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HUMAN CAPITAL IN THE DIGITAL ECONOMY AS A FACTOR OF SUSTAINABLE DEVELOPMENT

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Abstract

Digital transformation balances the risks and opportunities related to the development of human capital, while asymmetries arise in economics field and social sustainability. There is a need for continuous improvement, especially in terms of new competency development, due to the growth of information and emotional load, information leakage, digital failures, and the reduction in the rights of employees working remotely. There are risks associated with job cuts, including a fall in the real income of the population, discrimination against various groups of the population, and the growth of socio-economic inequality. Under these conditions, issues related to the access to information technologies for comprehensive professional and personal development are especially relevant. At the present stage, sustainable development, reduced inequality, the appropriate balance of supply and demand in the labour market, and responsible consumption are the priorities of governments. The purpose of this study is to identify the specifics of human capital development in the digital economy, including its trends and limitations. The analysis is based on scientific publications and expert opinions considering statistical and empirical data reflecting problems related to human capital development in the digital economy, culminating in cross-country comparisons of this development. The results of the study include a description of the challenges faced by various groups of the population and a systematisation of the factors that stimulate or restrain employment. The study then ranks the countries in terms of their human capital development in the digital economy.

Keywords: human capital, digitalisation, sustainable development, education, employment, innovation, cyber security

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ЧЕЛОВЕЧЕСКИЙ КАПИТАЛ В ЦИФРОВОЙ ЭКОНОМИКЕ КАК ФАКТОР УСТОЙЧИВОГО РАЗВИТИЯ

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Аннотация

Цифровая трансформация балансирует риски и возможности для формирования и применения человеческого капитала, при этом возникают асимметрии в области экономической и социальной устойчивости. Необходимость или вынужденность постоянного совершенствования, приобретения новых компетенций, стрессы из-за роста информационной и эмоциональной нагрузки, утечки информации, цифровых сбоев, уменьшение прав наёмных работников, перешедших на дистанционную занятость. Возникают риски общего сокращения рабочих мест и падения реальных доходов населения, риски дискриминации различных групп населения и роста социально-экономического неравенства. В этих условиях актуальны вопросы доступа к информационным технологиям при получении новых знаний, повышении профессиональной квалификации и всестороннего личностного развития на протяжении всей своей жизни. Содействие устойчивому развитию, сокращение неравенства, поддержание баланса спроса и предложения на рынке труда, стремление к ответственному потреблению – приоритетные задачи правительств на современном этапе. Цель исследования – выявить специфику развития человеческого капитала в цифровой экономике, тенденции развития, использования и ограничения. Анализ проводился на основе научных публикаций, мнений экспертов, с учетом статистических и эмпирических данных, отражающих проблематику развития человеческого капитала в цифровой экономике. Представлены межстрановые сравнения готовности к развитию человеческого капитала в цифровой экономике. К конкретным результатам относятся системное представление вызовов, с которыми сталкиваются различные группы населения, группировке факторов, стимулирующих и сдерживающих занятость населения, ранжирование стран по критерию условий развития человеческого капитала в цифровой экономике.

Ключевые слова: человеческий капитал, цифровизация, устойчивое развитие, образование, занятость, инновации, кибербезопасность

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1. Introduction

Scientific and technological progress evolve on the basis of existing scientific achievements. At the same time, the development of scientific and technical knowledge is disrupted on occasion by breakthroughs that fundamentally diverge from previous ideas. These discoveries serve as a basis for revolutionary changes in technologies used in a wide variety of areas of public life. Industry 4.0 is based on artificial intelligence, the Internet of Things, wireless communication, and robotics, enabling us to count on the effective implementation of concepts such as the Smart Factory, the Smart Supply Chain, and the Smart City (Rymarczyk, 2020). The current stage of digitalisation fundamentally differs from previous technological breakthroughs due to the scale of transformational processes that blur the boundaries between the physical, digital, and biological spheres of human life[1]. At the same time, the development of the digital world, with its potential for new challenges, should ensure the achievement of the sustainable development goals (UN SDGs) in conjunction with the economic, social, and environmental components of sustainability. The level of skill demanded in the labour market is rapidly changing, which creates both new opportunities and risks. Without investments in human capital, states will be unable to achieve sustainable economic growth and provide employment in the digital economy. Inaction in this area can be quite costly (WDR, 2019).

