index), the level of digitalization of the economy (Information and Communication Technology Development Index) and the achieved value of GDP (Table 1) [13, 14, 15].

When considering the global trends in the relations between the human capital index and the information and communication technology development index, it should be mentioned that a very close relations between them can be observed. While such relations with the level of GDP are not so obvious, the fact indicates that the industries that make the greatest contribution to GDP are not always high-tech.

The economy of the Russian Federation in these comparisons occupies 30-40 positions (while being on the 9th place in the world in terms of GDP). This is due to the fact that in the first 10-15 years of post-Soviet transformations, attention to human capital in Russia was insufficient, as a result of which systemic problems were formed, which are currently manifested.

On September 29, 2018, the main activities of the Government of the Russian Federation for the period up to 2024 were formulated [16]; its goals, main tasks and priorities for the implementation of breakthrough scientific, technological and socio-economic development were determined.

In the economic sphere by 2024 The Government of the Russian Federation will ensure the solution of the following tasks: creation of the digital economy legal regulation system based on a flexible approach to each area; creation of a global competitive infrastructure for data transmission, processing and storage mainly based on domestic developments; provision of training of highly qualified personnel; ensuring information security based on domestic developments in the field of data transmission, processing and storage, guaranteeing an increase in domestic spending on the development of the digital economy from all sources (as a share of GDP) by at least three times the level of 2017. Measures will be taken to introduce digital technologies into the practical activities of public authorities at the federal, sectoral and regional levels. Measures will be implemented to ensure the constantly updated human resources potential of the digital economy, the competence of citizens and training of personnel.

It is assumed that the share of households with broadband Internet access will increase from 79% in 2019 to 97% in 2024. There is no doubt that the digitalization of the economy is an important stage on the way to conscious growth and development of the country.

4 CONCLUSIONS

Digitalization is an objective, inevitable and irreversible process, due to the penetration of digital technologies into the life and activities of modern society under the influence of progress in the field of microelectronics, information technology and telecommunications.

In the near future, the main spheres of human activity – economics and management, science and security – will acquire a new form and content. In the digital economy, the importance of human capital is significantly increasing.

The work considers the role of human capital in the context of technological structures. Close relations between the level of human capital development and the achieved value of the economy digitalization have been revealed. At the same time, the gap between these indicators and GDP remains, which indicates that high-tech industries do not always occupy leading positions in the economy of most countries of the world, in terms of contribution to GDP.

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