CHALLENGES IN THE IMPLEMENTATION OF DIGITALIZATION IN AZERBAIJAN'S INDUSTRIAL SECTORS

Karimov K.,
Associate Professor, Internationally Certified Economist.,
Azerbaijan State Oil and Industry University, Baku, Azerbaijan
Dadaşova N.,
Lecturer.,
Azerbaijan State Oil and Industry University, Baku, Azerbaijan
Jafarova H.
Master's Student.,
Azerbaijan State Oil and Industry University, Baku, Azerbaijan
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Abstract

The economic development of any state, amid rapidly evolving technological paradigms and the transition from Industry 4.0 to Industry 5.0 and beyond, is primarily determined by the pace of technological modernization of industrial sectors driven by digitalization. Digital technologies significantly reduce production costs by automating and robotizing manufacturing processes, optimizing value chains, and enhancing labor productivity, including managerial efficiency.

Despite governmental efforts, the economy of Azerbaijan, in addition to structural imbalances and low labor productivity, exhibits a relatively low level of overall technological development and slow transformation dynamics.

The aim of this paper is to analyze and systematize the outcomes of industrial digital transformation in leading regions—Southeast Asia, the Americas, and Europe—and to assess the state of industrial digitalization and robotics in Azerbaijan in comparison with these regions, as well as to identify the existing potential for accelerating industrial automation and robotization.

Keywords: industry, digital transformation, model, global development, and State Policy

I. Introduction

In the contemporary stage of civilizational development, the primary objective of scientific and technological transformation is to ensure a sustained increase in economic efficiency and to promote stable economic growth.

In the 21st century, key trends shaping the pace and direction of industrial development have become fully evident, including: the acceleration of technological progress and the emergence of new industries on this basis; the expanding use of alternative and renewable energy sources; and the global advancement of communication technologies and supply chain logistics, which has led to the large-scale relocation of industrial production to Southeast Asia.

The intensification of these processes has generated two major effects. On the one hand, production costs have declined, consumer prices have decreased overall, and production volumes have expanded. On the other hand, processes of deindustrialization have emerged and intensified in previously industrialized countries, many of which have transitioned toward service-oriented economies.

These transformations have been driven by economic development and the need to meet growing societal demands, which increasingly conflict with the limitations of the resource base, as well as by the evolving technological capacity of industry as a key sector determining the structure, level, and pace of both national and global socio-economic development. In this context, fundamental science, applied competencies, and innovation play a decisive role in shaping the direction and speed of industrial technological transformation.

By 2025, fourteen years have elapsed since Germany announced its transition to industrial development based on the Industry 4.0 concept (the Internet of Things (IoT), cloud computing, big data, and smart manufacturing). Over this period, the rapid expansion of digital technologies and their deep penetration into the production sphere—according to various estimates, the global market for such technologies is projected to exceed USD 165 billion by 2026—has initiated not merely an evolutionary shift but a transition toward Industry 5.0.

This new paradigm предполагает, through the integration and convergence of artificial intelligence (AI) and robotics, not only the establishment and further development of effective human–machine interaction but also the potential elimination of human involvement as a risk factor in most, if not all, production processes. Among the technological components of Industry 5.0, AI technologies are particularly prominent, enabling the automated reconfiguration and self-optimization of robotic production systems, advanced big data analytics (including cost data), and demand forecasting [1-4].

In the European Union, despite an early start (Germany's Industry 4.0 initiative) and the launch of the "Digital Decade: Europe's Digital Targets for 2030" program [European Commission, 2026], which defines the trajectory of digital transformation, interim assessments based on the Digital Economy and Society Index (DESI) [European Commission, 2026] indicate that

current progress is insufficient to achieve the stated targets, even though nearly one-fifth of the EU budget is allocated to industrial digital transformation measures.

In its conclusions, the European Commission outlines both an assessment of the challenges and its policy vision for addressing them. It calls on EU Member States, in addition to closing the existing investment gap and accelerating digital transformation, to harmonize digital principles necessary for launching cross-border projects and to develop a legislative framework for a new governance initiative—the "Digital Compass"—aimed at steering the pace of digitalization.