Modern economic and social reality as well as the environmental agenda have been determining the growing importance and new features of human capital, generating higher and constantly changing demands in the face of growing uncertainty (Koneva and Lisenkova, 2019). According to empirical research, the highest priority for companies in the field of information and communication when choosing a location is the presence of highly qualified specialists, which emphasises the high importance of human capital in the modern economy (Marinkovic et al., 2018).

The rapidly changing principles of workplace organisation are calling into question the previously highly valued role of work experience. The determinants of education and new competencies have become the priorities in studying the effectiveness of investments in human capital (Kelchevskaya and Shirinkina, 2019). Lifelong learning should become an unconditional imperative for every professional who desires to remain competitive under the conditions of digitalisation (Manakhova et al., 2019). Overall, states and individuals alike now recognise the need for the ongoing development of human capital.

Researchers have also recognised trends in the use of human capital at the stage of Industry 4.0, including the possibility of an overall reduction in the number of jobs, the flow of specialists to industries with the highest added value, and an increase in demand for job seekers with the necessary skills to work in the digital environment (Sima et al., 2020).

The fourth industrial revolution has given birth to technologies that improve the economic efficiency of business, the quality of public administration, and the level of comfort in everyday life. These positive effects stem from the automation and robotisation of production, wireless communication, and the development of artificial intelligence—which is devoid of human error and constantly striving for optimisation. As surveys in European countries have shown (WDR, 2019), new technologies improve the quality of citizens' life (67% of respondents), the state of the economy (75% of respondents), and public sentiment (64% of respondents).

The purpose of this study is to clarify the role and specifics of human capital development in the new digital reality, grouping factors that stimulate or constrain employment, trends in the use of human capital, and emerging risks in the field of inclusiveness, innovation, and security. Specifically, in the present study, the conditions for the development of human capital in the digital economy were analysed in different countries, with global indices presented by leading institutions used to then rank these countries accordingly the strength of these conditions for the development of human capital by country.

[1] Schwab, K., 2016. The fourth industrial revolution. World Economic Forum, Geneva.

2. Literature Review

The concept of human capital has undergone changes in a way similar to its role's development in the economic life of society. The theory of human capital, which appeared in the 1960s, understood this concept as a set of knowledge, skills, competencies, health, and motivation accumulated by an individual. Within this theory, each person was seen as an investor, weighing the marginal rate of a return on an investment in their education or health care with the return on alternative investments. In recent decades, human capital has been understood by economists in a much broader way. The image of a rational egoist who invests resources in himself in order to maximise his income has been replaced by the image of a person who appreciates both work and leisure, political and cultural events (Demidova et al., 2019). In addition, the concepts of 'knowledge' and 'skills' have been replaced by the concept of 'competencies' in the field of education. The latter are more focused on practical achievements and also imply personal qualities that are significant in the professional sphere of the individual.

The digital economy—based on the rapid development of knowledge and the creative approach to its use—determines the exceptional role of high-quality human capital in economic progress. The paradigm of the economic success of any organisation in the modern world is the rival innovation enterprises (Alexankov et al., 2017). The key competencies necessary for the development of innovative products and technologies form the basis of the competitiveness of the individual, enterprise, and national economy as a whole. In addition, important task for enterprises is the fair distribution of benefits from digital transformation (Manakhova, 2018; Balynin, 2020).

The digital transformation of various aspects of human life has had a significant impact on the development of human capital. The increased availability of information has contributed to the cultivation of humanistic values in society, the effectiveness of social lifts, the development of creativity, and the acquisition of additional knowledge (Koneva and Lisenkova, 2019). The use of information technology makes it possible to intensify the learning process toward becoming more interesting and accessible. Artificial intelligence technologies will contribute to the individualisation of the learning process in accordance with the personal characteristics of each student (Frolova et al., 2020). Massive online courses act as an additional learning opportunity for students and a marketing strategy for well-resourced universities aiming to expand the market (Laaser, 2018). Moreover, digital hubs contribute to the dissemination of personal skills and knowledge as well as the development of digital literacy, e-commerce, and business mentoring, making them a powerful tool for the advancement of rural communities and businesses in Europe (Dyba, 2020). A high level of integration of individuals in social networks helps prevent depression and reduces the risk of death from cardiovascular diseases, drug overdose, and suicide (Bochaver, 2019). Social networks and Internet forums are convenient platforms where medical professionals or people with rare and chronic diseases can share knowledge and experience. Online interaction between medical organisations and patients increases the level of comfort and quality of services provided. Moreover, AI-enabled monitoring of Internet traffic and mobile device data can improve the prediction of infectious disease outbreaks (McKeeetal, 2019).

