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DIGITAL COMPETENCIES AND DIGITAL LITERACY

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The article examines the theoretical foundations for assessing the digital competence of human resources and the levels of digital literacy in the context of the digital transformation of the economy. The need to transition to a comprehensive model for measuring digital skills is substantiated, one that accounts for the level of technological proficiency and the ability to apply these technologies productively in professional, social, and educational activities. It is noted that digital competencies form a new quality of human potential, thereby ensuring the sustainability of the knowledge economy and its capacity to adapt to technological changes. The article proposes a system of indicators for evaluating the digital competence of the population in terms of complexity, universality, representativeness, and interpretability of results. It is argued that digital literacy serves as a foundation, while digital competence encompasses the creative, analytical, and critical use of technologies. Particular attention is given to the adaptation of these indicators to the conditions of Kazakhstan, taking into account differences in infrastructure, education levels, and Internet accessibility. The presented results can be used for further research on the mechanisms of competence formation and growth in digital environments, the structural interconnections among elements of competence, as well as the enabling conditions and risk factors associated with the digital transformation of labor markets.

Key words: *digital competencies, digital literacy, human potential, digital economy, education, innovation.*

Ікласов Бакитжан Ерлікович, Абилайханова Тана Абилайханівна, Саєнко Віталій Олександрович. ЦИФРОВІ КОМПЕТЕНЦІЇ ТА ЦИФРОВА ГРАМОТНІСТЬ

У статті розглядаються теоретичні основи оцінки цифрової компетентності людських ресурсів та рівнів цифрової грамотності в контексті цифрової трансформації економіки. Обґрунтовано необхідність переходу до комплексної моделі вимірювання цифрових навичок, яка враховує рівень володіння технологіями та здатність продуктивно застосовувати ці технології у професійній, соціальній та освітній діяльності. Зазначається, що цифрові компетентності формують нову якість людського потенціалу, тим самим забезпечуючи стійкість економіки знань та її здатність адаптуватися до технологічних змін. У статті пропонується система показників для оцінки цифрової компетентності населення з точки зору складності, універсальності, репрезентативності та інтерпретованості результатів. Стверджується, що цифрова грамотність слугує основою, тоді як цифрова компетентність охоплює творче, аналітичне та критичне використання технологій. Особлива увага приділяється адаптації цих показників до умов Казахстану з урахуванням відмінностей в інфраструктурі, рівнях освіти та доступності Інтернету. Представлені результати можуть бути використані для подальших досліджень механізмів формування та розвитку компетентності в цифрових середовищах, структурних взаємозв'язків між елементами компетентності, а також сприятливих умов та факторів ризику, пов'язаних з цифровою трансформацією ринків праці.

Ключові слова: *цифрові компетенції, цифрова грамотність, людський потенціал, цифрова економіка, освіта, інновації.*

Introduction. The modern stage of economic development is characterized by an active digital transformation that affects all spheres of social life and has become a key factor in enhancing national competitiveness [1]. The transition to a digital economy entails systemic changes in production relations, the structure of employment, and the quality requirements of the workforce, forming a new type of value–human capital–based on knowledge, skills, and digital competencies [2].

Digital transformation, taking place across all countries, shapes the new demands of the labor market, making the formation of digital competencies a necessity.

According to statistics [3], in the second decade of the 21st century, 61 million Europeans lack adequate digital skills. Approximately 40% of European employers report difficulties in finding employees with the necessary digital expertise to support innovation. It is estimated that by 2025, around 750,000 ICT–related jobs will remain unfilled due to the shortage of people with appropriate digital competencies. On the other hand, youth unemployment in the EU among people aged 15–24 reaches 15%, with many highly qualified young professionals working in jobs that do not match their skills or potential.

Thus, digital competencies have become a critical issue for the knowledge society and the modern economy. Emerging technologies such as adaptive learning systems, artificial intelligence, digital assessment tools, predictive analytics, virtual and augmented reality are increasingly used to teach digital skills. New human capital competencies combine creative thinking, curiosity, and problem–solving abilities. In this context, investments in people and broad access to lifelong learning opportunities are of decisive importance.

Materials and methods. In accordance with the Knowledge Society methodology [4], developed by the United Nations Department of Economic and Social Affairs (UNDESA), the assessment of a society's intellectualization is based on measuring the key parameters of intellectual potential formation (average years of schooling, share of the young population, and development of information technologies), as well as evaluating the factors that promote or hinder this process. The former include expenditures on R&D, education, and healthcare within the budget structure, among others. The inhibitory factors include (among others) child mortality, income inequality, and even CO_2 emission levels.

This methodology is of particular interest because, unlike many others, it incorporates the assessment of quality of life indicators as a necessary condition for the development of intellectual potential (Understanding Knowledge Societies).

