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СМАРТИЗАЦІЯ ТА ЦИФРОВІЗАЦІЯ ЯК ТЕОРЕТИЧНИЙ КОНЦЕПТ РОЗВИТКУ ЕКОНОМІКИ НА СУЧАСНОМУ ЕТАПІ

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THE THEORETICAL CONCEPT OF ECONOMIC DEVELOPMENT AT THE PRESENT STAGE IS THE PROCESS OF SMARTIZATION AND DIGITALIZATION

Анотація. Ключові тренди розвитку економіки на початку XXI століття відображають значні зміни, що відбуваються під впливом новітніх технологій, глобалізації та соціальних змін. Вони сприяють підвищенню ефективності, продуктивності та конкурентоспроможності економік, а також створюють нові можливості та виклики для бізнесу та суспільства. Ключовими трендами розвитку економіки на цьому етапі є смартизація та цифровізація, що стали передумовою економічного розвитку в усіх сферах виробництва та життя. Цифрова трансформація передбачає впровадження цифрових технологій у всі аспекти бізнесу та суспільного життя. Це включає автоматизацію бізнес-процесів, розвиток електронної комерції та використання великих даних. В той же час смартизація міст та економіки передбачає використання інтелектуальних систем для підвищення ефективності міського управління, енергетики, транспорту та інших секторів. Розвиток інформаційних технологій і зростання штучного інтелекту створюють умови для трансформації економіки, інтеграція цифрових технологій у всі сфери життя і господарства може призвести до змін, аналогічних до тих, які відбулися в результаті промислової революції. У перспективі стартекономіка може змінити не лише способи виробництва і споживання, але й соціальні структури і взаємодію між людьми і машинами. Однак це викликає потребу адаптації суспільства до швидко змінюваної технологічної реальності і на важливості розвитку навичок, які будуть потрібні в майбутньому цифровому світі. У статті визначено особливості цифровізації та смартизації як соціально-економічних явищ, що характеризують сучасний етап розвитку глобальної економіки, проаналізовано концептуальні відмінності між цифровізацією та смартизацією як базовими концепціями розвитку економіки та сучасному етапі її розвитку та визначено ключові характеристики їх реалізації.

Abstract. The principal trends in economic development at the advent of the 21st century evince substantial alterations occurring as a consequence of the advent of cutting-edge technologies, globalization, and social transformation. These developments contribute to the efficiency, productivity, and competitiveness of economies, while simultaneously creating new opportunities and challenges for business and society. The principal trends in economic development at this juncture are the processes of «smartization» and «digitalization,» which have become indispensable prerequisites for

economic advancement across all sectors of production and social activity. The digital transformation entails the integration of digital technologies into all facets of business and social activities. This includes the automation of business processes, the development of e-commerce, and the use of big data. At the same time, the smartization of cities and economies involves the use of intelligent systems to improve the efficiency of urban management, energy, transportation, and other sectors. The development of information technologies and the growth of artificial intelligence create conditions for economic transformation, and the integration of digital technologies into all spheres of life and economy can lead to changes similar to those that occurred as a result of the Industrial Revolution. In the long run, the smart economy may change not only the ways of production and consumption, but also social structures and the interaction between humans and machines. However, this raises the need for society to adapt to the rapidly changing technological reality and the importance of developing the skills that will be needed in the future digital world.The article identifies the features of digitalization and smartization as socio-economic phenomena that characterize the current stage of development of the global economy. The article analyzes the conceptual differences between digitalization and smartization as basic concepts of economic development and the current stage of its development and identifies the key characteristics of their implementation.

***Keywords*:** smartization, digitalization, intellectualization of economic activity, smart economy

JEL: F00, F60, F64, O14, O18, O21, R15

The statement of the problem. The evolution of economic relations evinces not merely progressive trends but also the exponential growth of a nascent technological ecosystem. The influence of technology is becoming pervasive, extending beyond a discrete sphere of production to permeate all facets of economic activity. It is facilitating the growth and advancement of a diverse range of economic endeavors. The pervasive influence of technology is a pivotal aspect of global economic advancement, influencing the capacity of business entities to compete, upholding the competitiveness of the national economy, and discerning avenues for prospective global leadership or its sustenance. The process of smartization, defined as the penetration of smart technologies into all production and management areas, represents an economic phenomenon. Digitalization can be defined as the process of integrating digital technologies into economic activities.

It is noteworthy that the advent of the concept of a new society is accompanied by pivotal processes of smartization and digitalization that pursue disparate objectives. The process of digital transformation entails the conversion of analog information into a digital format, the digitization of specific types of activities, the transition of information from paper-based formats, the integration of digital technologies into the operations of enterprises and organizations, the utilization of digital tools for process management, and the introduction of electronic services and online platforms into the work of business entities.