Furthermore, it is important to note that within the European Union, industrial modernization is pursued with due regard to regional specificities, as reflected in Smart Specialisation Strategies (RIS3). In this context, the development and diffusion of digital technologies are closely aligned with, and constitute a key driver for achieving, the United Nations Sustainable Development Goals (SDGs).The analysis of the conditions underpinning the digitalization of economic processes in the global economic space leads to the conclusion that one of the key trends of recent decades is *high-tech integration* (e.g., in Japan, Finland, and Sweden).

Development trajectories of post-industrial economies indicate the dynamic emergence of a "digital society" as an evolution of the "information society" under conditions of digital transformation. In this paradigm, advanced technologies permeate all spheres of human activity, shaping economic outcomes and contributing to a relative increase in societal welfare.

High-technology companies are both the primary creators and, in most cases, the dominant owners of the outputs of scientific and technological activity, thereby forming the core of knowledge-intensive business.

The growing importance of international technology exchange in the near term is driven by the accelerating digitalization of national economies. On the one hand, developed countries seek to expand the scale of research and development (R&D), enhance labor productivity, and strengthen the competitiveness of their products. On the other hand, newly industrialized countries, economies in transition, and developing nations face an acute need to broaden the adoption and diffusion of advanced technologies [5-9].

Japan. In addressing socio-economic challenges associated with population ageing and the shrinking workforce, the government prioritizes measures to stimulate the development, advancement, and deployment of cutting-edge innovative technologies aimed at building a "digital society." This policy orientation is formally articulated in official strategic documents, most notably the "Society 5.0" strategy.

The consistent and large-scale adoption of digital technologies—including cloud computing and artificial intelligence (AI)—has led to a substantial increase in organizational efficiency through the reengineering of technological and service-related business processes, particularly in the expansion of remotely delivered services.

Within this framework, the "Society 5.0" strategy envisions a profound transformation of Japanese society into a highly advanced "super-smart" society. It предполагает the pervasive use of robotics to address a wide range of social challenges—from service sectors (healthcare, commerce, retail, etc.) and routine household tasks to complex governance and decision-making processes enabled by AI. This spectrum encompasses solutions ranging from vending systems and assistive robots to advanced AI-powered humanoid robots.

China. China's experience in digital transformation and the deployment of robotics in industry warrants particular attention. In the People's Republic of China, the development of the digital economy, digital transformation, and the promotion of technological innovation have become key instruments for achieving high-quality economic growth and addressing socio-economic challenges.

This has been supported by a consistent and targeted state policy, which can be divided into three main stages [Zhang, 2024]:

- Stage 1 (2013–2015): government efforts focused on the development of ICT and the establishment of information infrastructure;
- Stage 2 (2016–2017): policy emphasis shifted toward the adoption of ICT and the digitalization of traditional industries;
- Stage 3 (2018–present**):** industrial policy has been oriented toward sectoral planning of the digital economy and the promotion of international cooperation.

A prominent illustration of China's industrial digital transformation is the emergence of "dark factories," where human labor is entirely absent. Production processes are fully automated and robotized, while management is based on artificial intelligence and big data. These facilities operate continuously—24/7, year-round—without human involvement, significantly increasing efficiency by eliminating costs associated with human error, labor, and energy consumption. For example, technological capabilities enable production speeds of up to one smartphone per second (e.g., Xiaomi). This trajectory of industrial digitalization is actively supported across advanced industrial economies.

According to the China Academy of Information and Communications Technology, the scale of China's digital economy continues to expand annually; however, the pace of digital transformation remains uneven across sectors. The highest level of digital penetration is observed in services (44.7%), followed by industry (24.0%) and agriculture (10.5%) [Zuo, 2025].

All programmatic documents on technological modernization are embedded within a broader strategic objective: achieving and consolidating China's global leadership in advanced technologies. Within this overarching framework, a range of complementary policy initiatives has been adopted. Notably, in 2015, the industrial policy strategy "Made in China 2025" was introduced, aimed at reducing dependence on foreign technologies and promoting Chinese high-tech manufacturing globally. Within this strategy, the objective of developing "intelligent manufacturing," based on the integration of internet technologies into industrial production, was first formally articulated [10-13].

