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**Natalia Bobro**
Ph.D, Doctor of Philosophy
Director of the Digital Department of the European University
director of the "NooLab & AI" Scientific Laboratory of the European University
European University
Kyiv, Ukraine
Walzenhausen, Switzerland
ORCID ID: 0009-0003-5316-0809
*e-mail: natalia@noolab.ch*

# DIGITALIZATION AND TRANSFORMATION OF SOCIO-ECONOMIC RELATIONS IN THE CONTEXT OF DIGITAL UNIVERSITY DEVELOPMENT

**Abstract.** The article provides a comprehensive theoretical and methodological analysis of digitalization as a key factor in the transformation of socio-economic relations and the development of a new institutional model of the university. It is substantiated that digitalization is not limited to the automation of individual processes, but is a systemic socio-technological phenomenon that affects production, the structure of the labor market, forms of employment, as well as the sphere of education and science. It is determined that in the digital age, the university is acquiring the characteristics of a digital university, which combines the functions of an educational, scientific, and organizational center with platform mechanisms for managing knowledge, data, and innovation. It has been shown that the spread of digital technologies, the growing role of artificial intelligence, big data analytics, virtual platforms, and remote work formats are leading to the emergence of new models for the functioning of educational institutions. The research focuses on the digital university as an institutional form that combines traditional resources (human, organizational, financial, and infrastructural) with digital assets, forming a multi-level ecosystem of sustainability and competitiveness. It has been proven that digitalization changes the content and structure of work, enhances the role of intellectual and creative competencies, and opens up new opportunities for personalizing education and developing digital skills. It has been revealed that universities in the digital environment perform the functions of integrating knowledge and technologies, analyzing educational data, and creating conditions for lifelong learning. It has been determined that the effectiveness of digital transformation is multidimensional: along with economic criteria, social, cultural, and environmental indicators are becoming increasingly important. It is emphasized that a digital university is not only an educational and scientific center, but also a key actor in socio-economic change, capable of ensuring the stability of the educational process, the development of partnership ecosystems, and integration into global knowledge networks. The practical significance of the results lies in the possibility of using them to improve strategies for the digital transformation of universities, the formation of modern management models, and the development of innovative educational services.

**Keywords:** digitalization; digital university; socio-economic relations; digital economy; educational ecosystem; human capital; transformation of education.

## INTRODUCTION

Today, digitalization is not just a technical innovation, but a comprehensive socio-technological process that defines the new architectonics of social development. It changes the logic of economic relations, forms new mechanisms for the distribution of labor and knowledge, and at the same time opens up space for the emergence of non-traditional formats for organizing the educational and scientific environment. It is in this area that the paradigm of the digital university is being shaped — an institution capable of accumulating and integrating information flows, transforming them into resources for the development of education and society.

**Problem statement.** The study of socially oriented development of the digital economy and the role of universities in these processes is a relevant and important area of contemporary science. Digitalization is changing the content of professional activities, the structure of the labor market, and approaches to the organization of education systems. This necessitates a

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scientific understanding of the digital university as an institutional form capable of ensuring lifelong learning, the development of digital competencies, and the formation of the socio-economic sustainability of society.

**Analysis of recent research and publications.** In scientific literature, the digital economy and digital transformation are viewed through the prism of globalization risks, innovation strategies, and educational changes. Thus, C. Safarli et al. analyze the risks of globalization in the context of the formation and implementation of international investment strategies [1]. In the domestic scientific field, attention is focused on the issues of modernizing enterprises with the help of automated systems (P. Huk, O. Skliarenko [2]) and on the practical aspects of developing innovative business ideas using digital services (Ya. Kolodinska, O. Skliarenko, O. Nikolaievskyi [3]).

The conceptual foundations of the digital economy were laid by T. L. Mesenbourg, who identified the key components of digital infrastructure, e-business, and e-commerce [4]. The development of educational formats in the digital age can be traced in the research of G. Kortemeyer, N. Dittmann-Domenichini, and C. Merki, who analyze students' choices between full-time, hybrid, and online lectures after the pandemic [5], as well as in the works of O. Khomenko, M. Paustovska, and I. Onyshchuk on the impact of interactive technologies on the learning and development of higher education students [6].