At the same time, digitalisation does not only create new opportunities and improve the quality of human capital being formed, but also generates negative effects in education and healthcare. For teachers, the digitalisation of the educational space is accompanied by an increase in workload and the displacement of experienced teachers who do not possess the required digital competency level. For students, information can be distorted in the process of its transmission, leading to an increase in overload, the simplification of interpersonal communications, and, consequently, elevated difficulties in the development of necessary competencies. Another significant disadvantage of digitalisation in the educational field is a decrease in the level of training of students who do not need to memorise information available online (Frolova et al., 2020). There is also a certain concern about the possibility of several large companies controlling the global educational market in providing the primary software and information platforms for the educational process (Laaser, 2018). The Internet search queries of the individual user create an information cocoon around him, which ultimately narrows his horizons and presents

a simplified view of reality (Koneva et al., 2019). Cyber attacks made on medical systems endanger the personal data of patients. Moreover, media companies' collection of information about user searches and purchases can lead to privacy violations, including those in relation to health issues. In some cases, this can seriously harm a person—for example, the leaking into the public domain of information about the disease status of an individual applying for a prestigious position or the pregnancy status previously kept hidden by a woman. Additionally, fake news and misinformation spread over the Internet, such as self-medication or anti-vaccine beliefs, can result in irrational patterns of behaviour (McKee, 2019).

The fourth industrial revolution has brought about significant changes to the process of human capital development. Nowadays, information technologies overcome territorial and temporal barriers, creating opportunities for flexible and non-standard forms of employment. Thanks to digitalisation tools, young people, women with children, and people with disabilities— previously considered the most vulnerable groups—now enjoy an increased competitiveness and new opportunities in the labour market. The availability of smartphones and mobile Internet as well as the development of electronic payment systems have created new income-generating mechanisms for young and enterprising African women (Bailur and Masiero, 2017). Overall, there is a steadily increasing demand in the labour market for professionals in the digital environment field as well as specialists with the competencies necessary to work with digital tools (Corejova and Al Kassiri, 2016). There is also a demand for specialists with the skills to build effective communication in management, education, and marketing (Chinoracký and Čorejová, 2019).

Some researchers also discuss certain negative impacts of digitalisation on human capital functioning. Vulnerabilities in cyberspace and digital dependency lead to an uncertain institutional landscape and disruptive decision-making that blocks collaboration, ultimately reducing the effective use of human potential (Knox, 2018). Specifically, interviewing job applicants using digital mediation technology leads to worse results than face-to-face interviews. Job candidates also perceive remote interviewing as unfair and limiting their chances of success (Basch and Melchers, 2020). Overall, the boundaries between the time devoted to work and rest are blurred. Many employees take advantage of working from home to complete their household affairs during their work hours, while others, on the contrary, work overtime in their free time (Rodríguez Fernández et al., 2018). In addition, there is a challenge related to the interaction between the man and information and communication technologies. The introduction of digital technologies in nuclear power plants can negatively affect the cognitive reliability of operators due to the peculiarities of interface management, an over-reliance on automation, and the complexity of information systems (Zhouetal, 2012). Automation and robotisation reduce the demand for low-skilled workers performing routine operations, with many employees involved in manual operations at a risk of losing their jobs (Chinoracký and Čorejová, 2019). These employees face the need to retrain to take into account the new demands of the labour market. In addition, almost all workers are forced to constantly improve their competencies also at the risk of looming unemployment (Rymarczyk, 2020). Workers employed in the digital technologies consistently earn less than their counterparts performing the same duties on the employer's premises. Remote work also implies unstable schedules, overwork, and high stress (Islam, 2018). The introduction of distance technologies into the economic system increases the risks of insecure employment. Remote work contributes to the transition from permanent employment to fixed-term employment and temporary contracts. This deprives workers of guaranteed rights to regular employment, regular wages, a safe working environment, social security, and holidays. The individualisation of employment not only highlights the necessity for an individual to acquire professional competencies, but also requires their ability to negotiate, analyse the situation on the labour market, and establish their own work–time balance[2].

