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КОНЦЕПТУАЛЬНІ ОСНОВИ РОЗВИТКУ ЦИФРОВОЇ КОМПЕТЕНТНОСТІ РОБОЧОЇ СИЛИ УКРАЇНИ

Актуальність. Ключова роль цифрової компетентності пов’язана із задоволенням потреб Четвертої промислової революції, драйвером якої є цифровізація, що стала головним імперативом сучасності. Весільніший і динамічний характер цифрової трансформації обумовлює зміни в більшості сферах життєдіяльності суспільства, які змушують людину швидко до них адаптуватися. В таких умовах наростаючий компетентнісний потенціал трудових ресурсів в частині цифрової компетентності стає необхідною умовою успішного функціонування не тільки окремих людей і суспільства, але і соціо-економічної системи взагалі. Цифрова компетентність є інструментом, що зафіксовано в багатьох міжнародних документах, зокрема, в Рамковій програмі оновлених ключових компетентностей для навчання впродовж життя Європейського Парламенту і Ради Європейського Союзу та звіті «На шляху до структурованої та узгодженої термінології наскрізних навичок і компетенцій» Європейської Комісії та Європейського центру розвитку професійної освіти. Європейський вектор розвитку та складність соціо-еколого-економічного середовища України обумовлюють необхідність побудови індивідуальної траєкторії цифрової освіченості населення на основі вивчення та імплементації досвіду Європейського Союзу в зазначений сфері діяльності.

Мета та завдання. Метою статті є розробка концептуальних основ розвитку цифрової компетентності робочої сили України.

Матеріали та методи. Інформаційними джерелами дослідження є фундаментальні та прикладні дослідження вітчизняних та зарубіжних вчених з питань компетентностного потенціалу в частині цифрової грамотності, а також провідних міжнародних організацій, зокрема, Європейського центру розвитку професійної освіти, Європейської Комісії, ЮНЕСКО, дані з відкритих джерел. Для досягнення поставленої мети використано методи системного аналізу, логічного узагальнення та контент-аналізу.

Результати. Розглянуто роль і значення цифрової компетентності в контексті сучасного соціо-економічного розвитку. Досліджено поняття «цифрова компетентність» з точки зоря сутнісного наповнення та офіційно визначених тлумачень. Запропоновано визначати рівні цифрової компетентності в господарській діяльності в розрізі структури бізнес-процесів та рівня наукоємності виробництва на основі європейського підходу до визначення рівня кваліфікацій, представленого в DigComp2.1, згідно якому запропоновано визначати в залежності від складності і рівня автономності виконання завдань, а також виду когнітивних операцій (запам’ятовування, розуміння, застосування, оцінювання, створення) 4 рівня кваліфікації: базовий, середній, просунутий та професійний. Окреслено, що перспективи подальших досліджень пов’язані з дослідженням критеріїв визначення рівнів цифрової компетентності в розрізі структуроутворюючих бізнес-процесів, що сприятиме ефективному використанню трудового потенціалу населення України.

Висновки. В умовах цифрової трансформації економіки цифрова компетентність набуває характеру трансверсальної, оскільки майже всі професії в майбутньому мають цифрову компоненту. В свою чергу, формування, застосування та розвиток цифрової компетентності населення в розрізі різних категорій є складним і привільним процесом, що вимагає угледжності та синхронізації в часі різних взаємозалежних складових, зокрема, нормативно-правової, інституційної, матеріально-технологічної та кадрової, кожна із яких потребує вирішення комплексу проблем. Важливо розуміти, що для ефективного використання трудового потенціалу населення України

Ключові слова: цифроваяизация економики; цифровая компетентность; бизнес-процесс; рівень володіння цифровою компетентністю.
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CONCEPTUAL FOUNDATIONS OF THE DEVELOPMENT OF DIGITAL COMPETENCE OF THE WORKFORCE OF UKRAINE