Analysis of the latest research and publications. The concept of «smartization» is a subject of considerable research interest among scholars, who define it as a pivotal trend in the evolution of modern society. The advancement of smartization in economic activity is a topic of investigation by Carlo Ratti, Michael Beattie, Rob Kitchen, and other prominent researchers in the field. Carlo Ratti defines smartization as a specific aspect of digitalization in his research. His research is centered on the

utilization of big data and digital technologies for the development of smart cities. The central tenets of this field of study are the potential impact of digital technologies on urbanism, the possibility of creating an adaptive, efficient, and sustainable urban environment, and the development of projects that demonstrate how digital technologies can change the urban environment. One such project is Treepedia, which uses data from Google Street View to measure green space in different cities around the world. The research identifies several potential benefits and challenges associated with the introduction of new technologies into economic activity. These include the possibilities of access to real-time data and its impact on the quality of urban services, as well as the promotion of an equitable distribution of resources [17].

Michael Batty also researches digitalization, and his work focuses on modeling and analyzing urban systems, using big data to optimize urban processes, and developing smart infrastructures [4]. A significant element of the scientist's research is the utilisation of computer modelling to analyse and predict the evolution of urban areas, transportation systems, and other facets of urban existence. The potential for aggregating a substantial corpus of data from disparate sources, including IoT sensors, social networks, and mobile devices, to enhance urban governance and decision-making represents a pivotal objective of scientific inquiry. Furthermore, the deployment of digital technologies to augment the efficacy of urban services, elevate the quality of life for residents, and guarantee sustainable development constitutes a crucial avenue of investigation [2; 3].

Rob Kitchin specializes in the study of smart cities, the use of big data and geographic information systems (GIS) to manage urban processes [15]. The incorporation of digital technologies is becoming a necessity for the advancement of economic activity through the establishment of more interactive and adaptive urban environments [10]. The advent of digital tools has the potential to alter the manner in which individuals engage with urban systems and infrastructures. By facilitating the utilisation of spatial data and geographic information systems, these tools can empower effective decision-making processes [11].

The importance of digital technologies and digital transformations in business, education, healthcare, and other industries cannot be overstated. Thus, Erik Brynjolfsson, who studies the impact of digital technologies on the economy, labor market, and society as a whole [5; 14]. The advent of digital technologies and artificial intelligence is transforming methodologies pertaining to production, consumption, and the organization of work processes [5].

The goal of the article. Nevertheless, the advent of the conceptual framework of the «smart economy» and the concomitant «smartization» of economic activity necessitates a theoretical understanding and an identification of the distinctions between this concept and that of «digitalization».

The main results. The advancement of information technology and the proliferation of artificial intelligence are establishing the foundation for a profound economic transformation. The integration of digital technologies into all facets of life and the economy has the potential to precipitate changes analogous to those that occurred as a consequence of the Industrial Revolution. In the long term, the advent of the smart economy may result in significant shifts not only in the ways of production and consumption, but also in social structures and the interaction between humans and machines. Nevertheless, this underscores the necessity for societal

adaptation to the accelerated pace of technological advancement and the pivotal role of cultivating the competencies that will be pivotal in the forthcoming digital age. The process of digitalization is becoming an integral component of industrial development and marketing strategies. The collected data can serve as a valuable source of information, influencing consumer behavior and enabling more effective market management by large industrial companies [18]. It is crucial to undertake a critical analysis of the impact of the digital revolution on privacy, corporate power, and social structures. In the works of some scholars, digitalization is regarded as a tool utilized by major technology corporations, including Google, Facebook, Amazon, and Apple (GAFA), which employ personal data to develop novel forms of economic power and control. The concept of «smartization» can be observed in the interplay between technology, spatial data, and urban systems. The application of Big Data can facilitate enhanced urban management and decision-making. The integration of data from diverse sources, including sensors, social networks, and mobile devices, enables the monitoring and optimization of urban processes. The integration of smart devices facilitates the formation of intelligent systems that oversee various aspects of human activity, including transportation, energy consumption, and security. The process of digitalization creates the potential for cities to be programmed, for changes to occur in the manner of their management, and for the lives of their residents to be transformed.