3. Materials and Methods

This study is based on an analysis of conceptual approaches to measuring the impact of the digital transformation on the development of human capital. In accordance with the systematic method of

[2]Bobylev S.N., Grigoriev L.M. (Eds.), 2018. Report on human development in the Russian Federation for 2018, Analytical Center under the Government of the Russian Federation, 172.

studying trends in the field of education, health care, and employment, the processes that change the requirements for human capital with both a destructive and positive impact on its development are specifically analysed.

At the first stage of this study, a literature review was carried out considering the problems associated with human capital development in the digital economy. At the second stage, an analysis of the preparedness of different countries for this development of human capital was carried out. A cross-country analysis was carried out using global indices provided by leading institutions to obtain a summary indicator and rank the nations in terms of preparedness. At the third stage, the obtained results were analysed, and trends in the development of human capital in the digital economy—together with the associated risks—were identified.

The analysis was carried out on the basis of data from the scientific publications, expert opinions, and data from international institutions as well as statistical indicators.

4. Results and Discussion

The study found an extremely ambiguous assessment of the impact of digitalisation on overall employment in terms of whether digital transformation cause an increase in demand for workers or, on the contrary, an increase in unemployment. Theoretical factors that can cause both an increase and decrease in the level of employment as well as the results of empirical research in this area are systematised in Table 1.

Table 1. The impact of digitalisation on the level of employment

Factors of Decline in the Level of Employment	Factors of Growth (Preservation) in the Level of Employment
• A decrease in the price of capital motivates the replacement of labour with capital (Islam, 2018) • Importing innovative technologies to developing countries will reduce their demand for labour (Ugur and Mitra, 2017) • The development of robotics and artificial intelligence technologies make more professions open to automation (Islam, 2018) • There is a dismissal of low-skilled workers (i.e., staff selection effect) (Genz et al., 2019) • High unemployment (Chinoracký and Čorejová, 2019) and a high proportion of non-manufacturing workers (Gómez-Plana and Latorre, 2019) increase the risk of job automation and reduced labour demand	• Income growth increases the demand for local products and, hence, the demand for labour, stimulating the creation of new professions and industries (Gregory et al., 2019) • ICT and related industries require new talent (Goos et al., 2015) • The lower capital intensity of firms and less wage flexibility contribute to the creation of new jobs (Gómez-Plana and Latorre, 2019) • National firms investing in ICT create more jobs than foreign firms (Gómez-Plana and Latorre, 2019) • Infrastructural constraints, older cultures, and union activity help keep jobs (Lloyd and Payne, 2021)
Effect of Reducing the Level of Employment	Effect of Increasing the Level of Employment
• One additional robot replaces 3 to 5.6 workers in the US (Acemoglu and Restrepo, 2020) • In the French manufacturing sector, hiring ICT professionals and using big data result in a 2.5% reduction in the workforce (Cette et al., 2021) • In the United States, 47% of jobs will be 70% automated over the next 20 years (Frey and Osborne, 2017)	• EU countries created up to 11.6 million new jobs between 1999 and 2010 (Gregory et al., 2016) • In Spain, a 1% increase in ICT investment increases employment by 0.02% (Gómez-Plana and Latorre, 2019) • Using the example of the European Union, one high-tech job creates five new jobs in other, low-tech industries (Goos et al., 2015)

The results of studying the impact of digital transformation on the level of income of the population were also very ambiguous and this topic requires further study. A study on the importance of digital solutions in German companies from 2011 to 2016 showed an increase in wages by 0.8%. The largest increase of 3.6% occurred in the category of low-skilled workers (Genz et al., 2019). Another study found that one additional robot per 1,000 workers results in wage cuts ranging from 0.25% to 0.5% (Acemoglu and

Restrepo, 2020). To prevent a decline in employment and a fall in the real incomes of the population, politicians and scientists suggest using tools such as 'helicopter money' and an unconditional basic income to ensure social stability and maintain the effective demand of the population.