**Topicality.** The key role of digital competence is related to meeting the needs of the Fourth Industrial Revolution, the driver of which is digitalization, which has become the main imperative of modernity. The comprehensive and dynamic nature of digital transformation causes changes in most spheres of life in society, which force people to quickly adapt to them. In such conditions, increasing the competence potential of labor resources in terms of digital competence becomes a necessary condition for the successful functioning of not only individuals and society, but also the socio-economic system in general. Digital competence is becoming transversal, which is recorded in many international documents, in particular the Framework Program of the renewed Key competences for lifelong learning of the European Parliament and the Council of the European Union and the report "Towards a structured and agreed terminology of cross-cutting skills and competences" of the European Commission and the European Center for the development of vocational training. The European vector of development and the complexity of the socio-ecological and economic environment of Ukraine determine the need to build an individual trajectory of digital education of the population based on the study and implementation of the experience of the European Union in the specified field of activity.

**Aim and tasks.** The purpose of the article is to develop the conceptual foundations of the development of the digital competence of the workforce of Ukraine.

**Materials and methods.** The information sources of the research are fundamental and applied research by domestic and foreign scientists on issues of competence potential in terms of digital literacy, as well as leading international organizations, in particular, the European Center for the Development of Professional Education, the European Commission, UNESCO, data from open sources. To achieve the goal, the methods of system analysis, logical generalization and content analysis were used.

**Research results.** The role and significance of digital competence in the context of modern socio-economic development is considered. The concept of "digital competence" was studied from the point of view of essential content and officially defined interpretations. It is proposed to determine the levels of digital competence in economic activity in terms of the structure of business processes and the level of knowledge-intensive production on the basis of the European approach to determining the level of qualifications presented in DigComp2.1, according to which it is proposed to use depending on the complexity and level of autonomy of task performance, as well as the type cognitive operations (memorizing, understanding, applying, evaluating, creating) 4 levels of qualification: foundation, intermediate, advanced and highly specialised. It is outlined that the prospects for further research are related to the study of the criteria for determining the levels of digital competence in terms of structure-forming business processes, which will contribute to the effective use of the labor potential of the population of Ukraine.

**Conclusion.** In the conditions of the digital transformation of the economy, digital competence acquires a transversal character, since almost all professions will have a digital component in the future. In turn, the formation, application and development of digital competence of the population in terms of different categories is a complex and long-term process that requires coordination and synchronization in time of various interdependent components, in particular, regulatory and legal, institutional, material and technological and personnel, each of which needs to solve a complex of problems. It is important to understand that in order to effectively use the labor potential and increase labor productivity, it is necessary to maintain the correspondence of the qualification level of the digital competence of the workforce to the complexity of the tasks, depending on the scientific intensity of the production processes.

**Keywords:** digitalization of the economy; digital competence; business process; proficiency level of digital competence.

**Problem statement and its connection with important scientific and practical tasks.** The European Commission has declared 2023 the European Year of Skills in response to challenges related to the quality of the workforce. Against the background of a low unemployment rate in the countries of the European Union (EU) in 2022, which hovered around 6%, 77% of companies experienced a shortage of workers with the necessary skills, starting as early as 2019. In the countries of the EU in 2021 in the healthcare industries, hotel business, construction, information and communication technologies, 28 professions were identified, which were
characterized by an insufficient level of skills (European Commission, 2023).

Unfortunately, Ukrainian realities are more severe. In pre-war 2021, the unemployment rate of the population aged 15 and older was 9.8% (State Statistics Service of Ukraine, 2022). The International Labor Organization estimated the unemployment rate by the end of 2022 at 15.5% or 2.4 million jobs. According to the estimates of the Ministry of Economy, at the beginning of 2023, the number of unemployed was 2.6 million people, and according to the estimates of the National Bank of Ukraine, it was in the range of 4.2-4.8 million people (The National Institute for Strategic Studies, 2023). According to the approximate estimates of experts, the number of the employed population of Ukraine under the destructive influence of military actions has decreased by a third.