The conceptual foundations of digital transformation constitute a separate layer of research. N. Verina and J. Titko proposed a conceptual framework for digital transformation [7], while another research examined the transformation of university information architecture in the process of digitalization [8]. In a socio-economic context, digital transformation is studied through inclusive models of development and overcoming inequality (A. Kozhyna [9]). The issues of innovation potential and legal regulation are highlighted by S. Kubiv et al. [10], while H. Lopuschnyak, O. Chala, and O. Poplavska focus on the socio-economic determinants of sustainable development [11].

In the broader context of digitalization and knowledge management, the research by L. Leiva, M. Matera, and J. Schöning on current trends in human-computer interaction is important [12].

Despite significant scientific achievements, issues such as the integration of digital universities into socio-economic ecosystems, methodological principles for assessing the effectiveness of educational digital transformation, and the impact of digital technologies on the formation of new social roles and professional competencies remain insufficiently studied.

**The aim of the article.** The aim of the article is to identify the determinants of socially oriented development of the digital economy and to study the functions of the digital university in ensuring the sustainability and competitiveness of the educational environment.

## RESEARCH RESULTS

Digitalization is causing fundamental changes in all areas of human life. Technologies are becoming not only the driving forces behind the formation and development of new industries and production methods, but also factors in the transformation of social roles of actors [9, p. 32]. A society focused on human needs in the digital economy is radically changing production processes, the market for goods and services, and the structure of the labor market, leading to the transformation of the system of lifelong learning and new formats of organizing economic activity.

The digital economy is based on the use of digital models of economic, social, engineering and technical, and natural and environmental systems, which concentrate knowledge about people, society, and the environment. This determines a new quality of socio-economic relations and the need to integrate educational resources into multi-level digital ecosystems.

The determinants of socially oriented development of the digital economy are presented in Fig. 1. They cover both direct effects — increased labor productivity, increased share of

intellectual and creative employment, innovative development of social production, digital transformation of business processes, expansion of remote employment opportunities — as well as indirect effects related to personal development, expanded access to knowledge and digital services, and improved quality of life for the population.