The study of smartization and digitalization is a fundamental precursor to the examination of alterations in the social order, which is of particular significance in an era of rapid transformation. The World Economic Forum, founded and chaired by Klaus Schwab, has confirmed changes in the social order [12], the objective of this study is to examine the impact of digitalization on society and the changes that have been brought about by innovative technologies. The advent of the concept of the «fourth industrial revolution,» which encompasses the convergence of physical, digital, and biological technologies, has opened up new avenues for accelerated economic growth and transformation. The latest technologies, including artificial intelligence, the Internet of Things, blockchain, and others, are affecting the global economy and society in a multitude of ways, including changes to business models, employment, and social structures. The advent of these technologies will necessitate the establishment of a global framework, which in turn will require the development of regulatory mechanisms to effectively oversee such transformations.

Smartization is understood as «the targeted implementation of the best international achievements in the field of innovation at the enterprise for the efficient use of resources, increasing the synergistic efficiency of all business processes at the enterprise to effectively achieve the set goals in the short and long term in the context of a constantly changing environment» [1]. The definition of smartification is also found in the work of Bashynska I., which is understood as “the targeted introduction of ... the latest world innovations in order to ensure its economic security” [1]. Digitalization is “the process of introducing modern digital technologies and innovations into the country’s economy in order to improve its competitiveness and development” [22]. The process of digitalization is inextricably linked to the European Union’s sustainable development goals, employment, gender equality, and research and development spending [6]. The term «digital economy» is used to describe economic activities that rely on digital technologies, including e-commerce, digital goods, electronic transactions, and information storage mechanisms [21].

The concept of «smartization» is evident in the development of smart cities, the utilization of Internet of Things (IoT) technologies, the application of big data and artificial intelligence to enhance urban living, and the capacity to integrate sensor networks that enable cities to adapt to evolving circumstances in real time. This may be exemplified by the optimization of traffic, energy, and water management. The process of «smartification» encompasses the capacity to leverage intelligent solutions and technologies to automate processes, optimize production, and enhance and facilitate the functioning of systems and devices. The process of «smartification» entails not only the utilization of digital devices, but also the integration of devices that are capable of expeditiously processing information and implementing modifications to system operations. This facilitates the creation of primarily adaptive and autonomous systems, including smart cities with smart infrastructure, smart homes with automated control systems, and smart devices that support life (such as smartphones, smartwatches, tablets, and other gadgets).

In the context of the current stage of global economic development, the economy is shaped by a number of key trends that reflect the priorities of post-industrial society. The notion that intellectual capital is a prerequisite for economic development is gaining traction. This is evidenced by the proposition that at least 40 % of the population must attain a higher education in order to facilitate the effective development of society. [20]. The classical models of societal development (1.0, 2.0, 3.0, 4.0) are currently being expanded by the newly proposed Society 5.0. This concept was developed by the Japanese Federation of Big Business, Keidanren [9], and it incorporates not only the characteristics of economic growth but also sustainable development as a means of addressing global challenges. The fundamental concepts include the establishment of a novel economic system based on the Internet of Things (IoT), Big Data, augmented and virtual reality, machine learning, and artificial intelligence.

The concept of 5.0 societies can be understood as digital spaces that complement the real world, enhancing and accelerating development effects. This understanding is based on the formation of the necessary infrastructure that will underpin both digital and physical spaces [19, c.5].

The advancement of technology has made it possible to create a repository of data that can be utilized to guarantee the continued vitality of society. However, this necessitates the digitization of data, its transfer to digital media, its storage, and its processing for a particular objective or set of tasks. This facilitates the acquisition of information regarding specific aspects of life and its utilization with the aid of contemporary communication tools. In this regard, the advent of Industry 4.0 and the nascent Industry X.0 are of particular note. Industry 4.0 represents the digitalization of the economic space, while Industry X.0 represents the pinnacle of smartization, encompassing the utilization of smart assets, services, business operations, and government initiatives [13]. Concurrently, Industry 4.0 anticipates a comprehensive digitalization process based on a multitude of technologies, including IT, digital, Internet of Things, nano- and biotechnologies, cryptocurrencies, and Big Data. [8, c. 39].

This has resulted in the creation of a dedicated digital environment, which in turn has facilitated further digitalization. Such a digital space has become an integral component of the physical space, facilitating the formation of a comprehensive digital

ecosystem that serves the physical space, establishing intricate connections between the constituent elements of both the physical and digital realms. Concurrently, the conjunction of these elements engenders the formation of interconnections between the constituents of the system. This, in turn, gives rise to a synergistic effect, whereby new interconnections or elements are formed. Such a system is not only capable of self-reproduction but also of self-learning, thereby forming the concept of Industry X.0 and Society 5.0. The processing of digital information by artificial intelligence tools generates a specific array of data that can be visualized, processed, and utilized for other purposes. This ensures the functioning of the same digital space or increases the usability of the physical space.