The development of human capital depends on factors related to both the traditional economy and the innovative economy, since they both determine the ability of different spheres to adapt to rapidly changing environmental conditions. Access to education, health care, environmental security, network resources, information security, and innovation determine the development of human capital in the digital economy.

Internationally, several indicators characterising the development of human capital in the digital economy are used: The Human Development Index[3] (HDI) is a normalised indicator of the three conditions for personal development—education, a long healthy life, and income level—taking into account environmental efficiency factors; the Healthy Life Expectancy Index[4] (HLEI) takes into account the activity and health of the lived years of an individual; the Networked Readiness Index[5] (NRI) reflects innovation and manufacturability—i.e., the possibilities of the digital economy; the Global Innovation Index[6] (GII) evaluates the resource base and practical results in the field of innovation; and the Global Cyber security Index[7] (GCI) evaluates cyber security as a factor in the development of the digital economy. The COVID-19 pandemic has changed social interaction (e.g., with remote employment, distance learning). According to some estimates, Internet traffic grew by 30% in 2020, rapidly expanding 'digital public services' and thus strengthening the requirements for data security. Technologies of the digital age have begun to play a key role in maintaining socio-economic processes, and a reliable environment is needed to realise this potential.

To analyse the factors of human capital development in the digital economy, groups of countries from the whole world with a high HDI as well as the countries with an average HDI were selected, and all relevant indices were calculated. A summarised cross-country assessment of the global indices is presented in Table 1.

Table 2. Ranking of the analysed countries based on indices reflecting the development of human capital in the digital economy

Country	Ranking по ИЧР	HDI (2020)	HLEI (2018)	NRI (2020)	GII (2020)	GCI (2020)	Total score	Rank by total score
Sweden	7	0.945	0.724	0.8275	0.625	0.9455	4.067	**1**
Singapore	11	0.938	0.762	0.8139	0.566	0.9852	4.0651	**2**
Netherlands	8	0.944	0.721	0.8137	0.588	0.9705	4.0372	**3**
Switzerland	2	0.955	0.735	0.8041	0.661	0.8697	4.0248	**4**
Great Britain	13	0.932	0.719	0.7627	0.598	0.9954	4.0071	**5**
USA	17	0.926	0.685	0.7891	0.606	1.0	4.0061	**6**
Finland	11	0.938	0.717	0.8016	0.57	0.9578	3.9844	**7**
Denmark	10	0.94	0.718	0.8219	0.575	0.926	3.9809	**8**
Germany	6	0.947	0.716	0.7748	0.565	0.9741	3.9769	**9**
Norway	1	0.957	0.73	0.7939	0.493	0.9689	3.9428	**10**
South Korea	23	0.916	0.73	0.746	0.561	0.9852	3.9382	11
Canada	16	0.929	0.732	0.7492	0.523	0.9767	3.9099	12
Japan	19	0.919	0.748	0.7354	0.527	0.9782	3.9076	13

[3]Human Development Reports, 2020. http://hdr.undp.org/en/content/download-data

[4]World Health Statistics, 2018. Monitoring health for the SDGs, World Health Organization, Geneva. https://who.int/gho/publications/world_health_statistics /2018/en/

[5]Network Readiness Index, 2020. https://networkreadinessindex.org

[6]Global Innovation Index, 2020. https://www.globalinnovationindex.org/Home

[7]The Global Cyber security Index, 2020. https://www.itu.int/epublications/publication/global-cybersecurity-index-2020/en/