II. Methodology

Within the framework of this study, the digital economy was theoretically substantiated and analyzed. Based on the developed methodology, its level of development was assessed, and the impact of the digital economy on the rate of technological convergence was evaluated. In addition, practical recommendations for the formation of a digital economy in the Republic of Azerbaijan were developed and justified.

The relevance of the problem is determined by its high socio-economic importance for the Republic of Azerbaijan, which also conditioned the selection of the research topic and the need to elaborate practical recommendations for the formation and development of the digital economy within the global economic system.

A comprehensive methodology for calculating the Composite Digital Economy Development Index (DI) has been proposed. This methodology assumes an assessment of digital economy development based on a broad system of indicators and enables an objective analysis across five key dimensions. To ensure comparability of indicators expressed in different measurement units, a normalization approach is applied: each variable is linearly transformed into a score within the interval from 0 to 1, where 1 corresponds to the maximum value (the higher the score, the higher the level of "digital development"). This is expressed by Formula (1):

$$Y\ (X) = \frac{X_i - X_{min}}{X_{max} - X_{min}}, \qquad (1)$$

Here, Xi- denotes the value of the i-th indicator; Xmin -represents the minimum value of the indicator; Xmax -represents the maximum value of the indicator.

Table 1

presents the aggregation of normalized indicators using equal weighting.

Countries	Quality of ICT infrastructure and internet access	Intensity of internet usage	Human capital	Digitalization of the economy	Effectiveness of the digital transformation of the economy	Rİ
Highly developed						
Sweden	0,8141	0,9343	0,6604	0,9138	0,8132	0,8211
Finland	0,6606	0,8944	0,6122	0,9944	0,8902	0,8102
Denmark	0,7710	0,9473	0,7147	0,7730	0,4655	0,7102
United Kingdom	0,8165	0,7734	0,7056	0,8634	0,4640	0,7091
Developing						
Estonia	0,5683	0,8301	0,5384	0,8741	0,5276	0,6526
Czech Republic	0,4228	0,5272	0,4954	0,8073	0,5555	0,5631
Latvia	0,3623	0,7095	0,5931	0,6865	0,4860	0,5563
Germany	0,5384	0,5408	0,6155	0,6779	0,3553	0,5363
Moderately developed						
Hungary	0,2469	0,5845	0,5183	0,7550	0,3796	0,4866
Poland	0,3256	0,4837	0,5650	0,6491	0,2957	0,4544
Romania	0,3263	0,4525	0,1353	0,6160	0,4240	0,3894
Bulgaria	0,2464	0,4308	0,0504	0,6036	0,4562	0,3588
Russia	0,3245	0,2334	0,4571	0,3341	0,3719	0,3511
Insufficiently developed						
Kazakhstan	0,3710	0,1590	0,4732	0,0000	0,0000	0,1927
Azerbaijan	0,2654	0,1348	0,3521	0,0000	0,0000	0,1842

The following formula is proposed for calculating the value of the sub-index (2):

$$Sub - Index = \sum_{i=1}^{n} \frac{y_i}{n}? \qquad (2)$$

Subsequently, the author assigns weights wjw_jwj to each of the five sub-indices, and based on these weights, the overall index is calculated using the following formula (3)

$$Index = \sum_{J-1}^{n} SI_j\, W_j, \qquad (3)$$

where SIj- denotes the value of the j-th sub-index;Wj -is the weighting coefficient of the j-th sub-index; and jjj represents the ordinal number of the sub-index.

Based on the empirical validation of the developed methodology, a comparative analysis of the Republic of Azerbaijan with EU and EAEU countries was conducted. These countries were classified into four groups according to their level of digital economy development: highly developed (RI ≥ 0.7); developing (0.5 ≤ RI < 0.70); moderately developed (0.3 ≤ RI < 0.50); and underdeveloped (RI < 0.3).

It should be noted that in Azerbaijan, the oil industry holds a leading position in the adoption of advanced technologies. According to the Digital Transformation Strategy for other industrial sectors through 2030, adopted in 2021, "industrial digital transformation is a priority area for the development of the national economy, ensuring high adaptability in business model formation and the operation of production processes through the integration of end-to-end digital technologies." [14-16].