In the contemporary era, society has become increasingly integrated into the digital domain. However, it is important to recognize that each individual simultaneously exists within both the digital and physical realms. The advent of virtualization has introduced novel avenues for exploration through the convergence of augmented and virtual reality. This, in turn, necessitates the timely and constant updating of information, the production of new knowledge, and the formation of a novel model for the production of knowledge [16].

While digitalization is primarily concerned with the transition to a digital society, which can facilitate improvements in efficiency, smartification is aimed at implementing intelligent solutions that enhance system adaptability and automation.

The specific forms of smartization and digitalization are determined by their inherent features and practical applications in the development of modern society. The concept of smartification is evidenced by the formation of a number of specific areas of focus, including smart cities, smart economy, smart energy, smart healthcare, smart education, smart industry, logistics, and so forth.

The phenomenon of digitalization is most visibly manifested in the digitalization of business, government, education, finance, manufacturing, and transportation. The digital transformation of society at this juncture is also evidenced by the platformization of economic activity [7]. In consequence, platforms are becoming both a form of digitalization and a factor in the process of smartization of economic activity, which is affecting business models and strategies in the digital world. In the contemporary era, platforms have become the foundation for the economic activities of numerous entities that exist solely within the virtual domain, integrating it with the tangible realm. For example, Airbnb, Uber, and Facebook are transforming traditional industries where physical capital and resources were previously the primary determinants of success. Furthermore, platforms generate network effects that enhance their value for users and participants, stimulate innovation by offering access to data and application development tools for third-party developers, develop their ecosystems, including a diversity of participants who create and consume value on the platform, and influence traditional business models and strategies, necessitating adaptation and responsiveness to these novel competitive conditions.

The concepts of digitalization and smartization are interrelated, yet they possess distinct emphases and objectives. A comparative analysis of the theoretical concepts of smartization and digitalization allows us to identify the key differences between them (Table 1).

Table 1

A COMPARATIVE ANALYSIS OF THE CHARACTERISTICS OF SMARTIZATION AND DIGITALIZATION AS ECONOMIC PROCESSES

Plane of manifestation	Smartification	Digitalization
Essence	The process of using intelligent technologies to automate, optimize and improve the functioning of systems	The process of converting analog information and processes into digital format and implementing digital technologies in all aspects of business
Key objective	Automation, optimization and improvement of the functioning of various systems and devices through intelligent technologies	Increase efficiency, productivity and convenience through the use of digital tools and technologies
Production processes	Waste-free production, greening of production, use of smart technologies in production, production in the concept of sustainable development	Using digital technologies in production processes, reducing the role of humans
Ensuring the functioning of the market	Smart technologies, environmental and ethical standards of market functioning, fair trade, smart marketing	Creation of digital content, use of digital technologies to organize market operations, cryptocurrencies, financial technologies
Smart city projects	Adapting road operations to traffic, urban safety, smart homes, smart construction, greening urban projects, intelligent transportation systems (ITS), smart lighting.	The management of traffic, the operation of surveillance cameras, and the administration of water and wastewater are all areas of responsibility.
Technologies	Інтернет речей (IoT), штучний інтелект (AI), великі дані, блокчейн.	Цифрові документи, хмарні обчислення, інформаційні системи.
Results of economic activity	Increasing automation, resilience and adaptability of systems, improving the quality of life.	Increase process efficiency, reduce costs, improve service quality

The effective use of data, artificial intelligence, and automation has the potential to significantly enhance productivity. However, this also gives rise to new challenges, including those related to income inequality and privacy concerns. The advent of modern technologies has created novel opportunities to enhance productivity, innovation, and efficiency across all sectors of the economy. The advent of automation, data analysis, and digital technologies has served as a catalyst for the emergence of novel business forms and organizational models.

Technological innovations, including the Internet of Things, artificial intelligence, and data analytics, permit corporations to optimize production and service while also facilitating the collection and analysis of users' personal data on a larger scale. This, in turn, gives rise to an increase in control over personal data and privacy, as well as an increase in inequality in the distribution of power and resources. In light of these developments, it becomes evident that there is a pressing need for enhanced regulatory measures and the safeguarding of privacy in the digital economy.

Conclusions. Therefore, both the processes of smartification and digitalization are crucial for the advancement of modern society, as they enhance the quality of life, optimize the utilization of resources, and guarantee sustainable development. Digitalization is a necessary precursor to smartification, as digital technologies are the enabling factor for the functionality of smart technologies. The process of digitalization increases the speed of data processing, while the process of smartification increases convenience and comfort through the use of smart technologies. Furthermore, digitalization provides security tools, and smartification allows the use of intelligent systems for security monitoring. If the objective of digitalization is the automation of processes, then the aim of smartification is to optimize and utilize these processes efficiently, thereby reducing the negative impact on the environment through the use of renewable energy sources and optimizing the use of resources. It is noteworthy that both concepts are designed to enhance the quality of life, augment resource efficiency, guarantee sustainable development and economic growth, and facilitate societal adaptation to contemporary challenges andexploitation of the opportunities afforded by cutting-edge technologies.