The military aggression of a neighboring country against Ukraine increased imbalances in socio-economic processes in most spheres of Ukrainian society. Today's realities indicate that the reconstruction of destroyed enterprises, industries, and infrastructure should be based on digitization, since digital technologies will become a tool for intelligent reconstruction in conditions of shortage of resources, and, first of all, labor resources. The only way to rebuild the state by Ukrainian society is through digital technologies, since every dollar invested in digital technologies over the past three decades has added an average of 20 dollars to GDP (Haustov, V.K., 2019). Thus, the problem of developing the system of knowledge and skills dissemination necessary for using the opportunities of digital technologies, i.e. the development of digital competence, becomes a priority.

Analysis of recent publications on the problem. The analysis of scientific literature showed that the study of the phenomenon of competence takes place to a greater extent in the educational plane, since it is in the education system that the primary knowledge of the population is formed. The fundamental foundations of the theoretical and methodological research of the "competence" category were laid in their scientific works by such outstanding Ukrainian and international scientists as: M.S. Golovan, O.A. Grishnova, S. Kulikovsky, S. Leyko, J. Raven, T.V. Semigina, R. White and others. The phenomenon of digital competence forms the scientific interests of many Ukrainian scientists, in particular, the conceptual issues related to it, highlighted in the works of G.O. Androschuka, V.S. Kuibidy, O.V. Ovcharuk, A.A. Oleshko, O.M. Petroye, L.I. Fedulova et al. L. Matveychuk, N.S. focused their attention on the study of digital competencies of public authorities. Orlova, G.V. Shlyakhina, V.V. Postikova, I.B. Zhilyaeva, A.I. Semenchenko, S.E. Zelinsky and others. Digital competence is also systematically studied by specialists of many international organizations, in particular, the European Center for Development and Vocational Training (CEDEFOP), the Organization for Economic Cooperation and Development (OECD), UNESCO, the European Commission, etc.

Allocation of previously unsolved parts of the general problem. A critical analysis of scientific literature and information presented in the mass media allowed us to conclude that in the countries of the European Union, digital competence, as an important characteristic of the workforce and the population in general, has been sufficiently researched and to date specific practical measures are being taken to spread it among the population. In Ukraine, however, the phenomenon of digital competence is being improved in the theoretical plane and is highlighted fragmentarily in the regulatory and legal field. Insufficient attention is paid to the practical application of theoretical developments in the field of digital competence in the practical sphere of the business sector.

Formulation of research objectives (problem statement). The purpose of the article is to study the phenomenon of digital competence and the influence of the degree of knowledge intensity of production processes on the level of digital competence of the workforce.

Materials and methods. The information sources of the research are fundamental and applied research by domestic and foreign scientists on issues of competence potential in terms of digital literacy, as well as leading international organizations, in particular, the European Center for the Development of Professional Education, the European Commission, UNESCO, data from open sources. To achieve the goal, the methods of system analysis, logical generalization and content analysis were used.

An outline of the main results and their justification. The number of jobs and professions that require digital competence is increasing rapidly as digital means of production and technology replace analog, creating endless opportunities for increased productivity. The digitized economy, representing the highest level of the digital economy, transforms production relations and factors of production under the influence of advanced digital technologies.
Scientists propose to investigate the competence potential in the conditions of digitalization of the economy of Ukraine, which means new opportunities for the workforce, on the one hand, and means of production, on the other, that meet the requirements of digital and information and communication technologies (Umanets, T.V. & Dariienko, O.V., 2022). Moreover, the rapid development of science and technology contributed to the formation of a basis for the formation of a new approach to determining the essence of labor potential. We are talking about a competency-based approach, which, unlike traditional approaches, reflects the degree of potential opportunities for effective work. From the standpoint of the competence approach, "labor potential" is revealed as the integral ability of the workforce to work, taking into account new opportunities (competencies and competences) that meet the requirements of digital and information and communication technologies (Shatalova, L.S., 2023).

In such conditions, the level of digital competence of employees determines the scope of their participation in socio-economic processes and the level of remuneration. Thus, it has been established that the hourly wages of those employed in jobs that do not require information and communication technology skills are approximately 8% lower. In turn, employees who work with advanced skills in the field of information and communication technologies require an hourly wage increase of about 3.7% compared to those who work with basic skills (Eurofond, 2021).