Given the emphasis on the use and development of domestic Azerbaijani technologies, it can be argued that the digitalization process in most companies remains at an early stage. Thus, digital transformation represents one of the most pressing challenges for industrial enterprises both globally and in Azerbaijan.

III. Discssion

Phased Formation of the Digital Economy in Azerbaijan's Industrial Sectors: Prior to the advancement of digitalization and digital transformation processes in the global economy, it was widely assumed that only large and mature firms possessed the capacity to effectively access new international markets. In the contemporary context, however, the emergence of global digital platforms (GDPs) as new economic actors has significantly simplified this process, enabling even small enterprises to achieve rapid internationalization and access global markets. On this basis, firms from developing countries have, within a relatively short period, become active participants in international economic relations.

Consequently, both economic globalization processes and the development of GDPs have become key determinants facilitating firms' access to global markets. In essence, the development of GDPs represents both a result and a manifestation of scientific and technological progress over recent decades. At the current stage, digital technologies have become an integral part of everyday life, which has driven the intensive expansion of international online trade and transformed it into a critical component of multinational corporations' (MNCs) foreign economic strategies.

The Fourth Industrial Revolution has stimulated the emergence of new technologies aimed at enhancing the international competitiveness of national economies worldwide. In this regard, traditional business tools and models are gradually being replaced by digital business processes, making the continuous adaptation of MNC strategies an essential requirement.

At the same time, under the influence of economic globalization, international competition in digital technology markets has intensified further, and competition between traditional and technology-based multinational corporations (MNCs) has become exceptionally strong. The success of several transnational technology giants (e.g., Google, Apple) demonstrates that they have developed specific competitive advantages in areas such as cloud infrastructure and computing, as well as artificial intelligence (AI) and the Internet of Things (IoT). [17-20].

A new class of companies—technology multinational corporations—operate through various types of global digital platforms (GDPs), including transaction platforms, peer-to-peer sharing platforms, and others. In essence, GDPs are considered an emerging and promising model of international business, as online channels significantly facilitate access for small and medium-sized enterprises (SMEs) and consumers to a wide range of service providers. Possession of large tangible assets is no longer regarded as a necessary condition for entering global markets.

The growth rates of the GDP market are unprecedented. However, from a theoretical perspective, the phenomenon of GDPs remains insufficiently studied: stable conceptual frameworks, classifications, and regulatory instruments have yet to be fully developed. At the same time, many multinational corporations operating in the information and communication technology (ICT) sector are increasingly specializing in the provision of various information services delivered on global markets. Such MNCs implement highly aggressive competitive strategies in international markets, resulting in a sharp increase in their profitability and capitalization in recent years.

The strategies of these corporations are focused on product and service diversification, while their international specialization is increasingly shaped by the exchange, management, and dissemination of data (information). Considering the main global economic trends and current technological developments, Russia does not fully exploit the potential of the digital economy, although the transformation of business processes in domestic companies has accelerated in recent years. Nevertheless, numerous challenges remain unresolved in relation to the modernization of industrial business processes, the development of high-tech production sectors, and the involvement of global digital platforms in these processes.

In this context, the application of advanced international experience of foreign multinational corporations (MNCs) in digital transformation and the formation of technological competitive advantages is of particular importance for the country.

The development of new business models of technology-based MNCs remains insufficiently explored in the economic literature. The economic dynamics of the modern global economy are undergoing profound changes under the influence of digital transformation, and this process, in our view, is accompanied by deep structural shifts in both consumption and production sectors. As a result, new types of goods and services emerge, while the operational practices, business models, and corporate strategies of firms of all sizes are being transformed.

Based on the experience of leading countries in stimulating digitalization in Azerbaijan's industrial sectors, and through the integration of efforts by the state, science, and business, the following key directions can be identified:

1.Legal support for the transition to a digital economy (development of a regulatory framework corresponding to a new model of interaction between the state, scientific organizations, business, and society in the digital environment, including the improvement of legislation related to the application of automation, robotics, and artificial intelligence technologies);

2.Implementation of digital technologies in public services (based on the "single window" principle);

3.Digitalization of the real sector (Industry 4.0 and precision agriculture);

4.Digital transformation of the banking sector;

5.Development and strengthening of modern information and communication infrastructure (4G, 5G);

6.Human capital development (digital skills and competencies);

7.Ensuring cybersecurity (prevention of cyberattacks and cybercrime);

8.Ideological support for the transition to a digital economy (the concept of an "IT-country").