References

1. Bashynska, I. (2019). Smartization as an alternative to innovative activity. Management mechanisms and development strategies of economic entities in conditions of institutional transformations of the global environment, collective monograph edited by M. Bezpartochnyi, Vol. 2, p. 73–81. URL: http://dspace.opu.ua/jspui/bitstream/123456789/8351/1/Bashynska_mon_Riga.pdf
2. Batty, M. (2007). Cities and complexity: Understanding Cities with Cellular Automata, Agent-Based Models, and Fractals. MIT Press. 592 p. ISBN-10:0262524791
3. Batty, M. (2009). Urban Modelling. Cambridge University Press. 408 pp. ISBN-10:0521134366
4. Batty, M. (2017). The new science of cities. MIT Press. 520 pp. ISBN: 9780262534567
5. Brynjolfsson E., Mcafee A. (2016). The second machine age: Work Progress and Prosperity in a Time of Brilliant Technologies. National Geographic Books.
6. Burinskienė A.; Seržantė M. Digitalisation as the Indicator of the Evidence of Sustainability in the European Union. *Sustainability* 2022, 14, 8371. https://doi.org/10.3390/su14148371
7. Choudary, S.P., Alstyne, M.W., & Parker, G. (2016). Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You.
8. HITECH office. (2016). Digital Agenda of Ukraine — 2020 («Digital Agenda» — 2020). Conceptual foundations (version 1.0). Priority areas, initiatives, projects of «digitalization» of Ukraine until 2020. URL: https://ucci.org.ua/uploads/files/58e78ee3c3922.pdf
9. Keidanren (Japan Business Federation). (n.d.). Toward realization of the new economy and society. URL: https://www.keidanren.or.jp/en/policy/2016/029_outline.pdf
10. Kitchin, R., & Dodge, M. (2011). Code/Space. In The MIT Press eBooks. https://doi.org/10.7551/mitpress/9780262042482.001.0001
11. Kitchin, R., Lauriault, T.P., & Wilson, M. W. (2017). Understanding spatial media. SAGE Publications Limited. ISBN: 9781473949683
12. Klaus Schwab. (2016). The Fourth Industrial Revolution. URL: https://law.unimelb.edu.au/__data/assets/pdf_file/0005/3385454/Schwab-The_Fourth_Industrial_Revolution_Klaus_S.pdf

13. Kraus K., Kraus N., Ishchenko I. (2023). Focus on the priorities of industry X.0 and its anatomy in the conditions of digitalization of economic relations. Innovation and Sustainability, 1, 33–50. https://doi.org/10.31649/ins.2023.1.33.50
14. Mcafee A., Brynjolfsson E. (2017). Machine, platform, crowd. National Geographic Books.
15. Rob Kitchin. (2014). The Data Revolution: Big Data, Open Data, Data Infrastructures and Their Consequences. SAGE Publications Ltd. 240 pp. ISBN-10: 1446287483
16. Ullah, A. S. (2020). What is knowledge in Industry 4.0? Engineering Reports, 2(8). https://doi.org/10.1002/eng2.12217
17. Urban imagination and social innovation through design & science. URL:https://senseable.mit.edu/
18. Zuboff, S. (2018). The age of surveillance capitalism: The Fight for a Human Future at the New Frontier of Power. PublicAffairs.
19. Kraus K.M., Kraus N.M., Osetskyi V.L. (2021). Society 5.0 based on the development of an innovative university and digital entrepreneurship. Economy and society, (28).
20. Maguta, O. V. (2017). The role of higher education in the innovation of the economy of Ukraine. Formation of market relations in Ukraine: scientific collection (Issue 12 (199), pp. 94–103. NDEI.
21. Myronova, M. I. (2023). Development of the digital economy: global trends and challenges for Ukraine. Vìsnik L′vìvs′kogo Torgovel′no-ekonomìchnogo Unìversitetu. Ekonomìčnì Nauki, 73, 103–110. https://doi.org/10.32782/2522-1205-2023-73-15
22. Minyaylenko I.V., Podkopova D.E. Digitization of the economy as the main driver of Ukraine's recovery. URL: https://reposit.nupp.edu.ua/bitstream/PoltNTU/12391/1/75 %20 %D0 %A2.1-389-390.pdf