Australia	8	0.944	0.73	0.7509	0.484	0.9747	3.8836	14
France	26	0.901	0.734	0.7318	0.537	0.976	3.8798	15
Luxembourg	23	0.916	0.726	0.7527	0.508	0.9741	3.8768	16
Austria	18	0.922	0.724	0.7292	0.501	0.9389	3.8151	17
Belgium	14	0.931	0.716	0.7067	0.491	0.9625	3.8072	18
Israel	19	0.919	0.729	0.6981	0.535	0.9093	3.7904	19
Ireland	2	0.955	0.721	0.7213	0.53	0.8586	3.7859	20
Spain	25	0.904	0.738	0.6731	0.456	0.9852	3.7563	21
Estonia	29	0.892	0.682	0.7032	0.483	0.9948	3.755	22
New Zealand	14	0.931	0.728	0.7327	0.47	0.8404	3.7021	23
Italy	29	0.892	0.732	0.6339	0.457	0.9613	3.6762	24
Iceland	4	0.949	0.73	0.7055	0.492	0.7981	3.6746	25
Portugal	38	0.864	0.72	0.644	0.435	0.9732	3.6362	26
UAE	31	0.89	0.667	0.6442	0.418	0.9806	3.5998	27
Malta	28	0.895	0.722	0.6673	0.464	0.8365	3.5848	28
Cyprus	33	0.887	0.733	0.6067	0.457	0.8882	3.5719	29
Lithuania	34	0.882	0.661	0.647	0.392	0.9793	3.5613	30
Poland	35	0.88	0.685	0.618	0.4	0.9386	3.5216	31
Latvia	37	0.866	0.662	0.6047	0.411	0.9728	3.5165	32
Malaysia	62	0.81	0.666	0.6143	0.424	0.9806	3.4949	33
China	85	0.761	0.687	0.5844	0.533	0.9253	3.4907	34
Czech	27	0.9	0.693	0.6633	0.483	0.7437	3.483	35
Slovakia	39	0.86	0.683	0.6078	0.397	0.9236	3.4714	36
Greece	32	0.888	0.72	0.552	0.368	0.9398	3.4678	37
Slovenia	22	0.917	0.705	0.6658	0.429	0.7493	3.4661	38
Hungary	40	0.854	0.668	0.6005	0.415	0.9128	3.4503	39
Croatia	43	0.851	0.69	0.5594	0.373	0.9253	3.3987	40
Saudi Arabia	40	0.854	0.657	0.5797	0.309	0.9954	3.3951	41
Qatar	45	0.848	0.686	0.6026	0.308	0.945	3.3896	42
Russia	52	0.824	0.635	0.5423	0.356	0.9806	3.3379	43
Turkey	54	0.82	0.66	0.5124	0.349	0.9749	3.3163	44
Mauritius	66	0.804	0.658	0.4983	0.344	0.9689	3.2732	45
Serbia	64	0.806	0.675	0.5296	0.343	0.898	3.2516	46
Oman	60	0.813	0.656	0.5533	0.265	0.9604	3.2477	47
Brazil	84	0.765	0.66	0.5058	0.319	0.966	3.2158	48
Thailand	79	0.777	0.668	0.5345	0.367	0.865	3.2115	49
Kazakhstan	51	0.825	0.634	0.5138	0.286	0.9315	3.1903	50
Bahrain	42	0.852	0.681	0.5759	0.284	0.7786	3.1715	51
Macedonia	82	0.774	0.671	0.4828	0.334	0.8992	3.161	52
Romania	49	0.828	0.666	0.5416	0.36	0.7629	3.1585	53
Chile	43	0.851	0.697	0.5406	0.339	0.6883	3.1159	54
Uruguay	55	0.817	0.688	0.5487	0.308	0.7515	3.1132	55
Mexico	74	0.779	0.677	0.4967	0.343	0.8168	3.1125	56
Bulgaria	56	0.816	0.664	0.5503	0.4	0.6738	3.1041	57
Georgia	61	0.812	0.649	0.4795	0.318	0.8106	3.0691	58
Azerbaijan	88	0.756	0.649	0.4876	0.272	0.8931	3.0577	59
Costa Rica	62	0.81	0.709	0.5215	0.335	0.6745	3.05	60
Kuwait	64	0.806	0.663	0.5227	0.284	0.7507	3.0264	61
Iran	70	0.783	0.654	0.4391	0.309	0.8107	2.9958	62
Ukraine	74	0.779	0.64	0.4943	0.363	0.6593	2.9356	63
Montenegro	48	0.829	0.681	0.5095	0.354	0.5323	2.9058	64
Colombia	83	0.767	0.671	0.4681	0.308	0.6372	2.8513	65