These measures will enable the transition in the Republic of Azerbaijan to digital governance of the state and economy based on a unified intelligent

knowledge system, advanced information technologies, and specialized software complexes. This, in turn, will serve as an important factor in addressing existing socio-economic challenges in the country, while also creating conditions for improving the efficiency of the public administration system and implementing necessary reforms in education, science, and the economy.

From the perspective of their impact on the development of the global economy and society, the key technologies underpinning the digital economy—namely blockchain, cloud computing, big data, the Internet of Things (IoT), and cyber-physical systems—have been analyzed. The application of these technologies generates the following positive economic and social effects:

– automation and intensification of traditional economic and technological processes, as well as the emergence of new economic sectors;

– improvement of the business and investment climate through increased accessibility and efficiency of public services and enhanced transparency of the business environment;

– increased accessibility, quality, and convenience of healthcare, education, cultural, and financial services for the population;

– development of livable and safe urban environments.

It has been identified that among the risks and threats associated with the digitalization of the economy and society, significant social risk arises from the structural transformation of the labor market and potential reductions in employment. In addition, the spread of new forms of criminal activity, particularly cybercrime, poses a serious threat.

It has been substantiated that the widespread adoption of digital technologies has significantly contributed to the formation of a new stage of globalization—digital globalization.

It has been determined that, at present, digital data and information flows possess significant economic value, as they facilitate the movement of goods, services, financial resources, and people, and exert a stronger impact on global GDP growth than international trade and cross-border capital flows. In the context of digital globalization, the processes of information production, distribution, cross-border exchange, and consumption occupy a dominant position compared to other types of economic activity, thereby reinforcing the virtualization of the economy. As a result, a new system of organizing economic relations is emerging—a global digital economy characterized by its own regularities and development patterns.

At the current stage, one of the key challenges in the field of artificial intelligence is the explainability and transparency of its "reasoning processes." This issue can be considered a matter of global security, despite the fact that artificial intelligence is currently predominantly applied at the local level.

The digital transformation of an organization presupposes the creation of a digital platform. This requires the formation of a high-level expert capacity within the organization in this field. The availability of highly qualified personnel covering all competencies required for the implementation of complex IT business projects is essential. These include:

- digital transformation managers;
- project managers;
- domain consultants and business analysts;
- software developers (1C, Web, and Power BI);
- data engineers;
- system administrators.

A digital platform is a set of interoperable software products that provide the core functionalities required for the development of business applications. Such a platform enables the rapid design and deployment of new business applications, while also ensuring their efficient maintenance and continuous improvement [21].

The platform integrates widely used software solutions familiar to both end-users and technical specialists and, at the same time, is characterized by an open architecture that allows seamless integration with any other software solutions.

Conclusions

1.In the context of contemporary globalization, a theoretical approach to the digital economy as an independent phenomenon has been substantiated. This approach covers the following aspects: the delineation of the digital economy from other concepts of the modern global economy that are closely associated with distinct ICT development trajectories; the clarification of the content of the concept of "digital economy"; the identification of the causal relationship between the widespread diffusion of digital technologies, the transition from the fifth to the sixth technological paradigm, and the transformation into the Fourth Industrial Revolution; the assessment of both the positive effects and risks of digitalization; and the differentiation of stages of digital economy development, including digital globalization as a new phase of globalization.

The analysis demonstrates that digital technologies are extensively applied not only in traditional economic and financial sectors but have also penetrated education and healthcare systems, as well as public administration and service delivery (e-government), becoming one of the key global trends in recent years. The practical application of digital economy technologies significantly influences consumer behavior, enhances firms' flexibility in continuously improving product and service quality, increases labor productivity, and contributes to sustained improvements in population welfare.