All types of business processes, starting from the security system and resource provision to the sale of products, are to some extent involved in the information, communication and digital environment. In order not to suffocate in the continuous flow of information, a modern worker must master digital competence, which includes digital consumption, digital knowledge and skills, and digital security. The ability to use and create content based on digital technologies, computer programs, to interact with other people using information and communication technologies is becoming transversal, as stated in the report "Towards a structured and agreed terminology of cross-cutting skills and competences" of the European Commission and the European Center development of professional education (European Commission, 2021). As transversal, digital competence is multi-purpose, necessary for a large number of work operations in different professions and fields. Officially recognized interpretations of the concept of "digital competence" are given in Table. 1.

<table>
<thead>
<tr>
<th>Official definitions of the concept of &quot;digital competence&quot;</th>
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<td><strong>Source</strong></td>
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<td>Key competences for lifelong learning (European Commission, 2021)</td>
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<td>UNESCO (UNESCO, 2018)</td>
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<td>Concept of development of digital competences of Ukraine (On the approval of the concept of the development of digital competences and the approval of the plan of measures for its implementation, 2021)</td>
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*Source: compiled by the author based on (European Commission, 2019; UNESCO, 2018; On the approval of the concept of the development of digital competences and the approval of the plan of measures for its implementation, 2021)*

Digital competence is recognized as one of the eight key competences for the full life and activity of citizens of the European Union, which are reflected in the Framework program of Key competences for lifelong learning (European Commission, 2021).

In Ukraine, for the period until 2025, the outlines of the main issues related to digital competence are defined in the Concept of the Development of Digital Competences (On the approval of the concept of the development of digital competences and the approval of the plan of measures for its implementation, 2021). Unfortunately, we are lagging behind the experience of the developed countries of the world in this area, including the EU countries, since in...
these countries the issues of practical implementation of the development of digital literacy of the population are already being resolved by creating specific tools with the determination of sources of their funding. Ukraine, on the other hand, is at the stage of defining the conceptual foundations of the development of digital competence of the population with fragmentary coverage in the regulatory and legal field.

According to the conceptual reference model of digital competences of the European Commission, digital competence is scattered over the spectrum of five areas: information and data literacy, communication and interaction in a digital society, creation of digital content, safety in a digital environment, problem solving in digital environment and lifelong learning (European Commission, 2017). For citizens of Ukraine, digital competence has been supplemented by the field of "Basics of computer literacy". The efforts of the system of formal, informal and informal education should be aimed at development along the above-mentioned vectors.

Based on the Digital Competence Framework, following the experience of the EU, it is expedient for the Cabinet of Ministers to develop a Digital Competence Framework for the main professional groups in each sector of the economy, i.e. for Ukrainian doctors, teachers, civil servants, etc., so that each person can use digital technologies as effectively as possible in their professional activity. For example, the EU has already developed a digital competence framework for teachers.

When designing digital competence for business processes, it should be assumed that a business process is a stable, purposeful set of interconnected activities that, using a certain technology, transforms inputs into outputs that have value for the consumer (Polinkevich, O. M., 2014). On the one hand, the heterogeneity of processes occurring within the framework of one business process requires an individual approach to the competence potential of personnel (including net and digital competence) depending on the complexity of the work performed. On the other hand, the necessary level of digital competence of the staff depends on the level of knowledge intensity of the economic sectors.

The structuring of business processes into main and auxiliary business processes, business processes of management and development (Umanets, T.V., Shlafman, N.L., Danilina, S.O. etc, 2022) is generally recognized. The European approach to determining the level of qualifications, highlighted in DigComp2.1 (European Commission, 2017), suggests using 4 levels of qualifications depending on the complexity and level of autonomy of task performance, as well as the type of cognitive operations (memorization, understanding, application, evaluation, creation): basic, intermediate, advanced and professional.