Albania	69	0.795	0.681	0.4421	0.271	0.6432	2.8323	66
Argentina	46	0.845	0.684	0.5036	0.283	0.5012	2.8168	68
Armenia	81	0.776	0.663	0.5191	0.326	0.5047	2.7888	69
Belarus	53	0.823	0.655	0.4916	0.313	0.5057	2.7883	70
Peru	79	0.777	0.675	0.4367	0.288	0.5567	2.7334	71
Sri Lanka	72	0.782	0.668	0.4265	0.238	0.5865	2.701	72
Panama	57	0.815	0.694	0.4474	0.29	0.3411	2.5875	73
Bosnia and Herzegovina	73	0.78	0.672	0.4173	0.29	0.2944	2.4537	74
Ecuador	86	0.759	0.679	0.422	0.241	0.263	2.364	75

Source: Compiled by the author based on Human Development Reports (2020) (http://hdr.undp.org/en/content/download-data); World Health Statistics (2018), Monitoring health for the SDGs, World Health Organization, Geneva (https://who.int/gho/publications/world_health_statistics /2018/en/); Network Readiness Index (2020) (https://networkreadinessindex.org); Global Innovation Index (2020) (https://www.globalinnovationindex.org/Home); the Global Cyber security Index (2020) (https://www.itu.int/epublications/publication/global-cybersecurity-index-2020/en/)

In descending order, the ten leading countries in terms of the development of human capital in the digital economy are: Sweden, Singapore, the Netherlands, Switzerland, Great Britain, the United States, Finland, Denmark, Germany, and Norway. The United States, which has the highest global cyber security index, ranks sixth in terms of composite score while ranking 17th in terms of HDI (2020). In Iceland and Ireland, countries in the top ten for HDI, the global innovation index is low, which increases the risks of technological backwardness in the digital economy, thus limiting the conditions for the development of human capital in the future.

A digital barrier or digital divide—i.e., the unequal access of various segments of the population to information resources, information technologies, and equipment due to economic, physical, and competency-based restrictions—produces risks of discrimination and growing inequality between different social groups (Kim, 2018; Balog et al., 2020). A digital barrier will increase the segmentation of the labour market and the income gap between specialists of different skill levels. The highest risk of negative consequences in this regard are for the elderly, people with low levels of education and income, those employed in the segment of low-skilled labour, and those who rarely use the Internet (Vasilescu et al., 2020). The trend in job cuts will also seriously affect the interests of developing countries, in which developed countries have previously transferred production facilities. Rising unemployment will worsen the social and political environment in developing countries, increase migratory pressure on wealthy neighbours, and heighten international tensions (Rymarczyk, 2020).

Digitalisation can be the reason for the growth of discrimination in society. There is a case when a computer programmed to learn a language by processing a large amount of data began to operate with stereotypes drawn from the studied texts. Automatic facial recognition systems make more mistakes when working with people of colour, leading to increased false accusations and arrests. Additionally, influencers can manipulate the results of user queries in search engines and limit the amount of information important to certain social groups using targeted advertising tools (McKee, 2019). The collection and analysis of big data imply risks in creating individual social ratings and clustering the population, as this will exacerbate problems of social differentiation and unequal access to opportunities and social benefits (Koneva et al., 2019).

The risks of discrimination and the growth of social inequality will mean depriving part of the population of opportunities to develop their potential. This will have a negative impact on the development of human capital not only for disadvantaged social groups: The motivation for personal and professional development may decrease among the members of society outside disadvantaged social groups whose competitive level may fall. Besides, income and opportunity inequality is already widening due to the spread of COVID-19.

The implementation of risks in the field of inclusive education is primarily related to the discrepancy between the content of educational programs implemented by educational institutions and the

expectations of employers regarding graduates (Alhamami, 2020). It is necessary to change educational programs in accordance with emerging market demands. It should be taken into account that the owners of the highest qualification of human capital will be the main beneficiaries of the fourth industrial revolution (Rymarczyk, 2020).

The consideration of the risks in the development of competencies due to the demands of digital-economy employers is associated with a lack of the competencies necessary for training a competitive employee in the current labour market. Competencies can be grouped on the professional, socio-behavioural, and technical (digital) level. This combination will allow an individual to effectively perform professional tasks and implement interpersonal communications, leading to success in various areas of life and a comfortable existence in a digital society (Kelchevskaya and Shirinkina, 2019; Sima et al., 2020).