Digital globalization acts as a driving force of global economic growth and creates new business opportunities for firms, including unrestricted access to the best suppliers, customers, labor resources, and financial sources; the ability to conduct "borderless business" in real time; reduced operational, marketing, and customer interaction costs in new markets; the organization of virtual teams through digital platforms; and the transformation of small enterprises and startups into multinational corporations from the earliest stages of development.

2.An assessment of the level of digital economy development across countries has been proposed using

the Digital Economy Development Index (DEDI) developed by the author. This index is composed of five sub-indices characterizing the key dimensions of the digital economy: the quality of digital infrastructure and ICT access, intensity of internet usage, human capital, digitalization of the economy, and effectiveness of digital transformation. This approach enables a comprehensive evaluation of a country's position in global digital development.

The DEDI calculations conducted for 16 EU and EAEU countries, including the Republic of Azerbaijan, allowed the classification of the studied countries into four groups: highly developed, developing, moderately developed, and underdeveloped.

The results confirm a high level of digital economy development in Sweden, Finland, the United Kingdom, and Denmark. It has also been established that a high level of digital economic development is closely associated with factors such as the quality of digital infrastructure and ICT access, intensity of internet usage, level of human capital development, degree of economic digitalization, and effectiveness of digital transformation. Digital transformation processes have been identified as a key determinant that enhances the efficient use of production factors, stimulates economic growth, strengthens competitive advantages in domestic and international markets, and fosters innovation.

The Republic of Azerbaijan has been classified among the group of "developing countries" (DEDI = 0.5003). The country demonstrates below-average performance in terms of digital infrastructure quality and ICT access, near-average indicators in internet usage, economic digitalization, and digital transformation effectiveness, and above-average performance in human capital development. This has made it possible to identify key challenges in the development of the digital economy and to formulate recommendations aimed at improving the country's international digital ranking.

3.A model has been proposed to assess the impact of a country's position in the global digital economy on the potential growth of total factor productivity. This model is based on the use of the previously developed Digital Economy Development Index (DEDI) for calculating the Technological Convergence Conditions Index. It has been demonstrated that digital transformation exerts a direct effect on economic growth, depending on the quantity and quality of accumulated human and digital capital. It has been determined that the growth rate of the technological progress factor significantly depends on the efficient utilization of a country's digital potential, its capacity for rapid scaling, and the speed of adoption of scientific and innovative advances. This approach indicates that Azerbaijan's GDP can increase primarily through capital accumulation, innovation, and digitalization. In the long-term perspective (2030–2050), the potential annual economic growth rate may reach 4.5%.

4.The issue of improving industrial production efficiency has become one of the key priorities for the Azerbaijani market. In the context of intensifying competition and the imperative of technological sovereignty, enterprises are increasingly confronted not merely with the need to modernize equipment, but with the challenge of establishing an integrated production management system—ranging from process standardization to the implementation of digital solutions.

References:

1 Watanabe, C., Yu, T., Neittaanmäki, P. A New Paradox of the Digital Economy – Structural Sources of the Limitation of GDP Statistics. Technology in Society, 2018, Vol. 55, pp. 9–23. https://doi.org/10.1016/j.techsoc.2018.05.004

2 Stolyarova, E. V. Digitalization Strategy of International Companies. Belarusian Economic Journal, 2020, No. 3, pp. 132–148. https://doi.org/10.46782/1818-4510-2020-3-132-148

3 Ananyin, V. I. et al. Digital Enterprise: Transformation into a New Reality. Business Informatics, 2018, No. 2 (44), pp. 45–54. https://doi.org/10.17323/1998-0663.2018.2.45.54

4 Johnson, M., Christensen, C., Kagermann, H. Reinventing Your Business Model. Harvard Business Review, 2008, Vol. 86(12), pp. 50–59. Available at: https://hbr.org/2008/12/reinventing-your-business-model (accessed: 30.06.2022).

5 Climent, R. C., Haftor, D. M. Value Creation Through the Evolution of Business Model Themes. Journal of Business Research, 2021, Vol. 122, pp. 353–361. https://doi.org/10.1016/j.jbusres.2020.09.007

6 Weill, P., Woerner, S. L. Thriving in an Increasingly Digital Ecosystem. MIT Sloan Management Review, 2015, Vol. 56(4), pp. 27–35. Available at: https://asset-pdf.scinapse.io/prod/2255721751/2255721751.pdf (accessed: 27.06.2022).