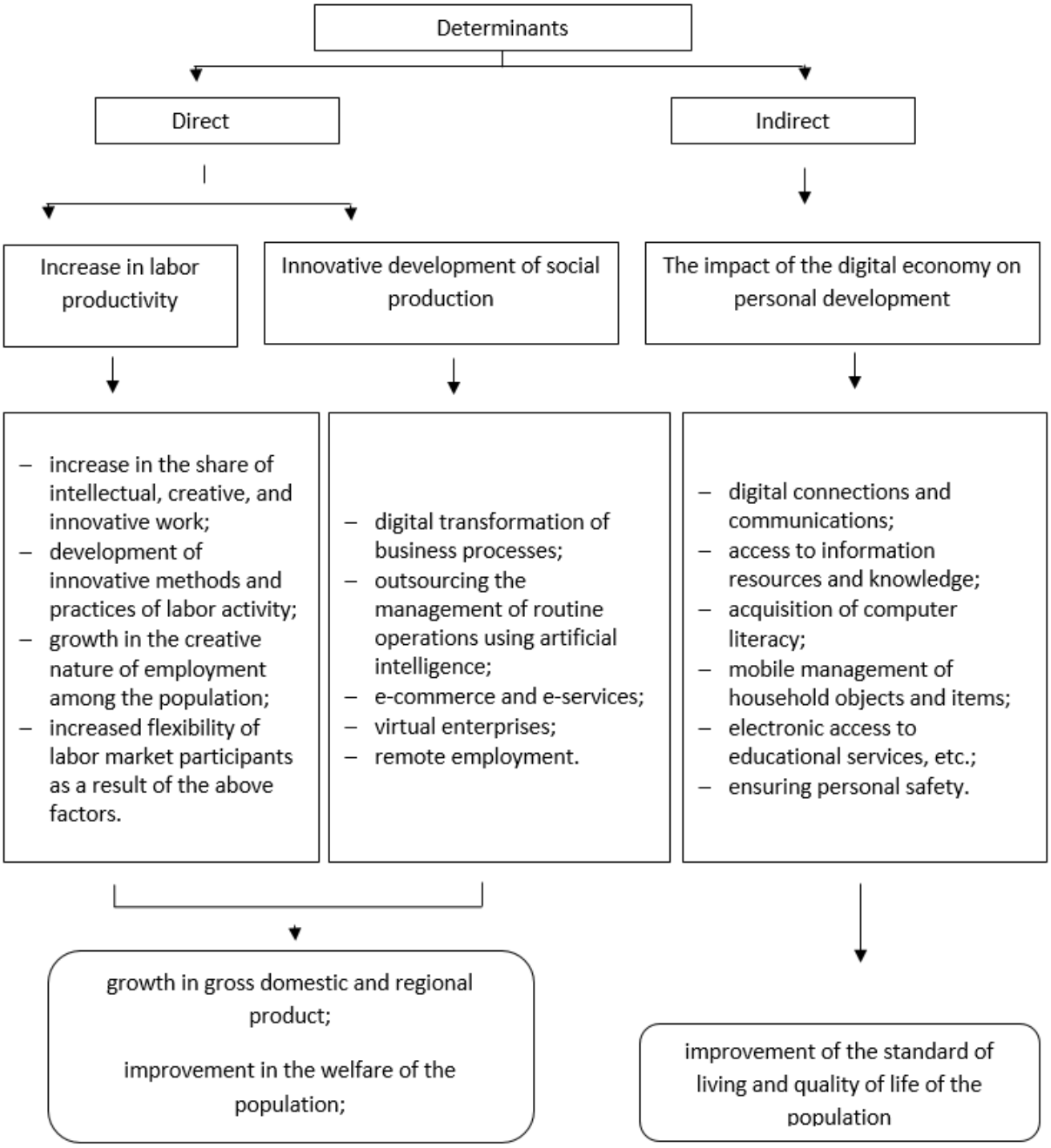



Fig. 1. Determinants of socially oriented development of the digital economy

Scientific literature attempts to periodize the development of the digital economy, which was initiated in 2001 by T. L. Mesenbourg [4]. According to his concept, the key elements of the digital economy are: digital infrastructure (computer hardware, software, telecommunications, network resources, etc.); e-business (digital organization of business processes); e-commerce.

Other researchers also identify stages of digital transformation of the economy that are similar in their essential characteristics [3], [9], [10]: automation based on the use of available information and repetitive decisions; digitalization, which involves the use of optimized information technologies and data analysis for decision-making; digital transformation, which is associated with the emergence of new business models based on the development of digital platforms. Digital platforms, which are considered software and hardware solutions that accumulate digital products in a single environment, play an important role in the functioning of the digital economy [2, p. 103]. Accordingly, the stages of development of the digital economy are also determined through the prism of platforms: the formation of platforms, their filling with digital products, and the commercialization of digital goods and services.

An analysis of the above interpretations of the periodization of the digital economy shows that they focus mainly on technical and technological aspects, do not sufficiently take into account the role of human capital, and are oriented toward the study of business processes and commodity markets. In fact, the scope of the digital economy is much broader, as it covers not only the digital fields of mathematics, programming, engineering, and information networks, but also healthcare, education, culture, housing and utilities, and others. Thus, the process of digitalization has, in one form or another, encompassed all spheres of human life, allowing us to interpret the digital economy as a sustainable socio-economic category [1], [5].

The foundation of the digital economy is a set of digital technologies, the list of which is constantly expanding, allowing it to be characterized as a qualitatively new economic system. At the present stage, the most widespread digital segments are BioTech (pharmaceuticals, healthcare, agro-industrial complex), NanoTech (industrial production), RetailTech (trade, marketing, logistics), FinTech (financial sector), LegalTech (law), InsurTech (insurance), and GovTech (public governance and social management).

The philosophical approach to the dialectic of human-artificial intelligence interaction reflects key issues of labor digitalization, including the development of a new concept of nature, the awareness of a person as both a creator and consumer of technology, and the process of technologization of one's own essence [7, p. 720]. Together, these trends are shifting the focus from production and labor relations to social and labor relations, within which employees consciously or unconsciously interact with technological systems, changing established behavioral roles.

Replacing human production functions with technological processes is not a new phenomenon, but digitalization has taken these relationships to a whole new level. Changes in the composition and structure of labor have highlighted the need to reform personnel training and human resource provision processes. At the same time, according to the laws of dialectics, every threat to the established system of labor relations opens up new opportunities for its effective functioning in the digital economy.

One of the key challenges of the digital economy from a social perspective is the layoff of employees due to their replacement by digital analogues, not only in physical labor but also in intellectual labor, which has long been considered the exclusive prerogative of humans [12, p. 2]. This leads to structural changes in the labor market, a redistribution of employment between sectors, and the need for the population to adapt to new professional roles.