A number of studies discuss cognitive, financial, and entrepreneurial competencies. Employees in most positions will require skills such as the ability to concentrate and self-learn, emotional literacy and empathy, creativity, environmental awareness, and cross-culturalism (Peshkova and Samarina, 2018). It has also been noted that changes in the professional environment and career growth contribute changes in the required set of competencies for the individual[8].

It is possible to generate the required magnitude of students' competencies by creating educational clusters (Alexankov et al., 2018). Representatives of employers should be involved in the educational process; telecommunications infrastructure should be developed within and between educational institutions; and international cooperation should be strengthened in the form of the advanced training of teaching staff abroad (Avetisyan and Gevorgyan, 2020). It is possible to increase the effectiveness of the educational component of human capital through resources related to the goals of universal digitalisation, the popularisation of digital tools, the modernisation of the system for training and motivating teachers, and the introduction of changes in the criteria and mechanisms for monitoring the educational process (Frolova et al., 2020).

The uncertainty and security threats emerging in cyberspace require governments to create institutional conditions to foster an atmosphere of trust between the subjects of the digital reality (Knox, 2018). The dilemma between the free exchange of information for the development and enrichment of knowledge and the restriction of access to information in the framework of the protection of intellectual property should be resolved based on the interests of developing human capital.

Human capital, which is an accumulation of knowledge and creativity, is becoming a key factor in economic development and a criterion for success at both the level of the individual company and the national economy. Today, the ongoing complication affecting the work of specialists requires them to constantly improve their competencies, while governments should invest heavily in education, healthcare, and retraining. At the state level, the tasks of ensuring network accessibility, the development of innovations, ensuring cyber security, and improving financial literacy are to be solved.

This study showed that the European countries are the world-leaders in terms of high human capital development. A lower level of innovation support and cyber security in non-leading countries (compared to the leaders) increases the risks associated with the development of human capital in the digital economy.

Overall, the scientific literature presented an extremely ambiguous assessment of the impact of digitalisation on overall employment in terms of whether digital transformation will cause an increase in demand for manual labour or, on the contrary, an increase in unemployment. The introduction of digital innovations in the economic and social spheres is often associated with growing risks of discrimination and growing inequality between different social groups. Second, the results of studying the impact of digital transformation on the level of income of the population were also ambiguous and require further

[8]Bobylev, S.N., Grigoriev, L.M. (Eds.), 2018. Report on human development in the Russian Federation for 2018. Analytical Center under the Government of the Russian Federation, p. 172.

study.

5. Conclusion

The fourth industrial revolution is determining the specifics of human capital development. Separate social groups previously considered to be the least protected in the labour market are receiving new opportunities through remote employment. Moreover, there is a growing demand for professionals who help develop the digital environment as well as for workers who have successfully mastered digital tools. On the other hand, the digitalisation of employment is a reduction in jobs and a drop in income due to the automation and robotisation of production. There is also a decrease in the rights of employees as a result of the refusal of employers regarding permanent employment when specialists switch to remote employment. Additionally, working in an uncertain and digitally fraught cyberspace increases the risk of making destructive decisions.

The same tools of the digital economy can have both positive and destructive effects on the process of human capital development. The positive impact is associated with the expansion of the individual's opportunities in the field of remote knowledge acquisition and medical care, with an increase in the individualisation level of the services provided and the emergence of new social lifts. The negative impact can be characterised by an increase in the level of stress of an individual due to information and emotional overload, a decrease in the motivation to master knowledge that is available online, a simplification of ideas about reality, and the potential for a monopoly in the global education market. The introduction of digital tools also increases the risks of discrimination and growing socio-economic inequalities.

The key areas for improving the efficiency of human capital at the present stage of digitalisation include altering educational programs in accordance with the trends in the digital development of the economy, the development of educational clusters, and the intensification of international academic mobility. Modern digital tools should be introduced into the educational environment, healthcare, and everyday life of all people. Digital transformation also requires professionals to acquire not only job skills but also cognitive, social, behavioural, digital, financial, and legal competencies. For this reason, new knowledge—especially in the domains of professional and personal development—are becoming a necessity for every individual striving to be competitive in modern world.

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