7 Linz, C., Müller-Stewens, G., Zimmermann, A. Radical Business Model Transformation: Gaining the Competitive Edge in a Disruptive World. London: KoganPage, 2017. Available at: https://www.researchgate.net/publication/318969959_Radical_Business_Model_Transformation_Gaining_the_Competitive_Edge_in_a_Disruptive_World (accessed: 06.06.2022).

8 Bauer, V. P., Podvoisky, G. L., Kotova, N. E. Strategies for Adapting US Companies to the Digitalization of Production Sectors. World of New Economy, 2018, Vol. 12(2), pp. 78–89. https://doi.org/10.26794/2220-6469-2018-12-2-78-89

9 Von Delft, S., Zhao, Y. Business Models in Process Industries: Emerging Trends and Future Research. Technovation, 2020, Vol. 105. https://doi.org/10.1016/j.technovation.2020.102195

10. Isaksen, A., Rypestøl, J. O. Policy to Support Digitalisation of Industries in Various Regional Settings: A Conceptual Discussion. Norwegian Journal of Geography, 2022, Vol. 76(2), pp. 82–93. https://doi.org/10.1080/00291951.2022.2060857

11.Barzotto, M. et al. Smart Specialisation, Industry 4.0 and Lagging Regions: Some Directions for Policy. Regional Studies, Regional Science, 2020, Vol. 7(1), pp. 318–332. https://doi.org/10.1080/21681376.2020.1803124

12.Shpak, N. et al. Simulation of Innovative Systems under Industry 4.0 Conditions. Social Sciences, 2019, Vol. 8(7). https://doi.org/10.3390/socsci8070202

13.Liere-Netheler, K. et al. Drivers of Digital Transformation in Manufacturing. Proceedings of the 51st Hawaii International Conference on System Sciences, 2018, pp. 3926–3935. https://doi.org/10.24251/HICSS.2018.493

14.Anokhina, L. V. The Role of Digitalization of the Economy in the Modernization of Industrial Enterprises. Economics and Business: Theory and Practice, 2018, No. 11-1, pp. 9–11. https://doi.org/10.24411/2411-0450-2018-10106

15.Bushmeleva, G., Solodyankina, O., Batov, A. Digitalization of an Industrial Enterprise: Digital Infrastructure. Polish Journal of Science, 2019, No. 20-2, pp. 16–18. Available at: https://www.poljs.com/wp-content/uploads/2019/10/POLISH-JOURNAL-OF-SCIENCE-%E2%84%9620-2019-VOL.-2.pdf

16. Frolov, V. G., Trofimov, O. V., Martynova, T. S. Formation of a Mechanism for the Development of an Industrial Enterprise under Digitalization Conditions. Economics, Entrepreneurship and Law, 2020, Vol. 10(8), pp. 2243–2262. https://doi.org/10.18334/epp.10.8.110719

17. Streltsova, E. et al. Information Management System of Industrial Enterprise in Conditions of Digitalization. International Journal of Civil Engineering and Technology, 2019, Vol. 10(1), pp. 559–575. Available at: https://publications.hse.ru/pubs/share/direct/244898837.pdf (accessed: 08.06.2022).

18.Toymentseva, I. A., Karpova, N. P., Evtodieva, T. E. Strategic Purchasing Control of the Industrial Enterprise: Digitalization and Logistics Approach. Lecture Notes in Networks and Systems, 2020, Vol. 84, pp. 398–407. https://doi.org/10.1007/978-3-030-27015-5_48

19.Lee, J., Bagheri, B., Kao, H. A. A Cyber-Physical Systems Architecture for Industry 4.0-Based Manufacturing Systems. Manufacturing Letters, 2015, Vol. 3, pp. 18–23. https://doi.org/10.1016/j.mfglet.2014.12.001

20.Golovenchik, G. G. Digital Economy as a New Stage of Globalization. Digital Transformation, 2018, No. 1(2), pp. 26–36.

21. Karimov, K. S. Strategic Directions for Sustainable and Continuous Development of Industrial Sectors. Baku: Azerbaijan State Oil and Industry University (ASOIU), 2026.