To neutralize negative trends in the development of labor relations, it is necessary to reorganize the education system, which should ensure not only the acquisition of a relevant specialty but also the possibility of rapid retraining in accordance with the demands of the digital labor market. An important feature is that the digital economy not only sets new requirements but also creates conditions for the formation of an effective system of lifelong learning, within which employees acquire the competencies necessary for successful adaptation throughout their professional lives.

The organization of such a system involves the active use of distance and interactive learning technologies, which corresponds to the basic principles of the digital economy. At the same time, teachers themselves need additional digital skills — both those who ensure the formation of digital literacy and those who teach disciplines related to digital transformation. As a result, the traditional system of training personnel in higher education institutions is gradually transforming into a multi-level system of lifelong learning, characterized by the ability to self-learn, self-organize, and self-develop.

Contemporary research emphasizes that in the digital economy, knowledge is becoming the main factor in value creation, while from a technological perspective, cybernetics is becoming increasingly important. In the social context, the concept of social synergetics has gained popularity, which, through the use of big data and artificial intelligence, allows for building an understanding of patterns and regulatory mechanisms at the societal level [10, p. 263]. For the educational environment, this means that the digital university is becoming a key platform for the integration of knowledge flows, their analysis, and management based on digital technologies.

The leading value in digital education is the student as an active participant in the educational process, who determines the development trajectories of educational programs and forms of learning [1], [3]. While the traditional pedagogical model was based on the dominance of the teacher, digitalization actualizes the principle of student-centeredness and personalization of educational services. In this context, the paradigm of a “culture of educational abundance” gains importance, where the key task is to meet a wide range of educational needs through digital platforms and services, even with limited resources.

It should be noted that, in addition to the already outlined dependence between information, technical, and energy resources, digital education reveals another specific feature — information as an inexhaustible resource. At the same time, the scale and complexity of its use are limited by human cognitive abilities [6], [11]. Thus, human intelligence is a finite natural and social resource, whose ability to create unique educational and scientific products should be considered a rare commodity that generates intellectual rent. Accordingly, the value of an information and educational product in a digital university should be interpreted as capitalized intellectual rent.

The result of the digital education functioning, like any complex socio-economic system, is the achievement of both quantitative and qualitative results. Traditionally, the indicator of this process was considered to be efficiency, which was determined by maximizing results or minimizing costs. However, this classical understanding is simplistic and does not reflect the specifics of educational digital transformation. In particular, digital education requires consideration not only of economic efficiency, but also of social impact, the quality of educational outcomes, and the ability of universities to provide sustainable educational trajectories.

It is important to note that the return on digital education is determined not only by the volume of investment in digital technologies, but also by the interaction of information, organizational, and human capital [8]. Organizational and human capital in a digital university are complementary to technological capital, and it is their structure and balance that determine the effectiveness of innovation implementation.

Modern science has expanded the criteria for effectiveness, distinguishing several levels: economic effect (in terms of cost), socio-economic effect (combination of educational and social benefits), social effect (indicators of the social significance of education), and environmental effect (sustainable development and environmental standards of the university environment). Equally important is the ecosystem approach, whereby the effectiveness of a university is also determined by its ability to meet the educational and social needs of all stakeholders.

Thus, the digital transformation of education has necessitated the development of new criteria for assessing the effectiveness of information resources and digital data management. Early research in systems theory emphasized that in order to improve a situation, it must be managed, which is impossible without reliable information about its state [10, p. 264]. In this sense, the digital university becomes a center for the collection, processing, and interpretation of educational data, which allows not only monitoring the effectiveness of educational processes, but also forming scientifically grounded management decisions.

The use of economic and mathematical tools in assessing the effectiveness of educational systems is reflected in the transformation of performance indicators: in digital conditions, effectiveness is determined not only by the ratio of costs and results, but also by the achievement of strategic educational goals. This meets the requirements of complex systems management theory, where the key criterion is the goal-oriented nature of their functioning. In this context, it is advisable to consider not only the effectiveness of digital processes but also their security, which in the educational environment means data protection, academic integrity, and the sustainability of digital infrastructure. Thus, the criteria for the effectiveness of a digital university are not only economic indicators or the quality of educational programs, but also the minimization of deviations in management processes and the guarantee of stable development of the educational system.

To summarize, it can be argued that a digital university is not limited to the integration of new information technologies, but is a qualitatively new institutional entity, the result of the functioning of which is the transformation of socio-educational relations. In the new digital reality, universities face complex economic, social, cultural, and ethical challenges, the resolution of which is a prerequisite for ensuring the digital sustainability of the educational environment.

## CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

The research has established that digitalization is a fundamental factor in the transformation of socio-economic relations, as it changes the structure of employment, models of labor organization, and approaches to human capital formation. It shapes a new quality of economic systems, where knowledge, data, and innovative products become leading resources. In this context, the university is not only an educational and scientific center, but also an institutional platform for the integration of digital knowledge flows and information resource management.

It has been proven that a digital university should be viewed as a socio-technological institution that integrates educational, organizational, and technological components into a single ecosystem. This ensures the continuity of education, the personalization of educational trajectories, the improvement of digital literacy, and the development of sustainable mechanisms for adapting to the labor market. At the same time, digitalization is shaping new approaches to performance evaluation: alongside economic criteria, social, environmental, and cultural indicators are becoming increasingly important. Thus, the digital university is considered an institutional model for the transformation of socio-economic relations, capable of strengthening the competitiveness of the educational environment, creating conditions for the generation of intellectual rent, and promoting the sustainable development of society.

Promising areas for further research include the development of quantitative and qualitative models for assessing the effectiveness of digital universities, taking into account multi-criteria indicators, studying the impact of artificial intelligence and big data analytics on educational management, and modeling scenarios for the interaction of digital universities with economic and social ecosystems. Of particular relevance is the analysis of the ethical and axiological dimensions of digitalization, which ensure a balance between technological innovation and the humanistic values of education.

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**Бобро Наталія Сергіївна**
кандидат економічних наук
директор цифрового департаменту Європейського університету
директор «NooLab & AI» наукової лабораторії Європейського університету
Європейський університет
Київ, Україна
Вальценхаузен, Швейцарія
ORCID ID: 0009-0003-5316-0809
*e-mail: natalia@noolab.ch*

# ЦИФРОВІЗАЦІЯ ТА ТРАНСФОРМАЦІЯ СОЦІАЛЬНО-ЕКОНОМІЧНИХ ВІДНОСИН У КОНТЕКСТІ РОЗВИТКУ ЦИФРОВОГО УНІВЕРСИТЕТУ

**Анотація.** У статті здійснено комплексний теоретико-методологічний аналіз цифровізації як ключового чинника трансформації соціально-економічних відносин та формування нової інституційної моделі університету. Обґрунтовано, що цифровізація не зводиться до автоматизації окремих процесів, а виступає системним соціально-технологічним феноменом, який впливає на виробництво, структуру ринку праці, форми зайнятості, а також на сферу освіти та науки. Визначено, що університет у цифрову епоху набуває ознак цифрового університету, який поєднує функції освітнього, наукового та організаційного центру з платформними механізмами управління знаннями, даними та інноваціями. Показано, що поширення цифрових технологій, зростання ролі штучного інтелекту, аналітики великих даних, віртуальних платформ і дистанційних форматів праці зумовлюють появу нових моделей функціонування освітніх інституцій. У центрі дослідження — цифровий університет як інституційна форма, що поєднує класичні ресурси (людський, організаційний, фінансовий та інфраструктурний) із цифровими активами, формуючи багаторівневу екосистему стійкості та конкурентоспроможності. Доведено, що цифровізація змінює зміст і структуру праці, підсилює роль інтелектуальних та креативних компетентностей, відкриває нові можливості для персоналізації освіти й розвитку цифрових навичок. Розкрито, що університет у цифровому середовищі виконує функції інтеграції знань і технологій, аналітики освітніх даних та створення умов для безперервного навчання. Визначено, що ефективність цифрової трансформації має багатовимірний характер: поряд з економічними критеріями дедалі більшого значення набувають соціальні, культурні та екологічні показники. Підкреслено, що цифровий університет виступає не лише освітнім і науковим осередком, а й ключовим актором соціально-економічних змін, здатним забезпечувати стабільність освітнього процесу, розвиток партнерських екосистем і інтеграцію у глобальні мережі знань. Практична значущість результатів полягає у можливості використання їх для вдосконалення стратегій цифрової трансформації університетів, формування сучасних управлінських моделей та розробки інноваційних освітніх сервісів.

**Ключові слова:** цифровізація; цифровий університет; соціально-економічні відносини; цифрова економіка; освітня екосистема; людський капітал; діджиталізація; трансформація освіти.

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