In Table 2 shows how the levels of digital competence change as the knowledge intensity of production increases in terms of the main structural elements of the business process.

Table 2

<table>
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<tr>
<th>The level of scientific intensity of production</th>
<th>Types of business processes</th>
<th>Foundation</th>
<th>Intermediate</th>
<th>Advanced</th>
<th>Highly specialised</th>
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Source: compiled by the author based on (European Commission, 2017; Umanets T.V., Shlafman N.L., Danilina S.O. etc, 2022; Antonyuk V.P., Shamileva L.L., 2017)
The group with low knowledge capacity includes extractive industry, food production, textile production, production of wood products, furniture production, metallurgical production, production of rubber and plastic products. The personnel involved in the main production processes must confidently operate the equipment, while being able to explain the problems arising in the production process to the service staff, management personnel, personnel involved in the business development processes. Support staff must possess cognitive abilities – understanding, as their role is reduced to the performance of well-defined routine and non-routine tasks and straightforward problems in order to provide resources for reproductive processes and support infrastructure. Personnel engaged in business development processes should possess such cognitive ability as generating new ideas in accordance with the strategic goals of the enterprise. That is why personnel involved in business development processes must have a professional level of digital competence.

The group with medium-low scientific capacity includes the production of chemicals and chemical products, the production of electrical equipment. Personnel engaged in core business processes must possess an advanced level of digital competence, as they must perform various tasks and solve problems of a non-routine nature, while at the same time being ready to become a subordinate and a leader. Support staff independently perform well-defined routine and non-routine tasks (due to cognitive ability – understanding). Management processes require mastery of digital competence at an advanced level, as they require solving various tasks, making evaluative decisions and training staff. Personnel engaged in business development processes must possess digital competence at a professional level, which will allow solving complex tasks in conditions of uncertainty and generating new ideas for improving further activities.

The group with medium-high scientific capacity includes the production of machines and equipment, electronic and optical products. Basic business processes require an advanced level of digital competence, as the shift from serial production to production oriented to the individual customer often forces to solve non-standard tasks that modern digital technologies allow. The digital competence of personnel performing supporting business processes must be at an advanced level due to the complexity of production processes. For these enterprises, as a rule, raw materials and components are imported from other countries of the world, they are of foreign origin, in connection with which the ability to communicate, to study the peculiarities of the legislative regulation of other countries, and logistics based on modern information and communication technologies are crucial. Management and development business processes require a professional level of mastery of digital competence, as the personnel performing them determine the directions of further movement based on the study of advanced digital technologies.

Production of coke, oil refining products, motor vehicles, pharmaceutical products and drugs is included in the group with high scientific intensity. Basic business processes and business processes of development and management require a professional level of digital competence. The automation of basic production processes that are dangerous for humans requires meticulousness in the processes of setting up, monitoring and managing work operations, and the presence of a high level of digital competence of the personnel employed in the basic production processes. Supporting business processes require advanced digital competence, as they require solving a variety of routine and non-routine tasks using advanced technologies.

A basic level of digital competence involves performing simple tasks under the guidance of other more experienced individuals and requires the presence of such cognitive abilities as memorization. According to the author, in conditions of dynamism and unpredictability of the internal and external environment, characteristic of the modern world, basic digital competence is not enough to participate in economic activity.

Conclusions and perspectives of further research.

Thus, digital competence becomes a necessary condition for the professional activity of a modern person, since the digital component is present in most modern professions and its presence will only increase in the future. However, the formation, application and development of the digital competence of the population in terms of different categories is a complex and long-term process that requires coordination and synchronization in time of various interdependent components, in particular, regulatory and legal, institutional, material and technological and personnel, each of which requires a complex solution problems. In order to rationally use the labor potential of the workforce, it is necessary to take into account that as the level of knowledge-intensive production increases, so do the requirements for the level of digital competence. Prospects for further research
are related to the study of the criteria for determining the levels of digital competence in terms of structure-forming business processes, which will contribute to the effective use of the labor potential of the population of Ukraine.

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