Results. A comprehensive approach to the formation of digital competencies suggests that it is essential to develop not only technical skills– specific sets of abilities related to the use and maintenance of digital tools such as 3D printers, CAD (Computer–Aided Design) software, and robots [5]–but also the appropriate attitude toward continuous learning, improvement of digital literacy, and the ability to collaborate, communicate, and co–create digital content while ensuring cybersecurity.

The European Union's experience is particularly noteworthy, especially the initiative known as the New Skills Agenda for Europe, aimed at helping EU member states equip citizens with better, high–quality skills, ensure leadership, stimulate innovation, and enhance competitiveness.

Based on the experience of other researchers, it is necessary to distinguish between the concepts of "digital literacy" and "digital competencies." Digital literacy refers to the set of knowledge and skills necessary for the population to safely and effectively use digital technologies and Internet resources. This aspect is crucial, as insufficient development of digital skills represents a serious barrier to the innovation–driven socio–economic transformation of society.

Digital competencies represent a system of knowledge, abilities, and skills required for the effective use of ICT. Mastery of digital competencies enables individuals to navigate within the digital knowledge society and pursue lifelong learning. The development of such competencies contributes to tasks such as:

– managing information, creating, and disseminating digital content;

– facilitating collaboration, communication, and collective problem–solving;

– observing ethical standards of behavior;

– developing autonomy, flexibility, and adaptability;

– enhancing critical and creative thinking.

The digital competence of the labor force is manifested through the accumulation of additional skills that ensure effective functioning and professional development in the digital environment. This competence can be divided into user–level and professional–level competencies.

User–level competencies involve the skills required for the effective use of ICT in personal contexts (education, self–development, communication, etc.), whereas professional digital competence refers to the skills necessary for work and for the development, operation, and maintenance of ICT systems themselves.

The competence of the labor force is determined by its ability and readiness to perform efficiently and productively in various socially significant contexts through the application of key competencies. The main objective

of improving the quality of the workforce is not merely to increase the volume of knowledge but to acquire practical experience in applying it.

The quality of the workforce is influenced by a system of personal and environmental factors. Personal factors include age structure, education level, and income. Typically, individuals with higher education demonstrate a similar level of digital competence development, and this trend also holds true for income levels, which correlate with education. The key environmental factors, however, include the level of socio–economic development, the availability of infrastructure, the maturity of digital ecosystems, and the quality and affordability of digital services.

These environmental factors largely determine personal factors by influencing both the quality of education and income levels. Therefore, any system for managing the development of digital competencies must be built primarily upon environmental conditions.

Indicators for Assessing Digital Competence of the Workforce

Based on the above considerations, the following indicators can be used to evaluate digital competence:

– internet use by the population (% of total population);

– daily or near–daily internet usage (% of total population);

– number of active fixed broadband Internet subscriptions per 100 inhabitants (units);

– number of active mobile broadband Internet subscriptions per 100 inhabitants (units);

– number of connected mobile devices per 1,000 inhabitants (units);

– organizations using personal computers (% of all surveyed organizations);

– organizations using servers (% of all surveyed organizations);

– organizations using local area networks (% of all surveyed organizations);

– organizations using cloud services (% of all surveyed organizations);

– organizations using the Internet (% of all surveyed organizations) [7–10].

Using these indicators, an integrated digital competence index is calculated based on the collection, processing, and normalization of statistical data, the computation of composite indicators, and the derivation of an overall digital competence index.

An analysis of digital competencies reveals that their structure is multilevel, encompassing both basic (informational) and transversal (cognitive, communicative, analytical) components.

In Kazakhstan, the level of digital literacy is uneven–high in urban areas and relatively low in rural regions. According to data from the Bureau of National Statistics (2024), the vast majority of the population uses the Internet (over 96% nationwide), and more than 92% demonstrate strong digital literacy skills in using various devices and services. These trends create favorable conditions for accelerating digitalization in business and the labor market [6].

Conclusions. Digital competence is a key factor in the sustainable development of the knowledge economy and increasing the competitiveness of the workforce. The modern labor market requires not only basic ICT knowledge but also the ability to apply digital technologies for analysis, communication, creativity, and innovation. Digital literacy is the foundation that ensures access to information, while digital competence is the superstructure, reflecting the ability to transform this information into practical value.

It is recommended to implement a system for continuous monitoring of the population's digital competencies using open data and artificial intelligence to predict trends.

Going forward, the development of digital competencies should become part of public employment and education policies, ensuring the integration of the digital economy, innovation, and social inclusion. Improving digital literacy is directly linked to increased productivity, expanded employment opportunities, and the development of a culture of responsible technology use.

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